Kurukshetra University, Kurukshetra
(Established by the State Legislature Act XII of 1956)
('A+' Grade, NAAC Accredited)

|| योगस्थ: कुरु कर्माणि ||
समबुद्धि व योग युक्त होकर कर्म करो
(Perform Actions while Stead fasting in the State of Yoga)

Scheme of Examination and Syllabus of
Bachelor of Computer Applications (BCA) (CBCS) in Phased Manner

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS

CBCS CURRICULUM (2020-21)

Program Name: Bachelor of Computer Applications (BCA) (CBCS)

(For the Batches Admitted From 2020-2021)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

NAME OF THE PROGRAMME : BACHELOR OF COMPUTER APPLICATIONS (BCA)
DURATION : THREE YEARS

PROGRAMME OUTCOMES (POs)		
PO1	Knowledge	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study.
PO2	Communication	Ability to communicate effectively on general and scientific topics with the scientific community and with society at large.
PO3	Problem Solving	Capability of applying knowledge to solve scientific and other problems.
PO4	Individual and Team Work	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings.
PO5	Investigation of Problems	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions.
PO6	Modern Tool Usage	Ability to use and learn techniques, skills and modern tools for scientific practise.
PO7	Science and Society	Ability to apply reasoning to access the different issues related to society and the consequent responsibilities relevant to the professional scientific practices.
PO8	Life-Long Learning	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout the life.
PO9	Environment and Sustainability	Ability to design and develop modern systems which are environmentally sensitive and to understand the importance of sustainable development.
PO10	Ethics	Apply ethical principles and professional responsibilities in scientific practices.
PO11	Project Management	Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects.

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
The objective of the curriculum designed for BCA course is to nurture the technical aptitude of students for professional competency in the IT industry.	
PSO1	Develop proficiency for solving real world problems with the application of programming and supplementary computing skills.
PSO2	Promote exposure to hardware as well as software knowledge with the inclusion of course content targeted to administer technical expertise for employment in the IT industry.
PSO3	Explicit course content is targeted to inculcate programming skills using both conventional and contemporary programming languages as well as to develop potential for realizing web oriented and other commercial/non-commercial applications.
PSO4	Judicious structuring of the course curriculum has been aimed in order to strengthen competitive ability as per the trending industry requirements.
PSO5	Encourage skillful expertise for employment in Commercial/ Government sectors or pursuance of higher studies aimed towards innovational research leading to the progressive growth of the society and the nation.

KURUKSHETRA UNIVERSITY, KURUKSHETRA
SCHEME OF EXAMINATIONS FOR BACHELOR OF COMPUTER APPLICATIONS (BCA)
CHOICE BASED CREDIT SYSTEM (CBCS)
W. E. F. ACADEMIC SESSION 2020-21in Phased Manner

Semester	Course	Paper Code	Nomenclature of Paper	Credits	Work load/ hour/ week	Exam Time (Hrs)	Internal Marks		External Marks		Total Marks
							Max	Pass	Max	Pass	
1	CC-BCA-1A	BCA-101	COMPUTER FUNDAMENTALS- I	3	3	3	15	6	60	24	75
		BCA-102	OFFICE AUTOMATION- I	3	3	3	15	6	60	24	75
		BCA-103	S/W LAB – I BASED ON BCA-102	2	4	3	10	4	40	16	50
	CC-BCA-1B	BCA-104	C PROGRAMMING – I	3	3	3	15	6	60	24	75
		BCA-105	SOFTWARE ENGINEERING – I	3	3	3	15	6	60	24	75
		BCA-106	S/W LAB – II BASED ON BCA-104	2	4	3	10	4	40	16	50
	CC-BCA-1C	BCA-107	WEB DESIGNING – I	3	3	3	15	6	60	24	75
		BCA-108	LOGICAL ORGANIZATION –I	3	3	3	15	6	60	24	75
		BCA-109	S/W LAB – III BASED ON BCA-107	2	4	3	10	4	40	16	50
	AECC-1	AECC-110	FUNCTIONAL ENGLISH / FUNCTIONAL MIL	2	2	3	10	4	40	16	50
			TOTAL	**26**	**32**	**30**	**130**	**52**	**520**	**208**	**650**
2	CC-BCA-2A	BCA-201	COMPUTER FUNDAMENTALS- II	3	3	3	15	6	60	24	75
		BCA-202	OFFICE AUTOMATION- II	3	3	3	15	6	60	24	75
		BCA-203	S/W LAB – I BASED ON BCA-202	2	4	3	10	4	40	16	50
	CC-BCA-2B	BCA-204	C PROGRAMMING – II	3	3	3	15	6	60	24	75
		BCA-205	SOFTWARE ENGINEERING – II	3	3	3	15	6	60	24	75
		BCA-206	S/W LAB – II BASED ON BCA-204	2	4	3	10	4	40	16	50
	CC-	BCA-207	WEB DESIGNING – II	3	3	3	15	6	60	24	75

	BCA-2C	BCA-208	LOGICAL ORGANIZATION –II	3	3	3	15	6	60	24	75
		BCA-209	S/W LAB – III BASED ON BCA-207	2	4	3	10	4	40	16	50
	AECC-2	AECC-210	ENVIRONMENT STUDIES	2	2	3	10	4	40	16	50
			TOTAL	**26**	**32**	**30**	**130**	**52**	**520**	**208**	**650**
3	CC-BCA-3A	BCA-301	C++ PROGRAMMING – I	3	3	3	15	6	60	24	75
		BCA-302	COMPUTER ARCHITECTURE	3	3	3	15	6	60	24	75
		BCA-303	S/W LAB – I BASED ON BCA-301	2	4	3	10	4	40	16	50
	CC-BCA-3B	BCA-304	OPERATING SYSTEM – I	3	3	3	15	6	60	24	75
		BCA-305	DATA STRUCTURES – I	3	3	3	15	6	60	24	75
		BCA-306	S/W LAB – II BASED ON BCA-305	2	4	3	10	4	40	16	50
	CC-BCA-3C	BCA-307	DATA BASE MANAGEMENT SYSTEM – I	3	3	3	15	6	60	24	75
		BCA-308	COMPUTER NETWORKS – I	3	3	3	15	6	60	24	75
		BCA-309	S/W LAB – III BASED ON BCA-307	2	4	3	10	4	40	16	50
	SEC-1	SEC-310	ELECTIVE – I	2	2	3	10	4	40	16	50
			TOTAL	**26**	**32**	**30**	**130**	**52**	**520**	**208**	**650**
		ELECTIVE-I									
	SEC-310 (I)		SOFT SKILLS	2	2	3	10	4	40	16	50
	SEC-310 (II)		E-COMMERCE	2	2	3	10	4	40	16	50
	SEC-310 (III)		MOOC *	2	2	3	10	4	40	16	50
4	CC-BCA-4A	BCA-401	C++ PROGRAMMING – II	3	3	3	15	6	60	24	75
		BCA-402	CYBER SECURITY	3	3	3	15	6	60	24	75
		BCA-403	S/W LAB – I BASED ON BCA-401	2	4	3	10	4	40	16	50
	CC-BCA-4B	BCA-404	OPERATING SYSTEM – II	3	3	3	15	6	60	24	75
		BCA-405	DATA STRUCTURES – II	3	3	3	15	6	60	24	75

		BCA-406	S/W LAB – II BASED ON BCA-405	2	4	3	10	4	40	16	50
	CC-BCA-4C	BCA-407	DATA BASE MANAGEMENT SYSTEM – II	3	3	3	15	6	60	24	75
		BCA-408	COMPUTER NETWORKS – II	3	3	3	15	6	60	24	75
		BCA-409	S/W LAB – III BASED ON BCA-407	2	4	3	10	4	40	16	50
	SEC-2	SEC-410	ELECTIVE – I	2	2	3	10	4	40	16	50
			TOTAL	**26**	**32**	**30**	**130**	**52**	**520**	**208**	**650**
		ELECTIVE-I									
	SEC-410 (I)		PRINCIPLES OF ACCOUNTING	2	2	3	10	4	40	16	50
	SEC-410 (II)		IT ACT & CYBER LAWS	2	2	3	10	4	40	16	50
	SEC-410 (III)		MOOC *	2	2	3	10	4	40	16	50
5	DSE- 1	BCA-501	ELECTIVE – I	2	3	3	15	6	60	24	75
		BCA-502	ELECTIVE – II	2	3	3	15	6	60	24	75
		BCA-503	S/W LAB – I BASED ON BCA-502	2	4	3	10	4	40	16	50
	DSE- 2	BCA-504	ELECTIVE –II	2	3	3	15	6	60	24	75
		BCA-505	ELECTIVE – IV	2	3	3	15	6	60	24	75
		BCA-506	S/W LAB – II BASED ON BCA-505	2	4	3	10	4	40	16	50
	DSE- 3	BCA-507	ELECTIVE –V	2	3	3	15	6	60	24	75
		BCA-508	ELECTIVE –VI	2	3	3	15	6	60	24	75
		BCA-509	S/W LAB – III BASED ON BCA-508	2	4	3	10	4	40	16	50
	SEC- 3	SEC-510	ELECTIVE – VII	2	2	3	10	4	40	16	50
		TOTAL		**20**	**32**	**30**	**130**	**52**	**520**	**208**	**650**
		ELECTIVE- I									
	BCA-501(I)		ARITFICAL INTELLIGENCE	2	3	3	15	6	60	24	75
	BCA-501(II)		COMPUTER ORIENTED NUMERICAL AND STATISTICAL METHODS	2	3	3	15	6	60	24	75
		ELECTIVE- II									

	BCA-502(I)		PROGRAMMING IN JAVA	2	3	3	15	6	60	24	75
	BCA-502(II)		PHP AND MYSQL	2	3	3	15	6	60	24	75
		ELECTIVE- III									
	BCA-504(I)		COMPUTER GRAPHICS	2	3	3	15	6	60	24	75
	BCA-504(II)		MANAGEMENT INFORMATION SYSTEM	2	3	3	15	6	60	24	75
		ELECTIVE- IV									
	BCA-505(I)		VISUAL PROGRAMMING USING C#	2	3	3	15	6	60	24	75
	BCA-505(II)		PROGRAMMING IN JAVA SCRIPT	2	3	3	15	6	60	24	75
		ELECTIVE- V									
	BCA-507(I)		DATA WAREHOUSEING & MINING	2	3	3	15	6	60	24	75
	BCA-507(II)		SOFTWARE PROJECT MANAGEMENT	2	3	3	15	6	60	24	75
		ELECTIVE- VI									
	BCA-508(I)		PROGRAMMING IN PYTHON	2	3	3	15	6	60	24	75
	BCA-508(II)		LINUX AND SHELL PROGRAMMING	2	3	3	15	6	60	24	75
		ELECTIVE- VII									
	SEC -510(I)		TIME MANAGEMENT	2	2	3	10	4	40	16	50
	SEC -510(II)		INFORMATION SECURITY	2	2	3	10	4	40	16	50
	BCA-510(III)		MOOC *	2	2	3	15	6	60	24	75
6	DSE- 1	BCA-601	ELECTIVE –I	2	3	3	15	6	60	24	75
		BCA-602	ELECTIVE –II	2	3	3	15	6	60	24	75
		BCA-603	S/W LAB – I BASED ON BCA-602	2	4	3	10	4	40	16	50
	DSE- 2	BCA-604	ELECTIVE –III	2	3	3	15	6	60	24	75
		BCA-605	ELECTIVE –IV	2	3	3	15	6	60	24	75
		BCA-606	S/W LAB – II BASED ON BCA-605	2	4	3	10	4	40	16	50
	DSE- 3	BCA-607	ELECTIVE –V	2	3	3	15	6	60	24	75

	BCA-608	ELECTIVE –VI	2	3	3	15	6	60	24	75
	BCA-609	S/W LAB – III BASED ON BCA-608	2	4	3	10	4	40	16	50
SEC- 4	SEC-610	ELECTIVE –VII	2	2	3	10	4	40	16	50
	TOTAL		**20**	**32**	**30**	**130**	**52**	**520**	**208**	**650**
GRAND TOTAL			**144**	**192**	**180**	**780**	**312**	**3120**	**1248**	**3900**
	ELECTIVE- I									
BCA-601(I)		INFORMATION RETRIEVAL SYSTEMS	2	3		15	6	60	24	75
BCA-601(II)		SIMULATION AND MODELLING	2	3		15	6	60	24	75
	ELECTIVE- II									
BCA-602(I)		SPSS	2	3		15	6	60	24	75
BCA-602(II)		PROGRAMMING IN R	2	3		15	6	60	24	75
	ELECTIVE- III									
BCA-604(I)		MULTIMEDIA AND ITS APPLICATIONS	2	3		15	6	60	24	75
BCA-604(II)		PRINCIPLES OF BIG DATA	2	3		15	6	60	24	75
	ELECTIVE- IV									
BCA-605(I)		PROGRAMMING IN XML	2	3		15	6	60	24	75
BCA-605(II)		GUI PROGRAMMING	2	3		15	6	60	24	75
	ELECTIVE- V									
BCA-607(I)		COMPUTER VISION	2	3		15	6	60	24	75
BCA-607(II)		INTERNET-OF-THINGS	2	3		15	6	60	24	75
	ELECTIVE- VI									
BCA-608(I)		DTP PACKAGES	2	3		15	6	60	24	75
BCA-608(II)		SCILAB	2	3		15	6	60	24	75
	ELECTIVE- VII									
SEC -610(I)		STRESS MANAGEMENT	2	2		10	4	40	16	50
SEC -610(II)		E-CRM	2	2		10	4	40	16	50
BCA-610(III)		MOOC *	2	2		15	6	60	24	75

Total Credits: 26 + 26 + 26 + 26 +20 + 20 = 144

- *** MOOC Course from Swayam Portal.**

1) A student can opt for any one paper out of the list of elective papers provided against each paper code for respective semester.
2) For the purpose of computation of work-load the following mechanism may be adopted:
- 1 Credit = 1 Theory period of one hour duration.
- 1 Credit = 1 Practical period of two hour duration.

Group Size of Practical: 15 students per group

BCA-101: COMPUTER FUNDAMENTALS- I

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to introduce the basic terminology of a computer system and fundamentals of problem solving on a computer.

Course Outcomes: At the end of this course, the student will be able to:
BCA-101.1 learn the basic terminology of hardware and software components of a computer system.
BCA-101.2.understand basics of memory system and working of storage devices.
BCA-101.3.understand the working of input/output devices commonly used in a computer system.
BCA-101.4.understand the concept of operating system and use Windows OS.

CO-PO Mapping Matrix for Course Code: BCA-101

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-101.1	3	3	2	3	3	2	2	2	2	3	2
BCA-101.2	3	2	3	3	2	3	2	2	2	2	2
BCA-101.3	2	3	3	3	2	2	2	2	1	1	1
BCA-101.4	3	2	2	2	3	3	3	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.5	2.5	2.25	2.25	2	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA-101

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-101.1	3	3	2	3	3
BCA-101.2	3	2	3	3	3
BCA-101.3	2	3	3	3	2
BCA-101.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

Computer Fundamentals: Evolution of Computers through generations, Characteristics of Computers, Strengths and Limitations of Computers, Classification of Computers, Functional Components of a Computer System, Applications of computers in Various Fields.
Software, Types of Software: System software, Application software, Utility Software, Shareware, Freeware, Firmware, Free Software. Hardware components of a computer system - processor, motherboard, power supply etc.

UNIT-II

Memory Systems: Concept of bit, byte, word, nibble, binary cell, storage locations and addresses, measuring units of storage capacity, access time, concept of memory hierarchy. Primary Memory - RAM, ROM, PROM, EPROM.
Secondary Memory - Types of storage devices, Magnetic Tape, Hard Disk, Optical Disk, Flash Memory.

UNIT-III

I/O Devices: I/O Ports of a Desk Top Computer, Device Controller, Device Driver. Input Devices: classification and use, keyboard, pointing devices - mouse, touch pad and track ball, joystick, magnetic stripes, scanner, digital camera, microphone, sensor, and MIDI instruments, Output Devices: speaker, monitor, printers: classification, laser, ink jet, dot-matrix. Plotter.

Unit – IV

Introduction to Operating System**:** Definition, Functions, Features of Windows Operating System, Icon, Folder, File, Start Button, Task Bar, Status Buttons, Folders, Shortcuts, Recycle Bin, Desktop, My Computer, My Documents, Windows Explorer, Control Penal.

Text Books:

1. Sinha P.K. & Sinha Priti, Computer Fundamentals, BPB.
2. Dromey R.G., How to Solve it By Computer, PHI.

Reference Books:

1. Norton Peter, Introduction to Computer, McGraw-Hill.
2. Leon Alexis & Leon, Mathews, Introduction to Computers, Leon Tech World.
3. Rajaraman V., Fundamentals of Computers, PHI.

BCA-102: OFFICE AUTOMATION - I

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to provide knowledge of basic requirements that are needed for establishing an automated Office. All office components have been introduced and students will be able to automate the office.

Course Outcomes: At the end of this course, the student will be able to:
BCA-102.1. develop, format, setup and print Word documents.
BCA-102.2. learn advance features of Word Processing and use tables, comments and mail merge.
BCA-102.3. create & format worksheets.
BCA-102.4. create worksheets and handle databases using advanced features such as filters, pivot tables and cell locking.

CO-PO Mapping Matrix for Course Code: BCA-102

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-102.1	3	3	2	3	3	2	2	2	2	3	2
BCA-102.2	3	2	3	3	3	2	2	2	2	2	2
BCA-102.3	2	3	3	3	2	2	2	2	1	1	2
BCA-102.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-102

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-102.1	3	3	2	3	3
BCA-102.2	3	2	3	3	3
BCA-102.3	2	3	3	3	2
BCA-102.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

Word Processing Basics: Creating, Formatting and Editing a Word Document: Word Wrap, Spelling and Grammar Check, Formatting Text and Paragraph, Paragraph Indents, Inserting and Formatting a Picture/ Clip Art in a Word document, Smart Art, Wrap Text around Images, Adding Effect to Images, Inserting Symbols and Equations, Document, Bullet and Numbered List, Find and Replace, Page Setup.

UNIT-II

Advance Features of Word Processing: Formatting Tables, Align Cell Text, Merge Cell, Text Directions, Adding a Chart and Chart Styles, using and Making Templates, Mail- Merge, Add to Dictionary, Treasures, Character Map, Headers and Footers, Page Numbering, Page Borders, Creating Columns, Creating and Dropping Comments, Watermark.

UNIT-III

Excel Basics: About Ribbon Menus, Creating & Editing Worksheet, Use of Various Data Types, Text Orientation, Formatting Spreadsheet: Cell Alignment and Border, Freeze Panes, Conditional Formatting, Using Formulas and Functions, VLookup, Cell Referencing, Page Setup, Page Options, Customizing Margins, Headers and Footers, Print Options, Print Formulas.

Unit – IV

Excel Advance Features: Transferring Data to and From Non Worksheet Files, Database Handling, Adding, Formatting and Customising Chart, Change Chart Type, Sorting Data, Use of Filters, Data Analysis with Goal Seek and Scenario Manager, Creating Scenario, Creating Pivot Tables, Using Slicers, Pivot Chart, Creating a Drop Down List, Locking Cells, Using Multiple Workbooks.

Text Books:

1. Kevin Wilson, Essential Office 2016, pdfdrive.com
2. Microsoft Office- Complete Reference, BPB Publication.
3. Russell A. Stultz, Learn Microsoft Office, BPB Publication.

Reference Books:

1. Steven M. Freund, Mary Z. Last, Philip J. Pratt, Susan L. Sebok, Misty E. Vermaat, Jennifer T. Campbell, Mark Frydenberg, Discovering Computers & Microsoft Office 365- A Fundamental Combined Approach, Cengage Learning.
2. Courter, G Marquis, Microsoft Office 2000: Professional Edition, BPB.
3. Koers, D, Microsoft Office XP Fast and Easy, PHI.
4. Nelson, S L and Kelly J, Office XP: The Complete Reference, Tata McGraw-Hill.

BCA-104: C PROGRAMMING- I

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide basic knowledge of C. a High level language as one of the programming tool and generating logical development skills using programming.

Course Outcomes: At the end of this course, the student will be able to:
BCA-104.1. learn the basics of C program, data types and input/output statements.
BCA-104.2. understand different types of operators, their hierarchies and also control statements of C.
BCA-104.3. develop programs using functions.
BCA-104.4. implement programs using arrays and strings.

CO-PO Mapping Matrix for Course Code: BCA-104

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-104.1	3	3	2	3	3	2	2	2	2	3	2
BCA-104.2	3	2	3	3	3	2	2	2	2	2	2
BCA-104.3	2	3	3	3	2	2	2	2	1	1	2
BCA-104.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-104

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-104.1	3	3	2	3	3
BCA-104.2	3	2	3	3	3
BCA-104.3	2	3	3	3	2
BCA-104.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

Overview of C: History, Importance, Structure of C Program, Character Set, Constants and Variables, Identifiers and Keywords, Data Types, Assignment Statement, Symbolic Constant.
Input/output: Unformatted & Formatted I/O Function, Input Functions viz. scanf(), getch(), getche(), getchar(), gets(), output functions viz. printf(), putch(), putchar(), puts().

UNIT-II

Operators & Expression: Arithmetic, Relational, Logical, Bitwise, Unary, Assignment, Conditional Operators and Special Operators Operator Hierarchy & Associativity. Arithmetic Expressions, Evaluation of Arithmetic Expression, Type Casting and Conversion. Decision making with if statement, if-else statement, nested if statement, else-if ladder, switch and break statement, goto statement.

UNIT-III

Looping: for, while, and do-while loop, jumps in loops.
Functions: definition, prototype, function call, passing arguments to a function: call by value, call by reference, recursive functions.
Storage Classes in C: Auto, Extern, Register and Static and their Scope, Storage & Lifetime.

Unit – IV

Arrays: Definition, types, Initialization, multidimensional arrays, Processing on Arrays.
Strings: Declaration and Initialization, String I/O, Array of Strings, String Manipulation Functions: String Length, Copy, Compare, Concatenate etc., Search for a Substring.

Text Books:

1. Gottfried, Byron S., Programming with C, Tata McGraw Hill.
2. Balagurusamy, E., Programming in ANSI C, Tata McGraw-Hill.

Reference Books:

1. Jeri R. Hanly & Elliot P. Koffman, Problem Solving and Program Design in C, Addison Wesley.
2. Yashwant Kanetker, Let us C, BPB.
3. Rajaraman, V., Computer Programming in C, PHI.
4. Yashwant Kanetker, Working with C, BPB.

BCA-105: SOFTWARE ENGINEERING– I

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of Software Engineering as a paradigm in Computer Science. This course will enable students to be the computer engineer or system analysts for an enterprise.

Course Outcomes: At the end of this course, the student will be able to:
BCA-105.1. understand concept of Software Engineering and types of System.
BCA-105.2. plan the software project for an Enterprise.
BCA-105.3. analyze the requirement of a client to design a software.
BCA-105.4. design a software using structured and object-oriented approach.

CO-PO Mapping Matrix for Course Code: BCA-105

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-105.1	3	3	2	3	3	2	2	2	2	3	2
BCA-105.2	3	2	3	3	3	2	2	2	2	2	2
BCA-105.3	2	3	3	3	2	2	2	2	1	1	2
BCA-105.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-105

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-105.1	3	3	2	3	3
BCA-105.2	3	2	3	3	3
BCA-105.3	2	3	3	3	2
BCA-105.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

System Concept: Definition of Software Engineering, Goals and Principles of Software Engineering , Software Crisis, Factors Responsible for Software Crisis, Software Engineering Vs. Traditional Engineering, Software Processes & Characteristics, Elements of system, Physical and Abstract System, Open And Closed System, Man-Made Information Systems. System Development Life Cycle, Waterfall, Prototype, Evolutionary and Spiral Models, Various Phases of System Development.

UNIT-II

System Analyst: Definition, Qualification, Multifaceted Role of System Analyst, Analyst/ User interface.
System Planning: Introduction, Bases for Planning in System Analysis, Dimensions of Planning.
Software Cost Estimation, Cost And Benefit Categories, Procedure for Cost/ Benefit Determination, COCOMO Model. Project Scheduling, Team Structures, Software Configuration Management, Software Quality and Quality Assurance, Risk Management.

UNIT-III

Software Requirements Analysis and Specifications (SRS): Meaning, Structured Analysis: Data Flow Diagram, Guidelines for Developing DFDs, Context Diagram, and Feasibility study: System Performance Definition, Statement of Constraints, Identification of Specific System Objectives, Description Of Outputs, Feasibility Consideration, Steps in Feasibility Analysis, System Proposal. Overview of Decision Tress, Structured English, Entity-Relationship Diagrams, Cohesion and Coupling.

Unit – IV

Software Design process: Software Quality Guidelines And Attributes, Design Concepts: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Refactoring, Software Design Principles, Modularity, Structured Design Methodology,
Object Oriented Design Concepts and Methodology, Design Verification. Deployment Level Design Elements.

Text Books:

1. Roger S. Pressman, Software Engineering A Practioner's Approach, McGraw Hill Publication.
2. R.E Fairely, Software Engineering Concepts, Tata McGraw Hill Publication.
3. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publication House.

Reference Books:

1. Ian Sommerville, Software Engineering, International Computer Science Series.
2. Awad M. Elias, System Analysis and Design, Galgotia Publication.

BCA-107: WEB DESIGNING- I

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of web as a tool in presenting information. Each and every product in e-world now needs a website, this course will make student knowing about the concept of web design in general.

Course Outcomes: At the end of this course, the student will be able to:
BCA-107.1. learn about WWW and search engines.
BCA-107.2. understand domain and assigning name to them.
BCA-107.3. understand basic web languages and its components.
BCA-107.4. perform simple web page designing for practical exposure.

CO-PO Mapping Matrix for Course Code: BCA- 107

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-107.1	3	3	2	3	3	2	2	2	2	3	2
BCA-107.2	3	2	3	3	3	2	2	2	2	2	2
BCA-107.3	2	3	3	3	2	2	2	2	1	1	2
BCA-107.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA- 107

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-107.1	3	3	2	3	3
BCA-107.2	3	2	3	3	3
BCA-107.3	2	3	3	3	2
BCA-107.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

Introduction to Internet and World Wide Web (WWW). Evolution and History of World Wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Browsers. Hypertext Transfer Protocol, URLs. Searching and Web-Casting Techniques, Search Engines and Search Tools, Scripting Languages.

UNIT-II

Web Publishing: Hosting Web Site. Internet Service Provider. Planning and designing Web Site. Web Content Authoring, Web Graphics Design, Web Programming, Steps For Developing Web Site, Choosing the Contents, Home Page, Domain Names, Creating a Website and Markup Languages (HTML, DHTML).

UNIT-III

Web Development: HTML Document Features, HTML and XHTML, Standard XHTML Document Structure, Images, Headers, Text Styles, Text Structuring, Text Colors and Background, Formatting Text, Page Layouts. Hypertext Links, Syntactic Differences between HTML and XHTML. Overview and Features of HTML5.

Unit – IV

Images. Ordered and Unordered lists, Inserting Graphics. Table Creation and Layouts, Frame Creation and Layouts, Working with Forms and Menus, Working with Radio Buttons, Check Boxes. Text Boxes.

CSS: Introduction, Types of style sheets, Style specification formats, Font properties, List properties, Color, Alignment of text, Background images, The <span> and <div> tags, Features of CSS3.

Text Books:

1. Raj Kamal, Internet and Web Technologies, Tata McGraw-Hill.
2. Ramesh Bangia, Multimedia and Web Technology, Firewall Media.

Reference Books:

1. Thomas A. Powell, Web Design: The Complete Reference, Tata McGraw-Hill
2. Wendy Willard, HTML Beginners Guide, Tata McGraw-Hill.
3. Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI.

BCA-108: LOGICAL ORGANIZATION– I

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of computer as a system and making students aware of internal mechanism of computer hardware and its working.

Course Outcomes: At the end of this course, the student will be able to:
BCA-108.1. understand number systems, error detecting & correcting code and character representations.
BCA-108.2. learn number systems and representations of numbers in a computer system.
BCA-108.3. understand computer arithmetic and Boolean algebra and simplification of Boolean expressions.
BCA-108.4. understand working of logic gates and design various combinational circuits using these logic gates.

CO-PO Mapping Matrix for Course Code: BCA-108

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 108.1	3	3	2	3	3	2	2	2	2	3	2
BCA- 108.2	3	2	3	3	1	2	2	3	2	2	2
BCA- 108.3	2	3	3	3	2	2	3	2	1	3	2
BCA- 108.4	3	2	2	2	3	3	2	3	3	2	3
Average	2.75	2.5	2.5	2.75	2.25	2.25	2.25	2.5	2	2.5	2.25

CO-PSO Mapping Matrix for Course Code: BCA-108

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 108.1	3	3	2	1	3
BCA- 108.2	2	2	3	2	1
BCA- 108.3	3	3	1	3	2
BCA- 108.4	3	2	2	2	3
Average	2.75	2.5	2	2	2.25

UNIT-I

Number Systems: Binary, Octal, Hexadecimal etc. Conversions from one number system to another, BCD Number System. BCD Codes: Natural Binary Code, Weighted Code, Self-Complimenting Code, Cyclic Code.
Error Detecting and Correcting Codes. Character representations: ASCII, EBCDIC and Unicode.

UNIT-II

Number Representations: Integer numbers - sign-magnitude, 1’s & 2’s complement representation. Real Numbers normalized floating point representations.
Binary Arithmetic: Binary Addition, Binary Subtraction, Binary Multiplication, Binary Division using 1’s and 2’s Compliment representations, Addition and subtraction with BCD representations.

UNIT-III

Boolean Algebra: Boolean Algebra Postulates, basic Boolean Theorems, Boolean Expressions, Boolean Functions, Truth Tables, Canonical Representation of Boolean Expressions: SOP and POS, Simplification of Boolean Expressions using Boolean Postulates & Theorems, Kaurnaugh-Maps (upto four variables),Tabular Method, Handling Don't Care conditions.

Unit – IV

Logic Gates: Basic Logic Gates – AND, OR, NOT, Universal Gates – NAND, NOR, Other Gates – XOR, XNOR etc. NAND, NOR. Their symbols, truth tables and Boolean expressions.

Combinational Circuits: Design Procedures, Half Adder, Full Adder, Half Subtractor, Full Subtracor, Multiplexers, Demultiplexers, Decoder, Encoder, Comparators, Code Converters.

Text Books:

1. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd.
2. V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, Prentice Hall.

Reference Books:

1. Andrew S. Tanenbaum, Structured Computer Organization, Prentice Hall of India Pvt. Ltd.
2. Nicholas Carter, Schaum's Outlines Computer Architecture, Tata McGraw-Hill.

BCA-201: COMPUTER FUNDAMENTALS- II

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is help students to enhance their concept of computer hardware, software, memory and operating environments along with the concepts of problem solving using programming languages which will lead to code generation in future for computer science job aspirants.

Course Outcomes: At the end of this course, the student will be able to:
BCA-201.1 develop program logic using algorithms, flowchart, decision tables, DFDs, etc.
BCA-201.2.develop sorting, searching, merging and other basic algorithms to solve problems.
BCA-201.3 learn basics of Internet and its services specifically e-mail services.
BCA-201.4 check threats to a computer system and find suitable software to resolve them.

CO-PO Mapping Matrix for Course Code: BCA-201

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-201.1	3	3	2	3	3	2	2	2	2	3	2
BCA-201.2	3	2	3	3	3	2	2	2	2	2	2
BCA-201.3	2	3	3	3	2	2	2	2	1	1	1
BCA-201.4	3	2	2	2	3	3	3	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA-201

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-201.1	3	3	2	3	3
BCA-201.2	3	2	3	3	3
BCA-201.3	2	3	3	3	2
BCA-201.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

Planning the Computer Program: Techniques of Problem Solving, Program, Types of Program Errors, Debugging a Program, Testing Program, Documentation: Need & different Forms.
Developing Program Logic: Algorithm, Characteristics of Good Algorithm, Pseudo Code, Flowchart & its Symbols, Data Flow Diagrams (DFDs), Decision Tables & their types and Decision Trees.

UNIT-II

Developing Algorithms: Time & space complexity of algorithms, Big-O Notation, Drawing Flowcharts and writing algorithms in pseudo code for basic problems.
Sorting Algorithms – bubble sort, selection sort, insertion sort, quick sort.
Searching Algorithms – linear search, binary search. Merging Algorithm.

UNIT-III

The Internet: Introduction to networks and internet, history, Internet, Intranet & Extranet, Working of Internet, Modes of Connecting to Internet.

Electronic Mail: Introduction, advantages and disadvantages, User Ids, Passwords, e-mail addresses, message components, message composition, mailer features. Browsers and search engines.

Unit – IV

Threats: Physical & non-physical threats, Virus, Worm, Trojan, Spyware, Keylogers, Rootkits, Adware, Cookies, Phishing, Hacking, Cracking.

Computer Security Fundamentals: Confidentiality, Integrity, Authentication, Non-Repudiation, Security Mechanisms, Security Awareness, Security Policy, anti-virus software & Firewalls, backup & recovery.

Text Books:

1. Sinha, P.K. & Sinha, Priti, Computer Fundamentals, BPB.
2. Dromey, R.G., How to Solve it By Computer, PHI.

Reference Books:

1. Norton, Peter, Introduction to Computer, McGraw-Hill.
2. Leon, Alexis & Leon, Mathews, Introduction to Computers, Leon Tech World.
3. Rajaraman, V., Fundamentals of Computers, PHI.

BCA-202: OFFICE AUTOMATION - II

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to provide knowledge of basic requirements that are needed for establishing an automated Office. All office components have been introduced and students will be able to automate the office.

Course Outcomes: At the end of this course, the student will be able to:
BCA-202.1. develop PowerPoint presentations using basic features of PowerPoint application software.
BCA-202.2. develop PowerPoint presentations using advanced features of PowerPoint application software.
BCA-202.3. create tables and manipulate them.
BCA-202.4. acquire knowledge of MS Access advance concepts like writing queries and designing forms.

CO-PO Mapping Matrix for Course Code: BCA-202

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-202.1	3	3	2	3	3	2	2	2	2	3	2
BCA-202.2	3	2	3	3	3	2	2	2	2	2	2
BCA-202.3	2	3	3	3	2	2	2	2	1	1	2
BCA-202.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-202

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-202.1	3	3	2	3	3
BCA-202.2	3	2	3	3	3
BCA-202.3	2	3	3	3	2
BCA-202.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

PowerPoint Basics: Ribbon Menus, Creating a New Presentation, Designing a Slide, Adding Text and Images, Slide Master, Adding Notes, Applying Design Template,Inserting and Formatting Tables, Data Labels, Chart Legends, Chart Styles, Chart Color Scheme, Adding Objects, Smart Art, Adding Special Effect, Printing Options, PowerPoint Views, Saving PowerPoint Files in Different Formats.

UNIT-II

MS-PowerPoint Advance: Design Template, Adding Transitions, Animation, Motion Paths, Effects and Timing, Animation Pane, Adding and Timing Videos, Adding Sounds, Screen Recording, Photo Albums, Preparing Audience Handouts, Import and Export to and From Non PowerPoint Files, Using Office Mix, Online Collaboration.

UNIT-III

Access Basics: Fundamental Concepts and terminology of Database System, Creating a Database, Determining Tables and Fields, Creating a Table, Importing or Linking Data from other Applications to Access, To Change Database Properties, Determining Keys, and Determining Relationship between Tables. Assigning Data Types to Fields, Identifying and Removing Redundancy.

Unit – IV

Access Advance Features: Creating a Database Query, Use a Wildcard, Comparison Operator, Sorting Data in a Query, Joining Tables, Crosstab Queries, Designing Form for a Query, Updating Records, Filtering Records, And Exporting Data.

Text Books:

1. Kevin Wilson, Essential Office 2016, pdfdrive.com
2. Microsoft Office- Complete Reference, BPB Publication.
3. Russell A. Stultz, Learn Microsoft Office, BPB Publication.

Reference Books:

1. Steven M. Freund, Mary Z. Last, Philip J. Pratt, Susan L. Sebok, Misty E. Vermaat, Jennifer T. Campbell, Mark Frydenberg, Discovering Computers & Microsoft Office 365- A Fundamental Combined Approach, Cengage Learning.
2. Courter, G Marquis, Microsoft Office 2000: Professional Edition, BPB.
3. Koers, D, Microsoft Office XP Fast and Easy, PHI.
4. Nelson, S L and Kelly J, Office XP: The Complete Reference, Tata McGraw-Hill.

BCA-204: C PROGRAMMING– II

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of C as a High level language as one of the programming tool and generating logical development using programming.

Course Outcomes: At the end of this course, the student will be able to:
BCA-204.1. get familiar with advanced concepts like structures, union etc. in C language.
BCA-204.2. learn a complete overview of pointers in C and allocation and de-allocation of memory.
BCA-204.3. understand file types and errors in file handling along with its solutions.
BCA-204.4. learn macros and to implement C to acquire job in software industry.

CO-PO Mapping Matrix for Course Code: BCA-204

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-204.1	3	3	2	3	3	2	2	2	2	3	2
BCA-204.2	3	2	3	3	3	2	2	2	2	2	2
BCA-204.3	2	3	3	3	2	2	2	2	1	1	1
BCA-204.4	3	2	2	2	3	3	3	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA-204

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-204.1	3	3	2	3	3
BCA-204.2	3	2	3	3	3
BCA-204.3	2	3	3	3	2
BCA-204.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

Structures: Structure Variables, Initialization, Structure Assignment, Nested Structure, Structures and Functions, Structures and Arrays: Arrays of Structures, Structures Containing Arrays, Union: Introduction, Union of Structures. Typedef, Enumerations.

UNIT-II

Pointers Arithmetic: Pointer Variables, Pointer Operators, Pointer Assignment, Pointer Conversions, Pointer Arithmetic, Pointer Comparison, Pointers and Arrays, Pointers and Functions, Pointers and Strings, Pointer to Pointer, Dynamic Allocation and de-allocation of memory.

UNIT-III

File Handling in C: File Types, File opening modes and closing a file, Reading/Writing a file, Errors Handling in a file, Random-access I/O in files.

Unit – IV

Pre-processor: Introduction, #define, Macros, Macro versus Functions, #include, Conditional Compilation Directives, Undefining a Macro. Command Line Arguments: Defining and Using Command Line Arguments.

Text Books:

1. Yashwant Kanetker, Let us C, BPB publications.
2. Balagurusamy, E., Programming in ANSI C, Tata McGraw-Hill.

Reference Books:

1. Jeri R. Hanly& Elliot P. Koffman, Problem Solving and Program Design in C, Addison Wesley.
2. Gottfried, Byron S., Programming with C, Tata McGraw Hill.
3. Behrouz A. Forouzan & Richard F. Gilberg, Computer Science: A Structured Programming Approach Using C, Cengage Learning.
4. Ashok N. Kamthane, Programming with ANSI and Turbo C, Pearson Education.
5. Herbert Schildt, The Complete Reference: C, Tata-McGraw-Hill.

BCA-205: SOFTWARE ENGINEERING– II

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide advance knowledge of Software engineering process. Student after understanding this course will be able to design the system as a project and plan its implementation and development. Testing will also be taught.

Course Outcomes: At the end of this course, the student will be able to:
BCA-205.1. learn how to design software project and coding style for a project to build.
BCA-205.2. understand concept of software metrics and implementation issues.
BCA-205.3. understand software reliability and various testing techniques.
BCA-205.4. learn to ensure software quality and debugging of the flaws if any.

CO-PO Mapping Matrix for Course Code: BCA-205

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-205.1	3	3	2	3	3	2	2	2	2	3	2
BCA-205.2	3	2	3	3	3	2	2	2	2	2	2
BCA-205.3	2	3	3	3	2	2	2	2	1	1	2
BCA-205.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-205

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-205.1	3	3	2	3	3
BCA-205.2	3	2	3	3	3
BCA-205.3	2	3	3	3	2
BCA-205.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

Review of Software Project Planning, Software Requirement Analysis and Specification and Software Design. Gantt chart, PERT Chart, Preparation of DFD, ER, PERT Chart and Gantt Chart with case studies of Inventory, Library, Airline system, Traffic Light etc.

Software Coding: Programming Style, Structured Programming, Documentation, Verification and Validation, Coding the Procedural Design, Monitoring and Control.

UNIT-II

Software Metrics: Need and Benefits of Software Metrics, McCabe's cyclomatic complexity, Token Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics.

Software Implementation: Relationship between design and implementation, Implementation issues and programming support environment.

UNIT-III

Software Reliability: Errors, Faults and Failures, Software Reliability Metrics, Fault Avoidance, Fault Tolerance, Exception Handling.

Software Testing: Testing Process, Design of Test Cases, Types of Testing, Functional Testing, Structural Testing, Test Activities, Unit Testing, Integration Testing, Validation Testing, Alpha & Beta Testing and Regression Testing etc., Debugging Activities.

Unit – IV

Quality Assurance: Goal of Quality Assurance, Levels of Quality Assurance.

Software Maintenance: Primary Activities in Maintenance, Reducing Maintenance Costs.

Version and Release Management: Version Identification, Release Management, Version Management Tools.

Software Reusability, Software Reengineering. Software Refactoring.

Text Books:

1. Pressman R. S., Software Engineering – A Practitioner's Approach, Tata McGraw Hill.
2. Jalote P., An Integrated approach to Software Engineering, Narosa.

Reference Books:

1. Sommerville, Software Engineering, Pearson Education.
2. Fairley R., Software Engineering Concepts, Tata McGraw Hill.

BCA-207: WEB DESIGNING– II

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of web designing. Each and every product in e-world now needs a website, this course will make student ready to represent a website and also student will learn to host a site.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 207.1. learn JavaScript and VBScript.
BCA- 207.2. make use of control statement and objects of ASP.
BCA- 207.3. learn advanced web languages like DHTML and CSS along with its components.
BCA- 207.4. implement dynamic web page designing to acquire job as web developer.

CO-PO Mapping Matrix for Course Code: BCA-207

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-207.1	3	3	2	3	3	2	2	2	2	3	2
BCA-207.2	3	2	3	3	3	2	2	2	2	2	2
BCA-207.3	3	3	3	3	2	3	3	2	2	3	1
BCA-207.4	2	3	2	3	2	2	2	2	2	2	2
Average	2.75	2.75	2.5	3	2.5	2.25	2.25	2	2	2.5	1.75

CO-PSO Mapping Matrix for Course Code: BCA-207

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-207.1	3	3	2	3	3
BCA-207.2	3	3	2	1	3
BCA-207.3	2	3	3	3	2
BCA-207.4	2	2	2	2	3
Average	2.5	2.75	2.25	2.25	2.75

UNIT-I

Interactivity Tool: JavaScript: Introduction, Features, Data types, Operators, Statements, Functions, Event Handling, Use of Predefined Object and Methods, Frames, Windows, Tables, Images, Links, VBScript: Introduction, Features, Variables, Data Types, Numeric and Literal Constants, Arrays, Operators, Subroutine Procedures, Function Procedures, Control Statements, Strings, Message and Input Boxes, Date and Time, Event Handlers.

UNIT-II

Interactivity Tool: Active Script Pages: Introduction, Features, Client-Server Model, Data Types, Decision Making Statements, Control statements, Use of Various Objects of ASP, Various Techniques of Connecting to Database Other Interactivity Tools: Macromedia Flash, Macromedia Dreamweaver, PHP: Basic Introduction and Features.

UNIT-III

DHTML: Introduction, Features, Events, Dynamic Positioning, Layer Object, Properties of STYLE, Dynamic Styles, Inline Styles, Event Handlers. Cascading Style Sheets (CSS): Basic Concepts, Properties, Creating Style Sheets. Common Tasks with CSS: Text, Fonts, Margins, Links, Tables, Colors. Marquee. Mouse Overs. Filters and Transitions. Adding Links. Adding Tables. Adding Forms. Adding Image and Sound. Use of CSS in HTML Documents Linking and Embedding of CSS in HTML Document.

Unit – IV

Dynamic Website: Designing, rules to host the site, Ethics of Web hosting. Type of web hosting. Design of interactive form. Use of data base as backend to store form data. Import and export of data from server data base. Conversion of form data to Excel or other formats. Use of verifications in Form designing.

Text Books:

1. Jon Duckett, Beginning Web Programming with HTML, XHTML, CSS and JavaScript –Wiley India Pvt. Ltd.
2. Paul Wilton, Beginning JavaScript – Wiley India Pvt. Ltd.
3. Mitchell and Atikinson, Active Sever Page" – Techmedia Publishing.
4. Adrian Kingsley ,VB Script Programming Reference – Wiley India Pvt. Ltd.

Reference Books:

1. Thomas A. Powell, Web Design: The Complete Reference, Tata McGraw-Hill.
2. Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI.
3. Raj Kamal, Internet and Web Technologies, Tata McGraw-Hill.
4. Ramesh Bangia, Multimedia and Web Technology, Firewall Media.
5. Internet and Web Design, ITLESL Research and Development Wing, Macmillan India.

BCA-208: LOGICAL ORGANISATION- II

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of computer as a system and making student aware of internal mechanism of computer hardware and its working.

Course Outcomes: At the end of this course, the student will be able to:
BCA-208.1. understand working of different types of flip-flops.
BCA-208.2. design different types of registers and counters.
BCA-208.3. learn CPU organization and its working.
BCA-208.4. understand I/ O interface and various types of interrupt structures.

CO-PO Mapping Matrix for Course Code: BCA-208

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-208.1	3	3	2	3	3	2	2	2	2	3	2
BCA-208.2	3	2	3	3	3	2	2	2	2	2	2
BCA-208.3	2	3	3	3	2	2	2	2	1	1	2
BCA-208.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-208

COs#	PSO1	PSO2	PSO3	PSO4	SPO5
BCA-208.1	3	3	2	3	3
BCA-208.2	3	2	3	3	3
BCA-208.3	2	3	3	3	2
BCA-208.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

Sequential Circuits: Basic Flip- Flops and their working. Synchronous and Asynchronous Flip –Flops, Triggering of Flip-Flops, Clocked RS, D Type, JK, T type and Master-Slave Flip-Flops. State Table, State Diagram and State Equations. Flip-flops characteristics & Excitation Tables.

UNIT-II

Sequential Circuits: Designing registers –Serial-In Serial-Out (SISO), Serial-In Parallel-Out (SIPO), Parallel-In Serial-Out (PISO) Parallel-In Parallel-Out (PIPO) and shift registers.
Designing counters – Asynchronous and Synchronous Binary Ripple Counter, Binary Synchronous Counter, Modulo-N Counters and Up-Down Counters.

UNIT-III

CPU Organization: Stack Based, Accumulator Based, and General Purpose Register Based, ALU Design. Machine Instruction, Instruction Set Selection, Instruction Cycle, Instruction Formats and Addressing Modes with their merits, demerits and suitability.

Unit – IV

Input/ Output Interface: Functions, Program controlled and interrupt-controlled I/O transfer, DMA Transfer, Cycle Stealing. I/O Channels, IOP.

Interrupt Structures: interrupts, types of interrupts, levels and priorities of interrupts - single-level-single-priority, single-level-multi-priority, multi-level-single-priority, multi-level-single-priority. Vector interrupt.

Text Books:

1. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd.
2. V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, Prentice Hall.

Reference Books:

1. Andrew S. Tanenbaum, Structured Computer Organization, Prentice Hall of India Pvt. Ltd.
2. Nicholas Carter, Schaum's Outlines Computer Architecture, Tata McGraw-Hill.

BCA- 301: C++ PROGRAMMING- I

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of C++ (high level language) as one of the programming tool and generating logical development using programming. This course will help students to learn about OOPS concepts and linking C++ as a powerful OOPS language.

Course Outcomes: At the end of this course, the student will be able to:
BCA-301.1. understand basic concepts of C++.
BCA-301.2. learn operators, hierarchy and their precedence and different control structures of C++.
BCA-301.3. develop programs using arrays, strings and functions.
BCA-301.4. implement OOPS concepts with C++.

CO-PO Mapping Matrix for Course Code: BCA-301

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-301.1	3	3	2	3	3	2	2	2	2	3	2
BCA-301.2	3	2	3	3	3	2	2	2	2	2	2
BCA-301.3	2	3	3	3	2	2	2	2	1	1	1
BCA-301.4	3	2	2	2	3	3	3	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA-301

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-301.1	3	3	2	3	3
BCA-301.2	3	2	3	3	3
BCA-301.3	2	3	3	3	2
BCA-301.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

Introduction to C++: About C++, Character Set, Keywords, Identifiers, Constants, Punctuators, Date Types: User-Defined, Built-in, Derived Data Types, Access Modifiers.
Unformatted and Formatted I/O Operations. I/O using extraction and extraction operators, Type Conversion, Type Casting.

UNIT – II

Operators in C++: Arithmetic, Relational, Logical, Bitwise, Ternary, Precedence & associativity of Operators.
Control Structures: if statement, if-else statement, nested if, if-else-if ladder, switch...case statement, break and continue, goto statement, nested switch...case statement, Loops: while loop, do...while loop, for loop.

UNIT – III

Arrays and strings: Array definition, initialization, multidimensional arrays, Manipulation of array elements, String declaration and initialization, Manipulations, String handing functions.

Functions: Declaration and Definition, return values, arguments, passing parameters by value, call by reference, call by pointer, Recursions, Inline and external linkage Functions, storage classes.

UNIT – IV

Object-Oriented Features of C++: Class and Objects, Data hiding & encapsulation, abstraction, constructors & destructors.

Data Members and Member Functions, accessing class members, empty class, local class, global class, Scope Resolution Operator and its Uses, Static Data Members, Static Member Functions, Structure vs Class.

Text Books:

1. Herbert Scildt, C++, The Complete Reference, Tata McGraw-Hill
2. Robert Lafore, Object Oriented Programming in C++, SAMS Publishing

Reference Books:

1. Bjarne Stroustrup, The C++ Programming Language, Pearson Education
2. Balaguruswami, E., Object Oriented Programming In C++, Tata McGraw-Hill.
3. Richard Johnson, An Introduction to Object-Oriented Application Development, Thomson Learning.

BCA-302: COMPUTER ARCHITECTURE

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to provide knowledge of computer as a system and making students aware of internal mechanism of computer hardware and its working.

Course Outcomes: At the end of this course, the student will be able to:
BCA-302.1 learn various trends in computer architectures.
BCA-302.2 learn RTL and working of microprogrammed control unit.
BCA-302.3 learn hardware algorithms for basic arithmetic operations.
BCA-302.4 understand role of memory hierarchy and working of various types of memory.

CO-PO Mapping Matrix for Course Code: BCA-302

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-302.1	3	3	2	3	3	2	2	2	2	3	2
BCA-302.2	3	2	3	3	3	2	2	2	2	2	2
BCA-302.3	2	3	3	3	2	2	2	2	1	1	2
BCA-302.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-302

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-302.1	3	3	2	3	3
BCA-302.2	3	2	3	3	3
BCA-302.3	2	3	3	3	2
BCA-302.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

Computer Architecture: Evolution of Concept of Computer Architecture, Flynn's Classification of Computer Architectures, RISC & CISC architectures.
Introduction to instruction pipeline, multiprocessor, multicomputer, vector computer, array computer.

UNIT – II

Register Transfer and Microoperations: Register Transfer Language (RTL), Register Transfer, Bus and Memory Transfers, Arithmetic, Logic and Shift Microoperations.
Control Unit: control memory, address sequencing, conditional branching, mapping instructions, subroutines, microprogrammed control unit, microprogram sequencer.

UNIT – III

Computer Arithmetic: Hardware algorithms in flowchart for addition and subtraction - with signed-magnitude data, with 2's complement data. Hardware algorithms in flowchart for multiplication & division - booth multiplication, division with sign-magnitude data, non-restoring method. Algorithms for addition, subtraction, multiplication & division with floating-point data.

UNIT – IV

Memory System: Memory hierarchy, characteristics, locality of reference, inclusion, coherence properties of memory hierarchy, Cache Memory, Mapping schemes of Cache, Associative Memory, Interleaved Memory Virtual Memory: paging scheme and segmentation scheme, Page replacement policies.

Text Books:

1. Computer System Architecture By. Moris Mano, Pearson Education.
2. Computer Architecture and Organization By J.P. Hayes, Tata McGraw Hill.

Reference Books:

1. W. Stallings, Computer Organisation and Architecture, Pearson Education.
2. Harry, Jordan, Computer Systems Design & Architecture, Addison Wesley.
3. J.D. Carpinelli, Computer Systems Organization & Architecture, Addison Wesley.
4. P.V.S. Rao, Computer System Architecture, PHI.

BCA-304: OPERATING SYSTEM– I

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of Operating System (OS) as a system program. Making students to learn about OS and linking OS as a powerful tool to make system work. Students will be able to learn types of OS and learn about system operations using OS.

Course Outcomes: At the end of this course, the student will be able to:
BCA-304.1. understand the basic concepts of operating systems and its services.
BCA-304.2. understand concept of process management and scheduling.
BCA-304.3. acquire knowledge of process synchronization along with deadlock handling.
BCA-304.4. learn about memory management and virtual memory concepts.

CO-PO Mapping Matrix for Course Code: BCA-304

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-304.1	3	3	2	3	3	2	2	2	2	3	2
BCA-304.2	3	2	3	3	3	2	2	2	2	2	2
BCA-304.3	2	3	3	3	2	2	2	2	2	1	2
BCA-304.4	3	2	2	2	3	3	2	3	2	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-304

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-304.1	3	3	2	3	3
BCA-304.2	3	2	3	3	3
BCA-304.3	2	3	3	3	2
BCA-304.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

Introductory Concepts: Operating System Functions and Characteristics, Historical Evolution of Operating Systems, Operating System Structure, Operating System Operations;
Types of Operating System: Real time, Multiprogramming, Multiprocessing, Batch processing;
Operating System Services, Operating System Interface, Methodologies for Implementation of Operating System, Service System Calls, System Programs.

UNIT – II

Process Management: Process Concepts, Operations on Processes, Process States and Process Control Block. Inter-Process Communication;
Multithreaded Programming: Multithreading Models, Threading Issues;
CPU Scheduling: Scheduling Criteria, Levels of Scheduling, Scheduling Algorithms, Multiple Processor Scheduling; Algorithm Evaluation.

UNIT – III
Synchronization: Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classicla Problem of Synchronization, Monitors, Atomic Transactions; Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery.
UNIT – IV
Memory Management Strategies: Memory Management of Single-User and Multiuser Operating System, Partitioning, Swapping, Contiguous Memory Allocation, Paging and Segmentation; Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing, Memory Mapped Files.
Text Books: 1. Silberschatz A., Galvin P.B., and Gagne G., Operating System Concepts, John Wiley & Sons. 2. Godbole, A.S., Operating Systems, Tata McGraw-Hill Publishing Company, New Delhi.
Reference Books: 1. Deitel, H.M., Operating Systems, Addison- Wesley Publishing Company, New York. 2. Tanenbaum, A.S., Operating System- Design and Implementation, Prentice Hall of India, New Delhi.

BCA-305: DATA STRUCTURES– I

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Learning of data structure is like learning alphabets to learn any proper language. In this course students will be aware of memory management and use of data structure in computer programming.

Course Outcomes: At the end of this course, the student will be able to:

BCA-305.1. learn basics of data structure and algorithm complexities.

BCA-305.2. acquire knowledge of arrays and strings.

BCA-305.3. understand the idea of implementation for linked lists and stacks.

BCA-305.4. learn various searching and sorting techniques along with implementation of queues.

CO-PO Mapping Matrix for Course Code: BCA-305

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-305.1	3	3	2	3	3	2	2	2	2	3	2
BCA-305.2	3	2	3	3	3	2	2	2	2	2	2
BCA-305.3	2	3	3	3	2	2	2	2	1	1	2
BCA-305.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-305

COs#	PSO1	PSO2	PO3	PSO4	PSO5
BCA-305.1	3	3	2	3	3
BCA-305.2	3	2	3	3	3
BCA-305.3	2	3	3	3	2
BCA-305.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

Data Structure Definition, Data Type vs. Data Structure, Classification of Data Structures, Data Structure Operations, Applications of Data Structures;

Algorithm Specifications: Performance Analysis and Measurement (Time and Space Analysis of Algorithms- Average, Best and Worst Case Analysis), Asymptotic Notations and their use in Algorithm Handling.

UNIT – II

Arrays: Introduction, Linear Arrays, Representation of Linear Array In Memory, Two Dimensional and Multidimensional Arrays, Sparse Matrix and its Representation, Operations on Array: Algorithm for Traversal, Selection, Insertion, Deletion and its implementation.

String Handling: Storage of Strings, Operations on Strings viz., Length, Concatenation, Substring, Insertion, Deletion, Replacement, Pattern Matching.

UNIT – III

Linked List: Introduction, Array vs. linked list, Representation of linked lists in Memory, Traversing a Linked List, Insertion, Deletion, Searching into a Linked list, Type of Linked List.

Stack: Array Representation of Stack, Linked List Representation of Stack, Algorithms for Push and Pop, Application of Stack: Polish Notation, Postfix Evaluation Algorithms, Infix to Postfix Conversion, Infix to Prefix Conversion, Recursion.

UNIT – IV

Introduction to Queues: Simple Queue, Double Queue, Circular Queue, Priority Queue, Representation of Queues as Linked List and Array, Applications of Queue. Algorithm on Insertion and Deletion in Simple Queue and Circular Queue.

Searching and Sorting Techniques, Sorting Techniques: Bubble sort, Merge sort, Selection sort, Quick sort, Insertion Sort. Searching Techniques: Sequential Searching, Binary Searching.

Text Books:

1. Seymour Lipschutz, Data Structures, Tata McGraw- Hill Publishing Company Limited, Schaum's Outlines.
2. Yedidyan Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, Data Structures Using C, Pearson Education.

Reference Books:

1. Trembley, J.P. And Sorenson P.G., An Introduction to Data Structures With Applications, McGraw- Hill.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Addison- Wesley.

BCA-307: DATA BASE MANAGEMENT SYSTEM- I

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Today almost all real life problems include data**.** The objective of this course to get students aware about the basic concept of Data. In this paper students will learn database management and its implementation.

Course Outcomes: At the end of this course, the student will be able to:

BCA-307.1. learn basic concepts of data base along with its functions and components.
BCA-307.2. understand data base architecture and different data models.
BCA-307.3. design an ER diagram of an enterprise.
BCA-307.4. write SQL statements to retrieve information and learn the concept of relational algebra and calculus.

CO-PO Mapping Matrix for Course Code: BCA-307

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-307.1	3	3	2	3	3	2	2	2	3	3	2
BCA-307.2	3	2	3	3	3	1	2	2	2	2	2
BCA-307.3	3	3	3	3	2	2	1	2	1	1	2
BCA-307.4	3	3	2	2	3	3	2	3	3	2	2
Average	3	2.75	2.5	2.75	2.75	2	1.75	2.25	2.25	2	2

CO-PSO Mapping Matrix for Course Code: BCA-307

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-307.1	3	3	2	3	3
BCA-307.2	3	2	3	3	3
BCA-307.3	2	3	3	3	2
BCA-307.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

Basic Concepts – Data, Information, Records, Files, Schema and Instance etc. Limitations of File Based Approach, Characteristics of Database Approach, Database Management System (DBMS), Components of DBMS Environment, DBMS Functions and Components, Database Interfaces, Advantages and Disadvantages of DBMS.

UNIT – II

Database Users: Data and Database Administrator, Role and Responsibilities of Database Administrator, Database Designers, Application Developers etc. Database System Architecture – 1-Tier, 2-Tier & Three Levels of Architecture, External, Conceptual and Internal Levels, Schemas, Mappings and Instances, Data Independence – Logical and Physical Data Independence. Data Models: Hierarchical, Network and Relational Data Models.

UNIT – III

Entity-Relationship Model: Entity, Entity Sets, Entity Type, Attributes: Type of Attributes, Keys, Integrity Constraints, Domain and Tuple Constraint, Relationship: Role Names, Recursive Relationship, Types/ Degree, Cardinality Ratios, Relationship Constraints. Designing
of ER Diagram, Symbolic Notations for Designing ER Diagram, Design Issues, and Reduction of ER diagram into Relational Tables. Making ER Diagrams for Inventory, Book Store, Library and Flight Management System etc.

UNIT – IV

SQL: Meaning, Purpose and Need of SQL, Data Types, SQL Components: DDL, DML, DCL and DQL, Basic Queries, Join Operations and Sub-queries, Views, Specifying Indexes. Constraints and its Implementation in SQL.
Relational Algebra: Basic Operations: Select, Project, Join, Union, Intersection, Difference, and Cartesian Product etc. Relational Calculus: Tuple Relational and Domain Relational Calculus. Relational Algebra Vs. Relational Calculus.

Text Books:

1. Elmasri & Navathe, Fundamentals of Database Systems, Pearson Education.
2. A Silberschatz, H Korth, S Sudarshan, Database System and Concepts, McGraw-Hill.

Reference Books:

1. Thomas Connolly Carolyn Begg, Database Systems, Pearson Education.
2. C. J. Date, An Introduction to Database Systems, Addison Wesley.

BCA-308: COMPUTER NETWORKS– I

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Provide a comprehensive introduction to Computer Networks and its associated concepts and terminology along with the knowledge of Network architecture, design issues, and hardware components. Give exposure to the contemporary networking technologies

Course Outcomes: At the end of this course, the student will be able to:

BCA-308.1: have a comprehensive understanding of networking concepts and basic terminology along with its hardware components.
BCA-308.2: understand and characterize various types of computer networks.
BCA-308.3: conceptualize the various design issues related to Network Architecture and have an overview of the standard OSI reference model that illustrates the network architecture.
BCA-308.4: gain knowledge of Local Area Network technologies and components that will provide the competency for setting up of network environments in local areas.

CO-PO Mapping Matrix for Course Code: BCA-308

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-308.1	3	3	2	3	3	1	2	3	1	1	2
BCA-308.2	3	2	2	3	3	1	2	3	1	1	2
BCA-308.3	2	3	2	3	2	2	2	3	1	1	2
BCA-308.4	3	3	2	2	3	2	2	3	2	1	2
Average	2.75	2.75	2	2.75	2.75	1.5	2	3	1.25	1	2

CO-PSO Mapping Matrix for Course Code: BCA-308

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-308.1	2	3	2	3	3
BCA-308.2	2	3	2	3	3
BCA-308.3	2	3	2	3	3
BCA-308.4	2	3	2	3	3
Average	2	3	2	3	3

UNIT – I

Introduction to Computer Networks. Goals and applications. Types of Computer Networks. Network Design Issues and Protocols. Computer Communications and Networking Models.
Communication Service methods and Data Transmission Modes. OSI Reference Model. OSI Service Types. Functions of layers of OSI Model.

UNIT – II

Physical layer (layer 1) : Analog and Digital Communication concepts. Copper Media. Fiber-Optic Media. Wireless Communications. Satellite Communication. Speed and Capacity of a communication channel. Multiplexing. Switching.

UNIT – III

Data Link layer (layer 2): Overview. The IEEE and the Data Link layer. Framing Techniques. Flow Control. Sliding Window Protocols.

Error Control: Error Detection and Correction Methods. Medium Access Control: Random Access protocols. Token passing protocols. Network Hardware Components (layer 1 and 2). IEEE LAN Standards. Introduction to Wireless LANs

UNIT – IV

Network layer: Overview. Internetworking Concepts. Routers and Switches. Routing Protocol Concepts. Routing Algorithms: Flooding. Shortest path Routing. Distance-Vector Routing. Link-State Routing. Multicast Routing. Techniques for Congestion Control and Quality of Service. Virtual Private networks.

Text Books:

1. Michael A. Gallo, William M. Hancock, Computer Communications and Networking Technologies, CENGAGE learning.
2. Andrew S. Tanenbaum, Computer Networks, PHI.

Reference Books:

1. Behrouz A Forouzan, Data Communications and Networking, Mc-Graw Hill.
2. William Stallings, Data and Computer Communications, PHI.

SEC- 310 (I): SOFT SKILLS

Type: Skill Enhancement Courses (SEC) Course Credits: 02 Contact Hours: 02 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 40 External Pass Marks: 16 (i.e. 40%) Internal Maximum Marks: 10 Total Max. Marks: 50 Total Pass Marks: 20 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The objective of this course is to inculcate the basic soft skills into students. Students will learn the importance of soft skill, development of positive attitude and art of listening, writing and speaking. Students will be able to build their team and learn time management skills.

Course Outcomes: At the end of this course, the student will be able to:
SEC-310 (I).1. understand Soft Skill and learn to develop their personality.
SEC-310 (I).2. learn to form positive attitude and improve their communication skill.
SEC-310 (I).3. acquire the skills of listening, reading and writing.
SEC-310 (I).4. bulid team and manage their time.

CO-PO Mapping Matrix for Course Code: SEC- 310 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC-310 (I).1	3	3	2	3	3	3	2	2	1	3	2
SEC-310 (I).2	3	2	3	2	3	2	2	2	2	2	3
SEC-310 (I).3	3	2	3	3	2	2	2	2	2	3	1
SEC-310 (I).4	3	2	2	2	2	3	3	3	3	2	2
Average	3	2.25	2.5	2.5	2.5	2.5	2.25	2.25	2	2.5	2

CO-PSO Mapping Matrix for Course Code: SEC- 310 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
SEC-310 (I).1	3	2	2	1	3
SEC-310 (I).2	3	2	3	3	2
SEC-310 (I).3	3	3	1	2	2
SEC-310 (I).4	3	2	2	2	3
Average	3	2.25	2	2	2.5

UNIT – I

Soft Skills: Importance and attributes of soft skills, social soft skills, Identifying and Improving soft skills. Self-Discovery: Importance and process of Knowing oneself, SWOT Analysis.
Personality Development: Types and elements of Personality Development, Attitude and behavior, Features and Formation of Attitude, Attitude in Workplace, Examples of Positive and Negative Attitude.

UNIT – II

Forming Values: Core of Values, Values and Attitude, Importance, type and power of values.
Communication Skill: Purpose, elements and process of Communication, Tools of Effective Communication, Channels of Communication, Conversation Tips, Barriers in communication skill and Overcoming Barriers.

UNIT – III

Art of Listening: Benefit and kinds of listening, Factors that hamper listening, Poor listening habits.
Art of Reading: Different types of reading, Tips for effective reading, SQ3R Techniques, Different stages of reading.
Art of Writing E-Mail: Use Appropriate Salutation, Drafting the Subject Matter Significant, Shorten the Attachment.

UNIT – IV

Team Building and Teamwork: Characteristics and Aspects of Team Building, Role of Team Leader and Team Member, Inter-Group Collaboration, Difficulties Faced in Inter-Group Collaboration, Factors Shaping Inter-Group Collaboration.
Etiquette and Manners: Modern etiquette, benefits and classification of etiquette, poor manners, practicing good manner.
Time Management: The 80:20 Rule, Sense of time management, aspects of time management, time management matrix, Five Steps to Successful Time Management.

Text Books:

1. K. Alex, Soft Skills- Know Yourself and Know the World, S. Chand Publications.

Reference Books:

1. Manmohan Joshi, Soft Skills, BookBoon.Com.

SEC-310 (II): E-COMMERCE

Type: Skill Enhancement Courses (SEC) Course Credits: 02 Contact Hours: 02 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 40 External Pass Marks: 16 (i.e. 40%) Internal Maximum Marks: 10 Total Max. Marks: 50 Total Pass Marks: 20 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to make students aware of e-commerce in general and use of sites in particular. E-commerce is latest trend in modern era and this paper will help students establish relation to real life.

Course Outcomes: At the end of this course, the student will be able to:

SEC-310 (II).1. learn the main components of e-commerce and its prerequisites.

SEC-310 (II).2. understand the architecture of EDI and learn the different mode of electronic payment.

SEC-310 (II).3. learn the implementation of b2c type of e-commerce in real life applications.

SEC-310 (II).4. understand the idea of commerce over mobile phones, security prospectus and legal aspects of e-commerce.

CO-PO Mapping Matrix for Course Code: SEC- 310 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC-310 (II).1	3	3	2	3	2	3	2	2	3	3	2
SEC-310 (II).2	3	2	3	2	3	2	2	3	2	2	3
SEC-310 (II).3	2	3	3	3	2	2	2	2	2	3	2
SEC-310 (II).4	3	2	2	2	2	3	3	3	3	2	2
Average	2.75	2.5	2.5	2.5	2.25	2.5	2.25	2.5	2.5	2.5	2.25

CO-PSO Mapping Matrix for Course Code: SEC- 310(II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
SEC-310 (II).1	3	3	2	2	3
SEC-310 (II).2	3	2	3	3	2
SEC-310 (II).3	3	3	2	3	3
SEC-310 (II).4	3	2	2	2	3
Average	3	2.5	2.25	2.5	2.75

UNIT-I

Introduction to E-Commerce: Defining E-Commerce, Traditional Commerce and E-Commerce, Main Activities of E-Commerce, Benefits of E-Commerce, Broad Goals of E-Commerce, Components of E-Commerce, Functions of E-Commerce, Process of E-Commerce, Types of E-Commerce, Role of Internet and Web in E-Commerce, Pre-requisites of E-Commerce, Scope of E-Commerce.

UNIT-II

Electronic Data Interchange (EDI): Introduction and definition of EDI, EDI layered Architecture, EDI technology and standards, EDI communications and transactions, Benefits and applications of EDI.

Electronic Payment Systems: Electronic Funds Transfer. Digital Token Based E-Payment Systems, Modern Payment Systems, Steps for Electronic Payment, Payment Security, Net Banking credit/debit/smart cards, E-money.

UNIT-III

Products in B2C Model: Success Factors of E-brokers, Broker-based Services on-line, On-line Travel Tourism Services, Benefits and Impact of E-Commerce on Travel Industry, Deal Estate Market, Online Stock Trading and its Benefits, Online Banking and its Benefits, On-line Financial Services and their Future, E-auctions: Benefits, Implementation and impact of E-auctions.

Unit – IV

Mobile Commerce and Future of E-Commerce: Introduction to Mobile Commerce, Benefits of Mobile Commerce, Impediments of M-Commerce, M-Commerce framework.

Internet Security Issues, E-Business Risk Management Issues, Legal, Ethical and other public policy issues related to E-commerce, Emerging and future trends of E-commerce.

Text Books:

1. Ravi Kalakota, Andrew B. Whinston: Frontiers of Electronic Commerce, Addison Wesley.
2. Turban E., Lee J., King D. and Chung H.M, Electronic Commerce-A Managerial Perspective, Prentice-Hall International, Inc.

Reference Books:

1. K.K.Bajaj & D.Nag, E-Commerce, Tata McGraw Hill, New Delhi.
2. Bhatia V., E-commerce, Khanna Book Pub. Co. (P) Ltd., Delhi.

BCA-401: C++ PROGRAMMING– II

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of C++ (high level language) as one of the programming tool and generating logical development using programming. This course will help students to learn about OOPS concepts and linking C++ as a powerful OOPS language.

Course Outcomes: At the end of this course, the student will be able to:
BCA-401.1. understand pointers, constructor and destructors in C++.
BCA-401.2. acquire the detailed knowledge of polymorphism.
BCA-401.3. learn to implement exception handling and template.
BCA-401.4. learn File handling in C++.

CO-PO Mapping Matrix for Course Code: BCA-401

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-401.1	3	3	2	3	3	2	2	2	2	3	2
BCA-401.2	3	2	3	3	3	2	2	2	2	2	2
BCA-401.3	3	2	3	3	2	2	2	2	1	1	2
BCA-401.4	3	2	2	2	2	3	3	3	3	2	2
Average	3	2.2	2.5	2.75	2.5	2.25	2.25	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-401

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-401.1	3	3	2	3	3
BCA-401.2	3	2	3	3	3
BCA-401.3	2	3	3	3	2
BCA-401.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

Pointers & Runtime binding: pointer variable, address operator, void pointer, dynamic memory allocation & deallocation, Pointer arithmetic. Object Initialization and Cleanup: Constructors, types of constructors, destructors, constant objects and constructors. Friend Function & Class: defining friend function and friend class, defining member function of a class as friend function.

UNIT – II

Static Polymorphism: Function Overloading & Operator Overloading, over loadable operators, overloading unary & Binary Operators, Concatenating Strings using Operators overloading, Inheritance: Definition, Need, derivation types, different Forms of Inheritance, overloading vs overriding. Dynamic Polymorphism: Virtual and Pure Virtual Functions and their need, virtual derivation, Virtual Destructor.

UNIT – III

Exception Handling in C++: exception handling model, exception handling constructs - try, throw, catch, Order of catch blocks, Catching all exceptions, Nested try blocks, handling uncaught exceptions, unexpected(), terminate() and standard exceptions. Generic Programming: Function template, Overloading of template functions, Member function templates, class templates.

UNIT – IV

File handling: Hierarchy of File Streams, opening & closing files, file modes, file pointers and their manipulation. Sequential access to a file, Text & Binary files, saving and retrieving objects in a file, random access to a file.

Text Books:

1. Herbert Scildt, C++, The Complete Reference, Tata McGraw-Hill.
2. Robert Lafore, Object Oriented Programming in C++, SAMS Publishing.

Reference Books:

1. Bjarne Stroustrup, the C++ Programming Language, Pearson Education.
2. Balaguruswami, E., Object Oriented Programming In C++, Tata McGraw-Hill.

BCA-402: CYBER SECURITY

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Introduce the rationale of Cyber Security, Cyber threats, Cyber Crimes, Digital forensics and the legal perspective with respect to Indian Scenario. Provide the necessary awareness in the present scenario of growing cybercrimes.

Course Outcomes: Upon successful completion of the course, Students will be able to

BCA-402.1. get an awareness of notion of cyber security and cyber crimes and the implications of cybercrimes.

BCA-402.2. have a comprehensive understanding of computer and digital forensics ;

BCA-402.3. gain awareness about how to avoid becoming victims of cybercrime.

BCA-402.4. have an orientation on laws in reference to cybercrime and cyber security taking into account the Indian scenario.

CO-PO Mapping Matrix for Course Code: BCA-402

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 402.1	3	3	1	2	1	1	3	3	1	3	2
BCA- 402.2	3	2	2	2	1	2	3	3	1	3	2
BCA- 402.3	2	3	2	2	2	1	3	3	1	2	2
BCA- 402.4	3	2	1	2	1	1	3	3	1	2	2
Average	2.7	2.5	1.5	2	1.25	1.25	3	3	1	2.5	2

CO-PSO Mapping Matrix for Course Code: BCA-402

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 402.1	2	1	1	3	3
BCA- 402.2	3	2	1	3	3
BCA- 402.3	2	1	1	3	3
BCA- 402.4	2	2	1	3	3
Average	2.25	1.5	1	3	3

UNIT – I

Introduction to Cyber Security and Cyber crime; Classification of Cyber Crimes; Cyber Offences and Planning; Mobile & Wireless devices and the related security challenges ; Trends in Mobility; Authentication Service Security; Attacks on Mobile/Cell phones; Mobile Devices and Security Implications for Organizations; Organizational measures for handling mobile devices; Organizational Security Policies and Measures in Mobile Computing era; Basic Cryptography Concepts.

UNIT – II

Cyber Security Vulnerability; Data Integrity and Authentication; Tools and Methods used in Cyber Crime; Proxy Servers and Anonymizers; Phishing; Password Attacks & Cracking; Keyloggers and Spywares; Virus and Worms; Types of Viruses; Trojan Horses and Backdoors; Protection against Trojan Horses and Backdoors; Steganography; DoS and DDoS Attacks; SQL Injection; Buffer overflow; Attacks on Wireless Networks; Phishing and Identity Theft; Biometrics.

UNIT – III

Introduction to Computer Forensics; Historical background of Cyber Forensic; Digital Forensics Science; Need for Computer Forensics; Cyber Forensics and Digital Evidence; Forensic analysis of E-Mail; Digital Forensics Life Cycle; The Digital Forensics Process ; Network Forensics; Approaching a Computer Forensics Investigation ; Setting up a Computer Forensics Laboratory; Computer Forensics and Steganography; Forensics and Social Networking Sites; Computer Forensic from compliance perspectives; Special Tools and Techniques; Forensics of Hand-Held Devices.

UNIT – IV

Cyber Security and Organizational implications; cost of cybercrimes and IPR issues; Web threats for organizations; Social media marketing; Security and Privacy Implications from Cloud Computing; Protecting people's privacy in the organizations; Forensic best practices for organizations; Cyber Crime and Cyber terrorism; Intellectual Property in the Cyberspace; The Ethical Dimension of Cybercrimes; Cybercrimes and Cyber security: The Legal Perspectives; The Indian IT Act; Challenges to Indian Law and Cybercrime Scenario in India; Cybercrime and Punishment; Cyberlaw, Technology and Students: Indian Scenario;

Text Books:

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley.

Reference Books:

1. Gaurav K. Roy, Cyber Security and Digital Privacy: A Universal Approach, Highbrow Scribes Publication.
2. Thomas J. Mowbray ,Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions, Wiley.

BCA-404: OPERATING SYSTEM– II

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of Operating System (OS) as a system program. Making students to learn about OS and linking OS as a powerful tool to make system work. Students will be able to learn types of OS and learn about system operations using OS.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 404.1. learn to work process synchronization and directory structure.
BCA- 404.2. understand concept of data migration and process migration.
BCA- 404.3. learn security and protection mechanism for an operating system.
BCA- 404.4. learn to implement Linux an operating system in an organization.

CO-PO Mapping Matrix for Course Code: BCA- 404

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-404.1	3	3	2	3	3	2	2	2	2	3	2
BCA-404.2	3	2	3	3	3	2	2	2	2	2	2
BCA-404.3	2	3	3	3	2	2	2	2	1	1	2
BCA-404.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA- 404

COs#	PSO1	PSO2	PO3	PSO4	PSO5
BCA-404.1	3	3	2	3	3
BCA-404.2	3	2	3	3	3
BCA-404.3	2	3	3	3	2
BCA-404.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

File System: File Concept, Access Method, Directory and Disk Structure, File System Mounting, File Sharing, File Protection;
Implementing File System: File System Structure, File System Implantation, Directory Implementation, Allocation Methods, and Free Space Management.
Secondary Storage Structure: Disk Scheduling, Disk Management, Disk Attachment.

UNIT – II

System Protection: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Access Control, Access Rights;
System Security: Security Problem, Program Threats, System and Network Threats, User Authentication. Computer Worms, Computer Virus and Authentication. Firewalls.

UNIT – III
Distributed Operating Systems: Types of Network based Operating Systems, Network Structure, Communication Structures and Protocols, Design Issues; Distributed File System: Remote Login, Remote File Transfer, Stateful and Stateless Services, File Replication.
UNIT – IV
Distributed Synchronization: Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling. Election Algorithm. Real Time Systems: Features of Real-Time Kernels, Real Time CPU Scheduling. Multimedia Systems: Requirement of Multimedia Kernels, CPU Scheduling, Disk Scheduling.
Text Books: 1. Silberschatz A., Galvin P.B.,and Gagne G., Operating System Concepts, John Wiley & Sons. 2. Godbole, A.S., Operating Systems, Tata McGraw-Hill Publishing Company, New Delhi.
Reference Books: 1. Deitel, H.M., Operating Systems, Addison- Wesley Publishing Company, New York. 2. Tanenbaum, A.S., Operating System- Design and Implementation, Prentice Hall of India, New Delhi.

BCA-405: DATA STRUCTURES– II

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Learning of data structure is like learning alphabets to learn any proper language. This becomes even more important as it is main tool to learn computer storage and implementing problem solutions related to various aspects. After this course student will be aware of memory management and use of data structure in computer programming.

Course Outcomes: At the end of this course, the student will be able to:
BCA-405.1. learn tree structure and implementation of its different types.
BCA-405.2. implement various operations on graphs in data structure.
BCA-405.3. understand the idea file organization and hashing functions.
BCA-405.4. learn the idea of priority queues in data structures along with some advanced sorting techniques.

CO-PO Mapping Matrix for Course Code: BCA-405

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-405.1	3	3	2	3	3	2	2	2	2	3	2
BCA-405.2	3	2	3	3	3	2	2	2	2	2	2
BCA-405.3	2	3	3	3	2	2	2	2	2	1	2
BCA-405.4	3	2	2	2	3	3	2	3	2	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-405

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-405.1	3	3	2	3	3
BCA-405.2	3	2	3	3	3
BCA-405.3	2	3	3	3	2
BCA-405.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

Tree-Definitions and Concepts, Representation of Binary Tree, Binary Tree Traversal (Inorder, postorder, preorder), Threaded Binary Tree, Binary Search Trees – Definition, Operations viz., searching, insertions and deletion;
Applications of Trees - AVL trees and various operation viz. insertions, deletion, searching, B-tree and B+ trees along with various operations on these trees.

UNIT – II

Graph-Matrix Representation Of Graphs, Elementary Graph Operations viz., Traversal and Searching(Breadth First and Depth Searching), Insertions, Deletion; Spanning Trees, Minimal spanning tree;
Applications of Graphs: Topological Sorting, Shortest-Path Algorithms, Dijkstra’s Algorithm, Warshall’s Algorithm.

UNIT – III

Files: Introduction Attributes of a File, Classification of Files, File Operations, Comparison of Various Types of Files, File Organization: Sequential, Indexed-Sequential, Random-Access File.
Hashing: Hashing Functions, Collision-Resolution Techniques.

UNIT – IV

Priority Queues: Binary Heaps, Applications of Priority Queues, Leftist Heap, Skew Heap, Binomial Queues.
Sorting: Counting Sort, Shell Sort, Radix Sort, Merge Sort, and Lower Bound for Sorting, Randomized Quick Sort.

Text Books:

1. Seymour Lipschutz, Data Structures, Tata McGraw- Hill Publishing Company Limited.
2. Y. Langsam, M. J. Augenstein, and A. M. Tenenbaum, Data Structures Using C, Pearson Education.

Reference Books:

1. Trembley, J.P. And Sorenson P.G., An Introduction to Data Structures With Applications, McGraw- Hill.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Addison- Wesley.

BCA- 407: DATA BASE MANAGEMENT SYSTEM- II

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Today almost all real life problems include data**.** The objective of this paper to get students aware about the basic concept of Data. In this paper students will learn database management and its implementation.

Course Outcomes: At the end of this course, the student will be able to:

BCA-407.1. learn basic concepts of data base designing strategy of ER diagram.
BCA-407.2. understand functional dependency and normalization.
BCA-407.3. learn advance concept of DBMS.
BCA-407.4. implement SQL and PL/SQL in any software industry for database handling.

CO-PO Mapping Matrix for Course Code: BCA-407

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-407.1	3	3	2	3	3	2	2	2	2	3	2
BCA-407.2	3	2	3	3	3	2	2	2	2	2	2
BCA-407.3	2	3	3	3	2	2	2	2	1	1	2
BCA-407.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-407

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-407.1	3	3	2	3	3
BCA-407.2	3	2	3	3	3
BCA-407.3	2	3	3	3	2
BCA-407.4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

Database Concepts and Terminology, Characteristics of Database Approach, Data Dictionary, Database Languages, Actors on the Scene, Mapping in Three Levels of Architecture, Data Independence.
Classification of Database Management System, Conceptual and Physical Data Models, Comparison among data models, Codd’s Rule for Relational Model, Symbolic notations for designing ER Diagrams.

UNIT – II

Functional Dependency: Characteristics, Inference Rules for Functional Dependency, Types of Functional Dependency, Normalization: Benefits and Need of Normalization, Normal Forms Based on Primary Keys- (1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF, Domain Key Normal Form.

UNIT – III

Transactions: Acid Properties, Operations on Transactions, Concurrency: Problems, Concurrency Control Techniques, Locking Schemes, Deadlock: Methods for Handling Deadlock, Database Backup and Recovery: Recovery Techniques, Shadow Paging, Database Security.

UNIT – IV

SQL: Data Definition and Data Types, DDL, DML, and DCL, Views & Queries in SQL, Specifying Constraints & Indexes in SQL. PL/SQL: Architecture of PL/SQL Character Set, Data Types, User Defined Subtypes, Literals, Operators, Control Statement of PL/SQL. PL/SQL Arrays, Functions, Packages, Cursors, Procedure and Triggers.

Text Books:

1. Elmasri & Navathe, Fundamentals of Database Systems, Pearson Education.
2. A Silberschatz, H Korth, S Sudarshan, Database System and Concepts, McGraw-Hill.

Reference Books:

1. Thomas Connolly Carolyn Begg, Database Systems, Pearson Education.
2. C. J. Date, An Introduction to Database Systems, Addison Wesley.

BCA-408: COMPUTER NETWORKS- II

Type: Core Course (CC) Course Credits: 03 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Introduce the structural and architectural concepts of the Internet and its services. Give exposure to the major protocols of the Internet related with various services and other design issues along with the security concerns in networks and the Internet.

Course Outcomes: At the end of this course, the student will be able to:

BCA-408.1: have a comprehensive understanding of the Internet architecture and its Protocol stack.

BCA-408.2: gain insight into the functionality of major protocols and services of the Internet along with the different ways of getting access to the Internet.

BCA-408.3: comprehend application layer functionality of the Internet/ any network so as to acquire capabilities for designing service oriented applications.

BCA-408.4: get familiar with security issues related to computer networks and the Internet and the solutions for handling security related problems in networks.

CO-PO Mapping Matrix for Course Code: BCA-408

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-408.1	3	3	2	2	1	1	2	3	1	1	2
BCA-408.2	3	3	2	2	1	1	2	3	1	1	2
BCA-408.3	3	3	3	2	2	2	2	3	1	1	3
BCA-408.4	3	2	2	2	2	2	2	3	1	1	3
Average	3	2.75	2.25	2	1.5	1.5	2	3	1	1	2.5

CO-PSO Mapping Matrix for Course Code: BCA-408

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-408.1	2	3	2	3	3
BCA-408.2	2	3	2	3	3
BCA-408.3	2	3	2	3	3
BCA-408.4	2	3	2	3	3
Average	2	3	2	3	3

UNIT – I

Introduction to the Internet and its History. Internet Structure. TCP/IP architecture and its major Protocols. Comparison of TCP/IP and OSI reference Model. Overview of Internet based communications and access devices. Dialup Networking. Analog Modem Concepts. DSL Service. Cable Modems. Leased lines. Home Networking Concepts.

UNIT – II

Transport layer: Services, Port Numbers. The Transport Control Protocol (TCP) . Establishing and closing a TCP connection. The User Datagram Protocol (UDP). The Internet Protocol (IP). IPv4 and its addressing. Need for IPv6.

UNIT – III

Internet Routing Protocols: OSPF, BGP, RIP. Application Layer: Standard Client-Server Services and Protocols. World Wide Web. HTTP. FTP. Electronic mail. TELNET. Secure Shell(SSH). DNS. IP address resolution using DNS. Introduction to Network Management.

UNIT – IV

Network Security Issues: Security Goals. Threat Assessment. Network Attacks. Encryption Methods: Symmetric and Asymmetric-Key Ciphers. Firewalls, Digital Signatures, Authentication and Access Control Methods: Digital Certificates, Smart Cards, Kerberos. Virtual Private Networks and Internet Security. IP Security Protocol (IPSec).

Text Books:

1. Michael A. Gallo, William M. Hancock, Computer Communications and Networking Technologies, CENGAGE learning.
2. Behrouz A Forouzan, Data Communications and Networking, Mc-Graw Hill.

Reference Books:

1. William Stallings, Data and Computer Communications, PHI.
2. Andrew S. Tanenbaum, Computer Networks, PHI.

SEC-410 (I): PRINCIPLES OF ACCOUNTING

Type: Skill Enhancement Courses (SEC) Course Credits: 02 Contact Hours: 02 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 40 External Pass Marks: 16 (i.e. 40%) Internal Maximum Marks: 10 Total Max. Marks: 50 Total Pass Marks: 20 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The objective of this course is to inculcate the principle skills of accounting into students. Students will learn fundamental concept of accounting along with preparation of balance sheet.

Course Outcomes: At the end of this course, the student will be able to:
SEC-410 (I).1. learn the accounting concepts and conventions.
SEC-410 (I).2. understand double entry system, preparations of journal and ledger accounts.
SEC-410 (I).3. design trial balance after rectification of errors and learn the provisions of depreciation.
SEC-410 (I).4. draft final accounts with implementation of their learning in Tally accounting software.

CO-PO Mapping Matrix for Course Code: SEC-410 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC- 410 (I).1	3	3	2	3	2	3	2	2	3	3	2
SEC- 410 (I).2	3	2	3	2	3	2	2	1	2	2	1
SEC- 410 (I).3	2	3	3	3	2	2	2	2	2	3	2
SEC- 410 (I).4	3	2	2	2	2	3	3	3	3	2	2
Average	2.75	2.5	2.5	2.5	2.25	2.5	2.25	2	2.5	2.5	2

CO-PSO Mapping Matrix for Course Code: SEC-410(I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
SEC- 410 (I).1	3	3	2	2	1
SEC- 410 (I).2	3	2	3	1	2
SEC- 410 (I).3	3	3	2	1	3
SEC- 410 (I).4	3	2	2	2	3
Average	3	2.5	2.25	1.5	2.25

UNIT – I

Basic Accounting: Nature, scope and objectives of accounting, Users of accounting information, Accounting equation: Accounting concepts and conventions, Capital and revenue expenditure.

UNIT – II

Journal and Ledger: Double Entry System, Journal and recording of entries in journal and subsidiary books with narration, Ledger – Posting from Journal and subsidiary books to respective ledger accounts.

UNIT – III

Trial Balance: Need and objectives, Preparation of Trial Balance, Different types of errors, Rectification of errors before preparation of trial balance and after preparation of trial balance.
Depreciation provisions and reserves: concept and classification, Methods of depreciation accounting.

UNIT – IV

Final Accounts: Concept of adjustment; Preparation of Trading Account and Profit and Loss Account. Preparation of Balance Sheet. Preparation of Financial Statements at the end of financial year and their analysis.

An introduction to accounting software- Tally Version.

Text Books:

1. Anil Chowdhry, Fundamentals of Accounting & Financial Analysis, Pearson Education.
2. Jain and Narang : Financial Accounting.
3. Rajesh Agarwal & R Srinivasan, Accounting Made Easy, Tata McGraw –Hill.

Reference Books:

1. S.N. Maheshwari : An Introduction to Accountancy.
2. Amrish Gupta, Financial Accounting For Management, Pearson Education.
3. S. N. Maheshwari, Financial Accounting For Management, Vikas Publishing House.

SEC-410 (II): IT ACT & CYBER LAWS

Type: Skill Enhancement Courses (SEC) Course Credits: 02 Contact Hours: 02 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 40 External Pass Marks: 16 (i.e. 40%) Internal Maximum Marks: 10 Total Max. Marks: 50 Total Pass Marks: 20 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the curse is to make student aware with cyber laws and cyber crimes. Student will learn the law of digital contracts and get aware with Information technology act.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 205.1. learn the idea of cyber crime and Jurisprudence of Indian Cyber Law.
BCA- 205.2. understand how cyber crime occurs.
BCA- 205.3. get familiar with law of digital contracts.
BCA- 205.4. learn Information Technology Act and copyright.

CO-PO Mapping Matrix for Course Code: SEC-410 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC- 410 (II).1	3	3	2	3	3	2	2	3	2	3	2
SEC- 410 (II).2	3	2	3	3	3	3	2	2	2	2	2
SEC- 410 (II).3	3	3	2	3	2	2	2	2	1	1	2
SEC- 410 (II).4	3	2	2	2	3	3	2	3	3	2	2
Average	3	2.5	2.25	2.75	2.75	2.5	2	2.5	2	2	2

CO-PSO Mapping Matrix for Course Code: SEC-410 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
SEC-410 (II).1	2	3	2	3	2
SEC-410 (II).2	3	2	3	3	3
SEC-410 (II).3	2	3	3	2	2
SEC-410 (II).4	3	2	2	2	3
Average	2.5	2.5	2.5	2.5	2.5

UNIT-I

Basic Concepts**:** Definition of Cyber Law, Cyber-Crimes, Intellectual Property, Data Protection and Privacy, Scope and Needs of Cyber Laws, Reasons for Cyber Crimes and Cyber Criminals, Cyber Crime against Individual, Institution and State, The Jurisdiction of Indian Cyber Law.

UNIT-II

Evolution of Cyber-Crime, Cyber Fraud and Cyber Cheating, Virus on the Internet, Email Spoofing, Email Bombing, Cyber Stalking, Denial of Service Attack, Cyber Terrorism, Salami Attack, Online Gambling, Sale of Illegal Articles, Internet Time Theft, Web Jacking, Data Diddling, Intellectual Property Crimes, Web Defamation, Cyber Pornography.

UNIT-III

Law of Digital Contracts: Essence of Digital Contracts, System of Digital Signatures, Digital Signature Certificates, Certifying Authorities and Liabilities, Role and function of Certifying Authority. Legal Recognition of Digital Signature, Use of Electronic Records and Digital Signatures.

Unit – IV

Information Technology Act: Object and Scope of the IT Act, Major Issues Address by the IT Act, Jurisdiction of IT Act, Applicability of IT Act, and Relevant Authorities in India. Copyright: Meaning, Ownership and Assignment, License of Copyright, Copyright Protection of Content on the Internet.

Text Books:

1. Vivek Sood: Cyber Law Simplified, Tata McGraw Hill.
2. Vakul Sharma: Information Technology Law and Practice, Universal Law Publishing Co. Pvt. Ltd

Reference Books:

1. Farooq Ahmad: Cyber Law in India- (Pioneer Books), New Era Law Publications.
2. Suresh.T.Vishwanathan: The Indian Cyber Law, Bharat Law house New Delhi.
3. The Information Technology Act– Bare Act –Professional Book Publishers – New Delhi.

BCA- 501(I): ARTIFICIAL INTELLIGENCE

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to help students to understand the concept of Artificial Intelligence, Knowledge Representation, Logic, NLP and Learning.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 501(I).1 learn the basic concept of Artificial Intelligence (AI) and its application areas.
BCA- 501(I).2.acquire the knowledge of heuristic search and approaches for knowledge representations.
BCA- 501(I).3.understand the idea of natural language processing and predicate logic.
BCA- 501(I).4.gain the knowledge of learning technologies & build expert systems.

CO-PO Mapping Matrix for Course Code: BCA- 501(I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 501(I).1	3	3	2	2	3	2	2	2	3	3	2
BCA- 501(I).2	3	2	3	2	3	2	2	2	3	2	2
BCA- 501(I).3	3	3	3	2	2	2	2	2	3	1	1
BCA- 501(I).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA- 501(I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 501(I).1	3	3	2	3	3
BCA- 501(I).2	3	2	3	3	3
BCA- 501(I).3	2	3	3	3	2
BCA- 501(I).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT-I

Introduction to Artificial Intelligence (AI), Importance of AI, AI and its Related Field, AI Techniques, Criteria for success. Problem Space and Search: Problem as a State Space Search, Production System and its Characteristics, Issues in the Design of the Search Problem.

UNIT-II

Heuristic search techniques: Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction. Knowledge Representation: Definition and Importance of Knowledge, Knowledge Representation, Various Approaches Used in Knowledge Representation, Issues in Knowledge Representation.

UNIT-III

Using Predicate Logic: Representing Simple Facts in Logic, Representing Instances and is-a Relationship, Computable Function and Predicate, Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Discourse and Pragmatic Processing.

Unit – IV

Learning: Introduction to Learning, Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Example-Induction, Explanation Based Learning. Expert System: Introduction, Representing Using Domain Specific Knowledge, Expert System Shells.

Text Books:

1. E. Rich and K. Knight, Artificial Intelligence, TMH.

Reference Books:

1. D.W. Patterson, Introduction to AI and Expert Systems, PHI.
2. Nils J Nilsson, Artificial Intelligence -A new Synthesis, Harcourt Asia Ltd.

BCA- 501(II): COMPUTER ORIENTED NUMERICAL AND STATISTICAL METHODS

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to have a proper understanding of statistical and graphical techniques in statistical applications. This course will make students knowing about the concept of fundamentals of sampling.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 501(II).1 learn the concepts of algebraic methods and find solutions of polynomial equation.
BCA- 501(II).2 apply numerical methods to obtain approximate solutions to mathematical problems.
BCA- 501(II).3 fit curves and find correlations.
BCA- 501(II).4 solve statistical problems using probability distributions.

CO-PO Mapping Matrix for Course Code: BCA- 501(II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 501(II).1	3	2	2	3	2	3	2	3	2	-	1
BCA- 501(II).2	3	2	2	3	2	3	2	3	2	-	1
BCA- 501(II).3	3	1	2	3	2	1	2	2	2	-	1
BCA- 501(II).4	3	3	2	1	2	2	2	3	2	-	1
Average	3	2	2	2.5	2	2.25	2	2.75	2	-	1

CO-PSO Mapping Matrix for Course Code: BCA- 501(II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 501(I).1	3	2	2	3	3
BCA- 501(I).2	3	2	3	3	3
BCA- 501(I).3	2	2	2	3	2
BCA- 501(I).4	3	2	1	2	3
Average	2.75	2	2	2.75	2.75

UNIT – I

Algebraic and Transcendental Equation: Bisection Method, Iteration method, Method of false position, Newton-Raphson method, Methods of finding complex roots, Rate of convergence of Iterative methods, Finding solution for Polynomial Equations, Developing algorithms for these methods.

UNIT – II

Numerical Integration: Introduction, Trapezoidal rule, Simpson's 1/3 and 3/8 rule; Interpolation: Lagrange's method, Newton's method; Developing algorithms for these methods.
Differential Equations: Picard's Method, Euler's Method, Taylor's Method, Runge- Kutta Methods, Predictor Corrector Methods, Automatic Error Monitoring and Stability of solution, Developing algorithms for these methods.

UNIT – III

Curve Fitting: Straight line fit, Quadratic fit, Exponential fit, Correlation: Range Correlation, Karl Pearson correlation; Regression; Developing algorithms for these methods.

UNIT – IV

Mean, Median, Mode, Variance, Standard Deviation, kurtosis, moments, skewness; Probability distribution: Binomial, Poission, Normal distribution; Developing algorithms for these methods.

Text Books:

1. Rajaraman V, Computer Oriented Numerical Methods, Pearson Education.
2. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.

Reference Books:

1. Goon, A.M., Gupta Fundamental of Statistics. Vol. 1. 2002, world M.K., Dasgupta, B. Press. Calcutta.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, Pearson Publishers.

BCA- 502 (I): PROGRAMMING IN JAVA

Type: Discipline Specific Elective (DSE)
Course Credits: 02
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of JAVA as a High level language as one of the programming tool and generating logical development using programming. Making student to learn about OOPS and linking JAVA as a powerful OOPs language. Also making student aware of property of JAVA as Platform independent.

Course Outcomes: At the end of this course, the student will be able to:

BCA- 502 (I).1 demonstrate the basic programming constructs of Java and OOPs to develop Java programs.
BCA- 502 (I).2 learn and develop various controls and branching of logics under various cases using language control structures.
BCA- 502 (I).3 exemplify the usage to implement polymorphism and Inheritance in java programs.
BCA- 502 (I).4 acquire knowledge of Packages, Interfaces, Exceptions and Multithreading in building efficient applications.

CO-PO Mapping Matrix for Course Code: BCA- 502 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 502(I).1	3	2	3	1	3	2	2	3	2	1	2
BCA- 502(I).2	3	2	3	1	2	3	2	3	2	1	3
BCA- 502(I).3	3	2	3	1	2	2	2	3	2	--	2
BCA- 502(I).4	3	2	3	1	3	3	2	3	3	1	3
Average	3	2	3	1	2.5	2.5	2	3	2.25	0.75	2.5

CO-PSO Mapping Matrix for Course Code: BCA- 502 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 501(I).1	3	1	2	3	3
BCA- 501(I).2	3	1	3	3	3
BCA- 501(I).3	2	1	2	3	2
BCA- 501(I).4	3	1	3	3	3
Average	2.75	1	2.5	3	2.75

UNIT – I

Key Attributes of Object-Oriented Programming, Introduction to Java, History and Features of Java, Java Virtual Machine (JVM), JDK, Java Runtime Environment; Basic Elements: Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Data types, Operators, Assignments; Input/output in Java: Basics, I/O Classes, Reading Console Input.

UNIT – II

Control Structures in Java: Decision and Loop Control Statements.
Class and Object in Java: Class Fundamentals, creation of Objects, Defining Methods, Argument Passing Mechanism, Constructors, Abstract Class, Static Members. Array in Java: Defining an Array, Initializing & Accessing Array, Multi – Dimensional Array.

UNIT – III

String: String Fundamentals, Operations on Array and String, String Constructors, Creating Strings using String Class and StringBuffer Class. Polymorphism in Java: Basic Concept, Types, Overriding vs Overloading, Inheritance: Benefits of Inheritance, Types of Inheritance, Interface: Implementing Interface, extending Interface; package: creating a package.

UNIT –IV

Exception handling: catching multiple exception, throw/throws keyword, Finally keyword, user defined exception, Introduction to Multithreading, Thread Lifecycle. Introduction to Applet, Types of Applet, Applet Lifecycle.

Text Books:

1. E Balaguruswamy, Programming with java, Tata McGraw-Hill.
2. Patrick Naughton and Herbert Schlitz, JAVA-2 Complete Reference, TMH.

Reference Books:

1. Ivor Horton, Beginning JAVA 2, WROX Publications, New Delhi.
2. Paul Deital & Harvey Deital, Java: How to Program, Pearson Education.
3. Horstmann, John Wiley, Computing Concepts with Java 2 Essentials.
4. Decker & Hirshfield, Programming Java, Vikas Publication.

BCA- 502 (II): PHP and MYSQL

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The objective of this course is to create dynamic web sites. Students will be able to apply their skill for the creation of dynamic web applications such as content management and user registration etc.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 502 (II).1 understand operators and control statements in PHP.
BCA- 502 (II).2 gain a detailed knowledge on arrays, functions and strings.
BCA- 502 (II).3 design forms and perform operations on files and directories.
BCA- 502 (II).4 implement his/ her learning in PHP and MysQL.

CO-PO Mapping Matrix for Course Code: BCA- 502 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 502 (II).1	3	3	2	2	2	3	2	2	3	3	2
BCA- 502 (II).2	3	2	3	2	2	3	2	2	1	2	2
BCA- 502 (II).3	3	3	3	2	2	2	2	2	3	1	1
BCA- 502 (II).4	3	2	2	3	2	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2	2.75	2.25	2.25	2.25	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA- 502 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 502 (II).1	3	3	3	3	3
BCA- 502 (II).2	2	2	3	2	2
BCA- 502 (II).3	2	3	3	3	2
BCA- 502 (II).4	3	2	2	2	3
Average	2.5	2.5	2.75	2.5	2.5

Unit- I

Introduction to PHP: Advantages of PHP, HTML relationship, variable types and their scope, Types of Data, Type conversion, Type casting.
Operators, unary operators, arithmetic operators, logical operators, conditional operators, conversion operators, Comparison operators, Ternary Operator, Scope resolution operator.
Control statements – sequence, conditional statements, loops, jump statements.

Unit- II

Creating an array, Multidimensional arrays, Accessing array, Element Looping with Index based array, Looping with associative array using each () and foreach(), Array Library functions.

Functions and Strings: Function prototypes, arguments, Recursive functions, Mathematical conversion functions.

Strings: Basic operations on strings: Reading from part of a string, Replacing parts of a string, Finding a substring within a string, Trimming whitespace, Changing string case, Comparing strings.

Unit- III

OOPS Concept: Classes, Defining a class and Objects, Constructor & Destructor, Method Overloading, Basic inheritance, Overriding functions, Variables, 'this' variable, Access control modifiers-Public, Private, Protected, Final, Abstract, Iterating through object variables, Deleting objects, Abstract class and Interfaces.

Forms Processing: Designing a form, GET and POST, Handling data-register, Handling form, Form Validation**:** Client-side validation, Server-side validation**.** File Uploading – File Downloading through Form. Working with directory.

Unit- IV

PHP & MySQL: Introduction MySQL, PhpMyAdmin, PHP_MySQL-DB functions, Connecting to a MySQL database, Performing basic database operation(DML) (Insert, Delete, Update, Select), Setting query parameter, Executing query, Join (Cross joins, Inner joins, Outer Joins, Self joins.),Aggregate Functions(sum, avg, count).

Introduction to Cookies and Sessions: Using cookies, Sessions: Starting a session, ending a session, checking session data.

Text Books:

1. Robert W.Sebesta, PHP Programming, Peason Education.
2. Joel Murach, Ray Harris, Murach's PHP and MySQL: Training & Reference.

Reference Books:

1. StevenHolzner, PHP: The Complete Reference.
2. Mario Lurig, PHP Reference: Beginner to Intermediate PHP5.

BCA- 504 (I): COMPUTER GRAPHICS

Type: Discipline Specific Elective (DSE)
Course Credits: 02
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to help students gain experience in interactive computer graphics using 2D, 3D, point and line drawing algorithms.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 504 (I).1 understand the core concepts of computer graphics.
BCA- 504 (I).2 learn and implement point, line and circle drawing algorithms.
BCA- 504 (I).3 acquire knowledge two dimensional transformations and line clipping algorithms.
BCA- 504 (I).4 understand 3-D graphics concept and acquire skills for designing 3-D graphics.

CO-PO Mapping Matrix for Course Code: BCA- 504 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 504 (I).1	3	3	2	3	3	2	2	2	3	3	3
BCA- 504 (I).2	2	3	3	2	3	2	2	2	3	2	2
BCA- 504 (I).3	2	2	3	3	2	2	2	2	3	3	3
BCA- 504 (I).4	3	2	2	3	3	3	3	3	2	2	2
Average	2.5	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2.75	2.5	2.5

CO-PSO Mapping Matrix for Course Code: BCA- 504 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 504 (I).1	3	3	3	3	3
BCA- 504 (I).2	3	2	3	3	1
BCA- 504 (I).3	3	2	3	2	2
BCA- 504 (I).4	3	3	2	2	3
Average	3.0	2.5	2.75	2.5	2.25

Unit- I

Introduction: History of Computer Graphics (CG), Applications of Computer Graphics, Components of interactive graphics systems, Display devices: Refresh CRT, Color CRT, Plasma Panel displays LCD Panels, Raster-scan System, Random scan System, Graphic software, Input/output Devices, Tablets.

Unit- II

Output Primitives: Points and Lines, Line Drawing Algorithms: DDA algorithm, Bresenhams algorithm, Circle drawing algorithms: Polynomial Method, Bresenhams algorithm. Parametric representation of Cubic Curves, Bezier Curves.

Unit- III

2D Transformation: Use of Homogeneous Coordinates Systems, Composite Transformation: Translation, Scaling, Rotation, Mirror Reflection, Rotation about an Arbitrary Point. Clipping and Windowing, Clipping Operations. Line Clipping Algorithms: The Mid-Point subdivision method, Cohen-Sutherland Line Clipping Algorithms, Polygon Clipping, Sutherland Hodgeman Algorithms, Text Clipping,

Unit- IV

3-D Graphics: 3-D object representations, 3-D Transformations: Translation, Rotation, Scaling, Projections, Hidden surface elimination: Back face removal, Dept Buffer algorithm, Scan-line algorithm, Dept sort algorithm, Shading.

Text Books:

1. Hearn & P.M. Baker, Computer Graphics, Prentice Hall India.

Reference Books:

1. T. Vaughan, Multimedia, making it working, Tata McGraw Hill.
2. J.D. Foley & A VanDam, Fundamentals of Interactive Computer Graphics, Addison Wesley.
3. S. Harringion, Computer Graphics – A programming, Tata McGraw Hill.
4. Woo, Neider, Davis, Shreiner, OpenGL Programming Guide, Addison-Wesley Professional.

BCA- 504 (II): MANAGEMENT INFORMATION SYSTEM

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to help students to understand the role of information technology and decision support systems in business. Student will learn to design, implement, evaluate and maintain the system for an enterprise.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 504 (II).1 relate the basic concepts and technologies used in the field of Management Information Systems.
BCA- 504 (II).2 apply the understanding that how MIS is helpful in decision making.
BCA- 504 (II).3 learn the process of system detailed designing.
BCA- 504 (II).4 understand the processes of developing and implementing information systems.

CO-PO Mapping Matrix for Course Code: BCA- 504 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 504 (II).1	3	3	2	3	3	2	2	2	3	3	2
BCA- 504 (II).2	3	3	3	2	3	3	3	2	3	2	2
BCA- 504 (II).3	2	3	3	2	2	2	3	2	3	1	3
BCA- 504 (II).4	3	3	2	3	3	3	2	3	2	2	2
Average	2.75	3	2.5	2.5	2.75	2.5	2.5	2.25	2.75	2	2.25

CO-PSO Mapping Matrix for Course Code: BCA- 504 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 504 (II).1	3	3	2	3	3
BCA- 504 (II).2	2	3	3	2	2
BCA- 504 (II).3	2	3	3	3	2
BCA- 504 (II).4	3	2	2	2	3
Average	2.5	2.75	2.5	2.5	2.5

Unit- I

Introduction to Management Information System (MIS): Definition, Meaning and Role of MIS, The System View of Business, MIS organization within the Company, Management Organizational Theory and the System Approach, Development of Organizational Theory, Management and Organizational Behavior, Management Information and the System approach, Types of Information System at Management levels.

Unit- II

Information System for Decision Making: Decision Making and MIS, MIS as a Technique for Making Programmed Decisions, MIS response, MIS Planning. Conceptual System Design: Define the problem, Set system objectives, Establish system constraints, Determining information needs and sources, Develop alternative conceptual design and select one, Document the system concept, Prepare the conceptual design report.

Unit- III

Detail System Design: Aim of detailed design, Project Management of MIS Detail Design, Identifying the Domain and Tradeoff Criteria, Defining Subsystems, Detailed Operating Sub System and Information Flows, Determination of the Degree of Automation of Each Operation, Input/ Output and Processing, Early System Testing, Documentation of the detailed design

Unit- IV

Implementation, Evaluation and Maintenance of the MIS**:** Planning and Organization for Implementation, Develop Procedure From Implementation, Operating Personal Training, Computer Related Acquisitions, Testing the system, Cutover, Documentation of the System, Evaluation of the MIS Control and the System Maintenance. Pitfalls in MIS Development: Soft Spot Planning, Design Problems and Solution strategies.

Text Books:

1. Robert. G. Murdick, Joel E. Ross and James R. Claggett, Information Systems for Modern Management, Prentice Hall.
2. Gordan. B. Devis, Management Information System, Mcgraw-hill.

Reference Books:

1. Jerome Kanter, Managing with Information, Prentice Hall.
2. Kenneth. C. Laudon, Management Information System, Prentice Hall.

BCA-505 (I): VISUAL PROGRAMMING USING C#

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to get expertise in visual programming and understand the functionalities of middleware platform.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 505 (I).1 get the knowledge of the structure and model of the programming language C #.
BCA- 505 (I).2 develop various applications in C # classes and objects.
BCA- 505 (I).3 understand and implement object oriented features in C # programming language to solve the given problem.
BCA- 505 (I).4 learn LINQ that binds the gap between relational and object-oriented approaches.

CO-PO Mapping Matrix for Course Code: BCA-505 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 505 (I).1	3	2	2	3	1	2	1	2	1	--	2
BCA- 505 (I).2	3	2	3	3	1	2	2	2	1	1	2
BCA- 505 (I).3	3	2	3	3	1	3	2	2	1	1	2
BCA- 505 (I).4	3	2	2	2	1	2	1	1	--	--	2
Average	3	2	2.5	2.75	1	2.25	1.5	1.75	1	1	2

CO-PSO Mapping Matrix for Course Code: BCA-505 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 505 (I).1	3	3	3	3	3
BCA- 505 (I).2	2	3	3	3	3
BCA- 505 (I).3	2	3	3	3	2
BCA- 505 (I).4	1	3	3	2	3
Average	2	3	3	2.75	2.75

UNIT – I

Introduction to Object Technology: Introduction to C# Applications, Creating a Simple Application in Visual C# Express, Formatting Text with Console. Write and Console, WriteLine, Operators: Arithmetic, Logical, Relational, Ternary, Unary, Bitwise and Bit Shift operator; Decision Making, Array and Strings manipulations.

UNIT – II

Introduction to Classes and Objects: Classes, Objects, Methods, Properties and Instance Variables, Declaring Class with Method and Instantiating an Object of Class, Declaring a Method with Parameters, set and get accessors, Initializing Objects with Constructors, Floating-Point Numbers and Type decimal, Control Statements.

UNIT – III

Constructors, Composition, Garbage Collection and Destructors, static Class Members, Data Abstraction and Encapsulation, Object Initializers, Delegates Object-Oriented Programming: Inheritance, Polymorphism, Interfaces and Operator Overloading-Exception Handling.

UNIT – IV

Graphical User Interfaces with Windows Forms: Introduction to Windows Forms, Control Properties and Layout: Labels, TextBoxes and Buttons, GroupBoxes and Panels, CheckBoxes and RadioButtons, Numeric UpDown Control, Event Handling, Multiple Document Interface (MDI), User-Defined Controls, Data access using LINQ to SQL.

Text Books:

1. Paul Deitel & Harvey Deitel, C# 2010 for Programmers, Pearson Education.

Reference Books:

1. Rob Miles, C# yellow Book, Cheese Edition 8.1.
2. RB Whitaker, The C# Player's Guide.

BCA- 505 (II): PROGRAMMING IN JAVASCRIPT

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to develop the skill & knowledge of concepts commonly used in dynamic language programming. Student will also be able to learn about client side interfaces through the use of DOM.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 505 (II).1 understand concept of Scripting.
BCA- 505 (II).2 acquire knowledge about basic fundamentals of JavaScript.
BCA- 505 (II).3 understand the applicability of various objects like window, document used in programming.
BCA- 505 (II).4 acquire the skills that will enable him to design and build high level web enabled applications.

CO-PO Mapping Matrix for Course Code: BCA- 505 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 505 (II).1	3	3	2	3	1	3	2	3	2	1	2
BCA- 505 (II).2	3	3	3	3	1	3	2	2	2	1	2
BCA- 505 (II).3	3	3	3	3	2	3	2	2	2	1	2
BCA- 505 (II).4	3	3	3	3	2	3	2	3	2	2	3
Average	3	3	2.75	3	1.5	3	2	2.5	2	1.25	2.25

CO-PSO Mapping Matrix for Course Code: BCA- 505 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 505 (II).1	3	3	2	3	3
BCA- 505 (II).2	3	2	3	3	3
BCA- 505 (II).3	2	3	3	3	2
BCA- 505 (II).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

The Nature of JavaScript: Evolution of Scripting Languages, JavaScript -Definition, Programming for Non-Programmers, Introduction to Client–Side Programming, Comparison between Java, JavaScript & VB Script. Enhancing HTML Documents with JavaScript. Static and Dynamic web pages.

UNIT – II

Introduction to JavaScript: Document Object Model (DOM), obtaining user inputs, memory concepts, Character set, case sensitivity, comments, Literals, Expression & Operators, Control Structures, looping constructs, break, continue statements, variables, Data types, Keywords.

UNIT – III

JavaScript types, merge multiple JavaScript into one, Running Scripts, Methods, and Events, Introduction to Objects: String, Date, Boolean, Window, document and various Object interaction.

UNIT – IV

Array declaration and allocation, passing arrays to function, Scoping rules, Recursion and iteration, cookies, Form Validation. Introduction to XML.

Text Books:

1. David Flanagan, JavaScript: The Definitive Guide: The Definitive Guide.
2. Chris Bates, Web Programming, Building Internet Applications, WILEY.

Reference Books:

1. Kogent Learning, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.

BCA- 507 (I): DATA WAREHOUSING AND MINING

Type: Discipline Specific Elective (DSE)
Course Credits: 02
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to understand the classical models in data warehouses and data mining.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 507 (I).1 understand the concept of OLTP system.
BCA- 507 (I).2 acquire the knowledge of various tools and methodology of data warehouse.
BCA- 507 (I).3 learn the basic fundamentals of data mining.
BCA- 507 (I).4 learn preprocesses the data for mining applications.

CO-PO Mapping Matrix for Course Code: BCA- 507 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 507 (I).1	3	2	3	2	2	1	1	2	1	1	2
BCA- 507 (I).2	3	2	3	2	3	3	2	2	2	1	3
BCA- 507 (I).3	3	2	3	2	2	2	2	2	2	1	2
BCA- 507 (I).4	3	3	3	2	3	3	2	2	2	1	3
Average	3	2.25	3	2	2.5	2.25	1.75	2	1.75	1	2.5

CO-PSO Mapping Matrix for Course Code: BCA- 507 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 507 (I).1	3	3	2	3	3
BCA- 507 (I).2	3	2	3	2	3
BCA- 507 (I).3	2	3	3	3	2
BCA- 507 (I).4	3	2	2	2	2
Average	2.75	2.5	2.5	2.5	2.5

UNIT – I

Introduction to Data Warehouse: OLTP Systems, Differences between OLTP Systems and Data Warehouse, Characteristics of Data Warehouse, Functionality of Data Warehouse, Advantages and Applications of Data Warehouse.

UNIT – II

Top- Down and Bottom-Up Development Methodology, Tools for Data warehouse development, Data Warehouse Types, Data Warehouse Architecture, and Components of Data warehouse Architecture, Introduction to Federated Data Warehouse Architecture.

UNIT – III

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.

UNIT – IV

Data Preprocessing: Introduction to Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Text Books:

1. Jiawei Han & Micheline Kamber, Data Mining – Concepts and Techniques, Morgan Kaufmann Publishers.

Reference Books:

1. Sam Aanhory & Dennis Murray, Data Warehousing in the Real World, Pearson Education.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson Education.
3. Paulraj Ponnaiah, Data Warehousing Fundamentals, Wiley Student Edition.

BCA- 507 (II): SOFTWARE PROJECT MANAGEMENT

Type: Discipline Specific Elective (DSE)
Course Credits: 02
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to help students to understand the need for Software Project Management and to highlight different techniques for software cost estimation, activity planning, CASE tools and designing project closure report.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 507 (II).1 learn about activities methodologies and stepwise approach for software project planning.
BCA- 507 (II).2 acquire knowledge of cost estimation for a software project.
BCA- 507 (II).3 understand risk assessment and critical path analysis.
BCA- 507 (II).4 practice project management principles while developing software.

CO-PO Mapping Matrix for Course Code: BCA- 507 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 507 (II).1	3	3	2	2	3	2	2	2	2	3	2
BCA- 507 (II).2	3	3	3	3	2	2	2	3	3	2	2
BCA- 507 (II).3	3	3	2	2	2	2	2	2	3	1	1
BCA- 507 (II).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.75	2.25	2.5	2.5	2.25	2.25	2.5	2.5	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA- 507 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 507 (II).1	3	3	2	3	3
BCA- 507 (II).2	3	2	3	2	3
BCA- 507 (II).3	2	3	3	3	2
BCA- 507 (II).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.5	2.75

Unit- I

Project Evaluation and Project Planning: Importance of Software Project Management, Activities Methodologies, Categorization of Software Projects, Setting objectives, Management Principles, Management Control, Project portfolio Management, Cost-benefit Evaluation Technology, Risk evaluation, Strategic Program Management, Stepwise Project Planning.

Unit- II

Project Life Cycle and Effort Estimation: Software Process and Process Models, Choice of Process Models, Mental Delivery, Rapid Application Development, Agile Methods, Extreme Programming, Managing Interactive Processes, Basics of Software Estimation, Effort and Cost estimation techniques, COCOMO II.

Unit- III Project Planning: Objectives of Project Planning, Project Schedules, Activities, Sequencing and Scheduling, Network Planning Models, Forward Pass & Backward Pass Techniques, Critical Path Method, Risk Identification, Assessment, Monitoring, PERT Technique, Monte Carlo Simulation, Resource Allocation, Creation of Critical Patterns, Cost schedules.
Unit- IV Computer Aided Software Engineering (CASE) Tools: CASE Concepts, Classification of CASE Tools, Steps for CASE Tool Implementation, Integrated CASE Environments, Architecture of CASE Environment. Project Closure: Project Closure Analysis; Case Study 1: Infosys Project Closure Analysis Report; Case Study 2: ACIC Project Closure Analysis Report.
Text Books: 1. Bob Hughes, Mike Cotterell and Rajib Mall, Software Project Management, Tata McGraw Hill.
Reference Books: 1. Robert K. Wysocki, Effective Software Project Management, Wiley Publication. 2. Walker Royce, Software Project Management, Addison-Wesley. 3. Gopalaswamy Ramesh, Managing Global Software Projects, McGraw Hill Education.

BCA-508 (I): PROGRAMMING IN PYTHON

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to understand the core principles of the Python Language. This course will make student to design effective GUI applications.

Course Outcomes: At the end of this course, the student will be able to:
BCA-508 (I).1 understand the basic concepts of python programming.
BCA-508 (I).2 learn various data structure used in python programming.
BCA-508 (I).3 develop the simple programs of python using arrays and functions.
BCA-508 (I).4 illustrate the process of data file manipulations using python.

CO-PO Mapping Matrix for Course Code: BCA-508 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-508 (I).1	3	3	2	3	1	3	2	3	3	1	3
BCA-508 (I).2	3	3	2	3	1	3	2	3	2	1	2
BCA-508 (I).3	3	2	3	3	2	3	2	3	2	1	3
BCA-508 (I).4	3	3	3	3	2	3	2	3	2	1	3
Average	3	2.75	2.5	3	1.5	3	2	3	2.25	1	2.75

CO-PSO Mapping Matrix for Course Code: BCA-508 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-508 (I).1	3	3	2	3	3
BCA-508 (I).2	3	2	3	3	3
BCA-508 (I).3	2	3	3	3	2
BCA-508 (I).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

Unit- I

Introduction to Python: Python Interpreter, Python as calculator, Python shell, Indentation, identifier and keywords, literals, strings, Operators: Arithmetic, Relational, Logical, comparison, Bitwise, Assignment, Identity operator and Membership operator; Input & output statements; Control statements: Branching, looping, Conditional statement, Exit function.

Unit- II

String Manipulations: Subscript operator, indexing, slicing a string, other functions on strings, string module. Strings and number system: Format functions, converting strings to numbers & Vice Versa. List, Tuples, Sets, Dictionaries: Basic list operators, replacing, inserting, removing an element, searching, Sorting lists, dictionary literals, adding & removing keys, accessing & replacing values, traversing dictionaries.

Unit- III Array in Python, Design with Functions: hiding redundancy, complexity, arguments & return values; Formal/Actual arguments, named arguments, program structure and design, Recursive functions, scope & Global statements, Importing modules, Math modules & Random modules.
Unit- IV Exception Handling: Exceptions, except clause, try and finally clause, user defined exceptions. File Handling: Manipulating files & directories, OS & SYS modules, Reading, Writing text & numbers from/to file. Graphics: “Turtle” module, drawing colors, shapes, digital images, image file formats.
Text Books: 1. Sheetal Taneja, Naveen Kumar, Python Programming: A Modular approach, 5th Impression, Pearson. 2. Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press. 3. Mark Lutz, Learning Python (available online at pdf derive).
Reference Books: 1. Guttag John V, Introduction to Computation and Programming Using Python with Application to Understanding Data, PHI. 2. Charles Diorbach, Introduction to Computer Science using Python, Wiley.

BCA- 508 (II): LINUX AND SHELL PROGRAMMING

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to enable students to **i**dentify and use Linux commands and utilities to create and manage file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 508 (II).1 understand Linux architecture.
BCA- 508 (II).2 ability to use various Linux commands that are used to manipulate system operations.
BCA- 508 (II).3 acquire knowledge of Linux File System.
BCA- 508 (II).4 understand and make effective use of I/O and shell scripting language to solve problems.

CO-PO Mapping Matrix for Course Code: BCA- 508 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 508 (II).1	3	3	2	2	3	2	2	2	3	-	2
BCA- 508 (II).2	3	2	3	2	3	2	2	2	3	-	2
BCA- 508 (II).3	3	3	3	2	2	2	2	2	3	-	1
BCA- 508 (II).4	3	2	2	3	3	3	3	3	2	-	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	-	1.75

CO-PSO Mapping Matrix for Course Code: BCA- 508 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 508 (II).1	3	1	2	1	3
BCA- 508 (II).2	2	2	3	1	2
BCA- 508 (II).3	2	3	3	1	2
BCA- 508 (II).4	3	2	2	1	3
Average	2.5	2	2.5	1	2.5

UNIT – I

Introduction to Linux: Linux distributions, Overview of Linux operating system, Linux architecture, Features of Linux, Accessing Linux system, Starting and shutting down system, Logging in and Logging out, Comparison of Linux with other operating systems.

UNIT – II

Commands in Linux: General-Purpose commands, File oriented commands, directory oriented commands, Communication-oriented commands, process oriented commands, etc. Regular expressions & Filters in Linux: Simple filters viz. more, wc, diff, sort, uniq, grep; Introducing regular expressions.

UNIT – III

Linux file system: Linux files, inodes and structure and file system, file system components, standard file system, file system types. Processes in Linux: Starting and Stopping Processes, Initialization Processes, Mechanism of process creation, Job control in linux using at, batch, cron & time.

UNIT – IV

Shell Programming: vi editor, shell variables, I/O in shell, control structures, loops, subprograms, creating & executing shell scripts in linux.

Text Books:

1. Yashwant Kanetkar, Unix & Shell programming – BPB Publications.
2. Richard Petersen, The Complete Reference – Linux, McGraw-Hill.
3. M.G.Venkateshmurthy, Introduction to Unix & Shell Programming, Pearson Education.

Reference Books:

1. Stephen Prata, Advanced UNIX-A programmer's Guide, SAMS Publication.
2. Sumitabha Das, Your Unix - The Ultimate Guide, Tata McGraw-Hill.

SEC- 510 (I): TIME MANAGEMENT

Type: Skill Enhancement Course (SEC) Course Credits: 02 Contact Hours: 02 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 40 External Pass Marks: 16 (i.e. 40%) Internal Maximum Marks: 10 Total Max. Marks: 50 Total Pass Marks: 20 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to identify time wasters and adopt strategies for reducing them. Students should recognize the variety of causes of procrastination and apply relevant techniques to overcome these.

Course Outcomes: At the end of this course, the student will be able to:
SEC- 510 (I).1 manage their time effectively and think about their vision & mission.
SEC- 510 (I).2 plan their time effectively.
SEC- 510 (I).3 learn to set clear priorities and how to delegate.
SEC- 510 (I).4 overcome procrastination and understands how to plug time leakage.

CO-PO Mapping Matrix for Course Code: SEC- 510 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC- 510 (I).1	3	3	2	2	3	2	2	2	3	3	2
SEC- 510 (I).2	3	2	3	2	3	2	2	2	3	2	2
SEC- 510 (I).3	3	3	3	2	2	2	2	2	3	1	1
SEC- 510 (I).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75

CO-PSO Mapping Matrix for Course Code: SEC- 510 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
SEC- 510 (I).1	3	3	2	3	3
SEC- 510 (I).2	3	2	3	3	3
SEC- 510 (I).3	2	3	3	3	2
SEC- 510 (I).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

Unit- I

The Psychology of Time Management: The Four D's of Effectiveness, A Few Myths About Managing Your Time, The Law of Control, Visualize Yourself as You Want to Be, Determine Your Values: Meaning and Purpose, Analyze Yourself, Your Vision and Mission: Think Before Acting, Keep the End in Mind, Examine Your Methodology.

Unit- II

Project Forward Look Backward: Long Time Perspective, Make Better Decisions in the Present, Time Management Techniques, Planning for Goal Achievement, Create a PERT Chart, Set Clear Goals for Everyone, Create Your Daily "To-Do" List: The ABCDE Method, The Pareto Principle, Plan Your Work and Work Your Plan, The Not-To-Do List.

Unit- III

Set Clear Priorities: The Pareto Principle, The Law of Three, Stay on Track: Lifestyle Principle, The Important vs. the Urgent, Develop Good Work Habits, Define Your Key Result Areas, Clarity Is Essential, Multiply Your Value, Delegation: Delegation Is Learnable, To Whom, What, Why to delegate, Key Steps of Delegation. Practice Single-Handling, Avoid Multitasking, Dumb and Dumber.

Unit- IV

Overcome Procrastination: Causes, The Eight Factor, Mental Programming, The Salami Slice Method, Develop a Sense of Urgency, Art of Anticipating: Parking Meter Syndrome, False Deadline Strategy, The Pack-Rat Approach, Plugging Time Leaks, Power tools for Time Management.

Text Books:

1. Brain Tracy, Time Management, American Management Association.

Reference Books:

1. Marc Mancini, Time Management, McGraw Hill.

SEC- 510 (II): INFORMATION SECURITY

Type: Skill Enhancement Course (SEC)
Course Credits: 02
Contact Hours: 02 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 40
External Pass Marks: 16 (i.e. 40%)
Internal Maximum Marks: 10
Total Max. Marks: 50
Total Pass Marks: 20 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide an understanding of principal concepts, basic approaches of information security.

Course Outcomes: At the end of this course, the student will be able to:
SEC- 510 (II).1 get the knowledge of the components of information security and security model.
SEC- 510 (II).2 develop an understanding of various Laws in Information security.
SEC- 510 (II).3 gain familiarity with risk identifications and their control strategy.
SEC- 510 (II).4 get the knowledge of information security policy.

CO-PO Mapping Matrix for Course Code: SEC- 510 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC- 510 (II).1	3	2	2	2	3	2	1	2	2	1	2
SEC- 510 (II).2	3	2	3	2	2	2	2	2	3	3	2
SEC- 510 (II).3	3	3	3	2	2	2	2	2	2	2	1
SEC- 510 (II).4	3	2	3	3	3	3	2	3	3	2	2
Average	3	2.25	2.75	2.25	2.5	2.25	1.75	2.25	2.5	2	1.75

CO-PSO Mapping Matrix for Course Code: SEC- 510 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
SEC- 510 (II).1	3	3	2	3	3
SEC- 510 (II).2	3	2	3	3	3
SEC- 510 (II).3	2	3	3	3	2
SEC- 510 (II).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

UNIT – I

Introduction: History of Information Security, CNSS Security Model, Components of Information Security, Approaches to Information Security and Implementation, Security Systems Development Life Cycle, Security Professionals and the Organization.

UNIT – II

The Need for Security: Introduction, Business Needs First: Threats and Attacks, Legal, Ethical, and Professional Issues in Information Security, Law and Ethics in Information Security: Relevant Laws, International Laws and Legal Bodies.

UNIT – III

Risk Management: An Overview of Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies: Selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices.

UNIT – IV

Planning for Security – Introduction to Information Security Planning and Governance, Information Security Policy, Standards, and Practices, Security Education, Training, and Awareness Program.

Text Books:

1. Michael E. Whitman & Herbert J. Mattord, Principles of Information Security, Course Technology, Cengage Learning.

Reference Books:

1. Steve G Watkins, An Introduction to Information Security and ISO 27001:2013 – A Pocket Guide.

BCA- 601 (I): INFORMATION RETRIEVAL SYSTEMS

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The objective of this paper is to elaborate the idea of Information Retrieval (IR) System. This course will enhance the knowledge of students by study of indexing & linking, searching methods, evaluation on IR, browsing and visualization etc.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 601 (I).1 understand the idea of Information Retrieval Systems (IRS).
BCA- 601 (I).2 acquire knowledge of indexing and natural language.
BCA- 601 (I).3 learn Dissemination of Information Search and component of IRS.
BCA- 601 (I).4 evaluate IRS and various visualization aspects.

CO-PO Mapping Matrix for Course Code: BCA- 601 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 601 (I).1	3	3	2	2	3	2	2	2	3	3	2
BCA- 601 (I).2	3	2	3	2	3	2	2	2	3	2	2
BCA- 601 (I).3	3	3	3	2	2	2	2	2	3	1	1
BCA- 601 (I).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA- 601 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 601 (I).1	3	3	2	3	3
BCA- 601 (I).2	3	2	3	3	3
BCA- 601 (I).3	2	3	3	3	2
BCA- 601 (I).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

Unit- I

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems.
Functional Overview: Item Normalization, Selective Dissemination of Information, Document, Index and Multimedia Database Search.
Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities, Z39.50 and WAIS Standards.

Unit- II

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Scope of Indexing, Precoordination and Linkages, Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing

Natural Language, Concept Indexing, Hypertext Linkages, Information Extraction, Index Compression: Dictionary Compression, Posting File Compression.

Unit- III

User Search Technique: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext.

Computing Scores in a Complete Search System: Efficient Scoring and Ranking, Components of an Information Retrieval System.

Unit- IV

Evaluation in Information Retrieval, Standard Test Collections, Evaluation of Unranked Retrieval Sets, Evaluation of Ranked Retrieval Results, Assessing Relevance, System Quality and User Utility.

Information Visualization: Cognition and Perception, Aspects of Visualization Process, Information Visualization Technologies.

Text Books:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Introduction to Information Retrieval, Cambridge University Press.

Reference Books:

1. Gerald J. Kowalski, Mark T. Maybury, Information Storage and Retrieval Systems Theory and Implementation, Kluwer Academic Publishers.

BCA- 601 (II): SIMULATION AND MODELLING

Type: Discipline Specific Elective (DSE)
Course Credits: 02
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24 (i.e. 40%)
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30 (i.e. 40%)

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to predict the performance of an existing or planned system and to compare alternative solutions for a particular design problem.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 601 (II).1 learn the different components and types of system.
BCA- 601 (II).2 learn various techniques and models of simulation for problem solving.
BCA- 601 (II).3 understand various operation for random number generations.
BCA- 601 (II).4 acquire knowledge of various simulation tools and languages.

CO-PO Mapping Matrix for Course Code: BCA- 601 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 601 (II).1	3	3	2	2	3	2	2	1	3	1	2
BCA- 601 (II).2	3	3	3	2	2	1	3	2	3	2	2
BCA- 601 (II).3	3	3	3	3	2	2	2	2	3	1	1
BCA- 601 (II).4	3	2	3	3	3	3	3	3	2	2	2
Average	3	2.75	2.75	2.25	2.5	2	2.5	2	2.75	1.5	1.75

CO-PSO Mapping Matrix for Course Code: BCA- 601 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 601 (II).1	3	3	3	3	3
BCA- 601 (II).2	3	2	3	2	2
BCA- 601 (II).3	3	3	3	3	2
BCA- 601 (II).4	3	2	2	2	3
Average	3	2.5	2.75	2.5	2.5

UNIT-I

System Definition and Components, Stochastic Activities, Continuous and Discrete Systems, System Modeling, Types of Models, Static and Dynamic Physical Models, Static and Dynamic Mathematical Models, Full Corporate Model, Types of System Study.

UNIT-II

System Simulation, Why to Simulate and When to Simulate, Basic Nature of Simulation, Techniques of Simulation, Comparison of Simulation and Analytical Methods, Types of System Simulation, Real Time simulation, Hybrid Simulation, Simulation of Pure-Pursuit Problem, Single-Server Queuing System, An Inventory Problem, Monte Carlo Simulation, Distributed Lag Models, Cobweb Model.

UNIT-III

Simulation of Continuous Systems, Analog vs, Digital Simulation, Simulation of Water Reservoir System, Simulation of A Servo System, Simulation of An Autopilot, Discrete System Simulation, Fixed Time-Step vs, Event-To-Event Model, Generation of Random Numbers, Test for Randomness, Generalization of Non-Uniformly Distributed Random Numbers, Monte-Carlo Computation vs. Stochastic Simulation.

UNIT-IV

System Dynamics, Exponential growth models, Exponential decay models, Modified exponential growth models, Logistic curves and generalization of growth models, System dynamics diagrams and feedback in socio-economic systems. World model: critical path computation, Uncertainties in activity duration, Resource allocation simulation software, General purpose Vs Application-oriented simulation packages.

Text Books:

1. Geoftrey Gordon, System Simulation, PHI.
2. Narsingh Deo, System Simulation with Digital Computer, PHI.

Reference Books:

1. Averill M. Law, W. David Kelton, Simulation Modeling and Analysis, TMH

BCA-602 (I): SPSS

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: SPSS (Statistical Package for Social Science) is a tool for the statistical analysis of data. It allows to perform a wide variety of statistical procedures.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 602 (I).1 understand the features and learn the menu of SPSS.
BCA- 602 (I).2 acquire knowledge of data manipulation and transformation.
BCA- 602 (I).3 perform descriptive analysis and statistical test.
BCA- 602 (I).4 perform simple regressions and multivariate analyses (factor and cluster).

CO-PO Mapping Matrix for Course Code: BCA-602 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 602 (I).1	3	3	2	2	3	2	2	2	2	3	2
BCA- 602 (I).2	3	2	3	2	2	3	3	2	3	2	2
BCA- 602 (I).3	2	2	3	2	2	2	2	2	1	1	2
BCA- 602 (I).4	3	2	3	2	3	3	3	3	2	2	2
Average	2.75	2.25	2.75	2	2.5	2.5	2.5	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: BCA-602 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 602 (I).1	3	3	3	2	2
BCA- 602 (I).2	3	2	2	3	2
BCA- 602 (I).3	2	3	2	3	2
BCA- 602 (I).4	3	2	2	2	2
Average	2.75	2.5	2.25	2.5	2

Unit- I

Introduction - Introduction to SPSS - Data analysis with SPSS: general aspects, workflow, critical issues - SPSS: general description, functions, menus, commands - SPSS file management.

Unit- II

Input and data cleaning - Defining variables - Manual input of data - Automated input of data and file import, Data manipulation - Data Transformation - Syntax files and scripts - Output management.

Unit- III

Descriptive analysis of data - Frequencies - Descriptives - Explore - Crosstabs – Charts.
Statistical tests - Means - T-test - One-way ANOVA - Non parametric tests - Normality tests.

Unit- IV

Correlation and regression - Linear correlation and regression - Multiple regression (linear). Multivariate analysis - Factor analysis - Cluster analysis.

Text Books:

1. Agresti, A. and B. Findlay, Statistical Analysis for the Social Science. Prentice Hall.
2. Field, A. P., Discovering Statistics using SPSS (Introducing Statistical Method), Oriental Press.

Reference Books:

1. George, D. SPSS for Windows Step-by-Step: A Simple Guide and Reference 18.0.
2. Green, Samuel B. and Neil J. Salkind, Using SPSS for Windows and Macintosh: Analysing and Understanding Data. Prentice Hall.

BCA-602 (II): PROGRAMMING IN R

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: R is open source software. This course is designed to learn how to program in R and how to use R for effective data analysis.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 602 (I).1 Understand R programming structures.
BCA- 602 (I).2 Recognize and make appropriate use of different types of data structures, vector and list.
BCA- 602 (I).3 Learn Metrices, arrays and data frames in R.
BCA- 602 (I).4 Gain knowledge on input/output operations and learn to install packages in R.

CO-PO Mapping Matrix for Course Code: BCA- 602 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 602 (II).1	3	3	2	2	3	2	2	2	3	3	2
BCA- 602 (II).2	3	2	3	2	3	2	2	2	3	2	3
BCA- 602 (II).3	3	3	3	2	2	2	2	2	3	1	3
BCA- 602 (II).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	2.5

CO-PSO Mapping Matrix for Course Code: BCA- 602 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 602 (II).1	3	3	2	3	3
BCA- 602 (II).2	3	2	3	3	3
BCA- 602 (II).3	2	3	3	3	2
BCA- 602 (II).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

Unit – I

Introduction to R: Installing R, How to Run R, Functions, Start-up Files, Reading and Writing R, Arithmetic operations in R.

R Programming Structures: Control Statements, Loops, If-Else, Arithmetic and Boolean Operator values, Type Conversions-Functions.

Unit – II

R Data Structures: Lists Creation, Accessing List Elements, Adding or Deleting List Elements, Recursive Lists, Data Frames.

Vectors: Declaration, Arithmetic and logic operations, Indexing, Vector Elements-operations on vectors, Filtering, Matrices, Math Functions, Set operations.

Unit- III Matrices and Arrays: Creating Matrices, Applying Functions to Matrix Rows and Columns, Adding and Deleting Matrix Rows and Columns, Naming Matrix Rows and Columns, Higher-Dimensional Arrays. Data Frames: Creating Data Frames, Merging Data Frames, Applying Functions to Data Frames, Factors and Tables: Factors and Levels, Common Functions Used with Factors, Working with Tables, Other Factor- and Table-Related Functions.
Unit- IV Input /Output: Reading from the keyboard, Reading and Writing to a File, Reading a Matrix or Data Frame from a file, Accessing files on Remote Machines, String Manipulations, Interfacing R from other languages. Packages in R, Installation process of various packages in R, Data science packages in R, Building R packages.
Text Books: 1. Norman Matloff, The Art of R Programming A Tour of Statistical Software Design, No Starch Press.
Reference Books: 1. W. N. Venables, D. M. Smith and the R Core Team, An Introduction to R.

BCA-604 (I): MULTIMEDIA AND ITS APPLICATIONS

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to list out appropriate hardware, software and different applications of multimedia, evaluate the appropriate multimedia systems and develop effective multimedia applications.

Course Outcomes: At the end of this course, the student will be able to:
BCA-604 (I).1 learn multimedia applications, tools and products.
BCA-604 (I).2 understand multimedia building blocks and compression techniques.
BCA-604 (I).3 acquire knowledge of internet role in multimedia.
BCA-604 (I).4 identify the future prospectus of multimedia.

CO-PO Mapping Matrix for the Course Code: BCA-604 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA-604 (I).1	3	3	2	2	3	2	2	2	3	3	2
BCA-604 (I).2	2	2	3	2	1	2	2	2	3	2	2
BCA-604 (I).3	2	3	3	2	2	2	2	2	3	1	1
BCA-604 (I).4	3	2	2	3	3	3	3	3	2	2	2
Average	2.5	2.5	2.5	2.25	1.75	2.25	2.25	2.25	2.75	2	1.75

CO-PSO Mapping Matrix for the Course Code: BCA-604 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA-604 (I).1	3	3	2	3	3
BCA-604 (I).2	3	2	3	3	3
BCA-604 (I).3	3	2	3	3	2
BCA-604 (I).4	3	2	2	2	3
Average	3	2.25	2.5	2.75	2.75

Unit - I

Multimedia: Basic Properties and Medium Types, Multimedia Applications, Making Multimedia: Stages of Project, Requirements to Make Good Multimedia, Multimedia Skills and Training.
Multimedia-Hardware and Software: Hardware peripherals - Connections, Memory and storage devices, Multimedia software - Basic Tools, Making Instant Multimedia, Production Standards.

Unit-II

Multimedia Building Blocks Creating & Editing Media Elements: Text, Image, Sound, Animation, Analog/ Digital Video, Data Compression: Need, Difference of Lossless/ Lossy Compression techniques. Overview of Different Compression Algorithms.

Unit-III

Multimedia and Internet: Internet access methods, Connections, Internet Services, The World Wide Web, Tools for the WWW, Web Servers, Web Browsers, Web Page Makers and Editors, Plug-Ins and Delivery Vehicles, HTML, Designing for the WWW –Working on the Web, Multimedia Applications. Media Communication, Media Consumption, Media Entertainment, Media Games

UNIT-IV

Future Multimedia: Digital Communication and New Media, Multimedia Conferencing, Virtual Reality, Digital Camera. Assembling and Delivering a Multimedia Project-Planning and Costing.

Text Books:

1. Tay Vaughan, Multimedia: Making it work, TMH.
2. Ralf Steinmetz and Klara Naharstedt, Multimedia: Computing, Communications Applications ,Pearson.

Reference Books:

1. Keyes, Multimedia Handbook, TMH.
2. Steve Heath, Multimedia & Communication Systems, Focal Press.
3. K. Andleigh and K. Thakkar, Multimedia System Design, PHI.
4. Steve Rimmer, Advanced Multimedia Programming, MHI.

BCA-604 (II): PRINCIPLES OF BIG DATA

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to help students to get aware about big data concepts; its storage aspects, analytical process and various big data technologies.

Course Outcomes: At the end of this course, the student will be able to:
BCA-604 (II).1 understand big data adoption and acquisition.
BCA-604 (II).2 learn big data design planning and considerations.
BCA-604 (II).3 learn Big data tools for mining and analysis.
BCA-604 (II).4 understand the relationship of big data with emerging technologies.

CO-PO Mapping Matrix for Course Code: BCA- 604 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 604 (II).1	3	3	2	2	3	2	2	2	2	3	2
BCA- 604 (II).2	3	2	3	2	2	2	2	2	3	2	2
BCA- 604 (II).3	3	3	3	2	2	2	2	2	3	1	1
BCA- 604 (II).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.5	2.25	2.25	2.25	2.5	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA- 604 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 604 (II).1	2	2	2	3	3
BCA- 604 (II).2	3	2	1	3	3
BCA- 604 (II).3	2	2	1	3	2
BCA- 604 (II).4	3	2	2	2	3
Average	2.5	2	1.5	2.75	2.75

Unit- I

Big Data: Concept and Terminology, Definition, Historic Development, Characteristics, Features, Purpose, Value and Challenges of Big Data, Different types of Data, Business Motivations and Drivers for Big Data Adoption, Big Data Generation, Big Data Acquisition.

Unit- II

Big Data Storage: Storage System with Massive Data, Distributed Storage System, Storage Mechanism for Big Data, Sharding, Replication, CAP Theorem, Database Technology and Design Factors. Big data Planning Considerations, Database Programming Model: MapReduce, Dryad, All-Pairs, Pregel.

Unit- III

Big Data Analysis: Traditional Data Analysis, Big Data Analytic Methods, Architecture for Big Data Analysis, Tools for Big Data Mining and Analysis. Big Data Analysis Fields: Structured, Text, Web, Multimedia, Network, Mobile Traffic Data Analysis.

Unit- IV

Big Data Related Technologies: Cloud Computing, Relationship between Cloud Computing and Big Data, Data Security related to cloud based big data solutions, IoT, Relationship between Iot and Big Data, Hadoop, Relationship between Hadoop and Big Data. Data Center, Data Security.

Text Books:

1. Vince Reynolds, Big Data for Beginners.
2. Min Chen, Shiwen Mao, Yin Zhang, Victor C.M. Leung Big Data Related Technologies, Challenges and Future Prospects, Springer.

Reference Books:

1. Thomas Erl, Wajid Khattak and Paul Buhler Big Data Fundamentals- Concepts, Drivers and Techniques, Prentice Hall.

BCA- 605 (I): PROGRAMMING IN XML

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to help students to understand what exactly XML is? They will be able to conclude the relationship between HTML and XML. Students will learn the impact of XML in the real world.

Course Outcomes: Upon successful completion of the course, Students will be able to
BCA- 605 (I).1 Learn XML essential and defining, formatting and displaying data into XML.
BCA- 605 (I).2.Acquire Knowledge of elements, attributes and XML schema.
BCA- 605 (I).3 Understand XML documents and Basics of Cascading Style Sheets.
BCA- 605 (I).4 Implement XML Content with CSS and basic knowledge of XSL.

CO-PO Mapping Matrix for Course Code: BCA- 605 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 605 (I).1	3	3	2	3	3	2	2	2	3	3	2
BCA- 605 (I).2	3	3	3	2	3	3	2	2	3	2	2
BCA- 605 (I).3	3	3	3	2	2	2	2	2	3	1	3
BCA- 605 (I).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.75	2.5	2.5	2.75	2.5	2.25	2.25	2.75	2	2.25

CO-PSO Mapping Matrix for Course Code: BCA- 605 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 605 (I).1	3	3	2	3	3
BCA- 605 (I).2	3	2	2	3	3
BCA- 605 (I).3	3	3	3	2	2
BCA- 605 (I).4	3	3	2	2	3
Average	3.0	2.75	2.25	2.5	2.75

Unit – I

Introduction to XML: Getting Multilingual with XML ,The Convergence of HTML and XML, XML and Web Browsers, XML Building Blocks, XML's Five Commandments, Schemas and XML Data Modeling, Document Type Definitions (DTDs), XML Schema (XSDs), Comparing DTDs and XSDs, The Importance of Document Validation.

Unit – II

DTD Construction Basics: Pondering Elements and Attributes, Empty Elements, Empty-Only Elements, Mixed Elements, Putting Attributes to Work, String Attributes, Enumerated Attributes, Tokenized Attributes, Working with Multiple Attributes.
Using XML Schema: XSD Data Types, XSD Schemas and XML Documents, Working with Simple Types, Complex XML Schema Example, World of Entities.

Unit – III
Putting Namespaces to Use: Namespaces and XSD Schemas, Validating XML Documents: Validation Tools, DTD and XSD Validation, Repairing Invalid Documents. Formatting and Displaying XML Documents: Cascading Style Sheets (CSS): Layout Properties, Formatting Properties, Style Sheet into an XML Document.CSS and XSL, Rendering XML with Style Sheets, Leveraging CSS and XSLT on the Web.
Unit – IV
Styling XML Content with CSS**:** Tinkering with the z-Index, Creating Margins, The ins and outs of text formatting, Working with Fonts, Jazzing Up Text with Colors and Image Backgrounds. eXtensible Style Language (XSL) Fundamentals: Understanding XSL, XSL Transformation, XPath, XSL Formatting Objects, Patterns and Expressions.
Text Books: 1. Michael Morrison, Teach Yourself XML in 24 Hours, Sams Publishing.
Reference Books: 1. Joe Fawcett, Liam R. E. Quin, Danny Ayers, Beginning XML, John Wiley & Sons, Inc. 2. Jim Melton, Stephen Buxton, Querying XML, Morgan Kaufmann Publishers.

BCA-605 (II): GUI PROGRAMMING

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to demonstrate an understanding of the concept of GUI programming. The students will be able to design and implement small applications using GUI interfaces.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 605 (II).1 learn .net architecture and its fundamental concepts.
BCA- 605 (II).2 acquire knowledge of common controls in C#.
BCA- 605 (II).3 understand ADO.net architecture and GridView.
BCA- 605 (II).4 learn advance features in GUI programming and design report using Crystal reporting tool.

CO-PO Mapping Matrix for Course Code: BCA-605 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 605 (II).1	3	3	2	2	3	2	2	2	3	3	2
BCA- 605 (II).2	3	2	3	2	3	2	2	2	3	2	2
BCA- 605 (II).3	3	3	3	2	2	2	2	2	3	1	1
BCA- 605 (II).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA-605 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 605 (II).1	3	3	2	3	3
BCA- 605 (II).2	3	2	3	3	3
BCA- 605 (II).3	2	3	3	3	2
BCA- 605 (II).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

Unit- I

About .Net Framework: .Net definition and characteristics, Understanding the .Net Framework Architecture, The Basic of IL, CLS and CTS, Managed Module Framework Class Library(FCL), Common Language Runtime (CLR) and Just-in-Time Compiler (JIT) and its Type, Introduction to Assembly and NameSpace: Types of Assembly, difference between Assembly and NameSpace, Managed Code: Interoperability with Unmanaged Code.

Unit- II

About C Sharp: Introduction to C#, Versions, Features, Class and Object, Variables , data types, Property, Event and Method. Array, Functions and Subroutine, Creating User Define Class and Property, Concept of Inheritance, Window Form: SDI and MDI, Common Controls: Label, Button, TextBox, ListBox, ComboBox,Check Box, Radio Button and their Common Property, Event and Method.

Unit- III

ADO.Net: Introduction to ADO.Net, Importance/features of ADO.Net, ADO.Net Architecture: .Net Data Provider, Connection, Command, DataReader, DataAdapter, DataSet, Common Properties and Methods for Components of ADO.Net Architecture. Introduction to GridView.

Unit- IV

Advance Features: Collections (ArrayList) and Exception Handling, Advance Control: DateTimePicker, RichTextBox, Timer, Crystal Report: Creation of simple report using Crystal Report.

Text Books:

1. John Sharp, Microsoft Visual C# 2010 Step by Step.
2. Christian Nagel, Jay Glynn, Morgan Skinner, Microsoft Professional C# 5.0 And .Net 4.5.1, Wrox.

Reference Books:

1. Herbert Schildt, The complete reference c sharp 4.0, McGraw-Hill.

BCA-607 (I): COMPUTER VISION

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: In this course students will learn basic principles of image formation, image processing algorithms and different algorithms for 3D reconstruction and recognition from single or multiple images (video).

Course Outcomes: At the end of this course, the student will be able to:
BCA- 607 (I).1 implement fundamental image processing techniques required for computer vision.
BCA- 607 (I).2 understand Image formation process and perform shape analysis.
BCA- 607 (I).3 extract features from Images and do analysis of Images.
BCA- 607 (I).4 learn shapre representation and segmentation techniques.

CO-PO Mapping Matrix for Course Code: BCA-607 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 607 (I).1	3	3	2	2	3	2	2	2	3	3	2
BCA- 607 (I).2	3	2	3	2	3	2	2	2	3	2	2
BCA- 607 (I).3	3	3	3	2	2	2	2	2	3	1	1
BCA- 607 (I).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75

CO-PSO Mapping Matrix for Course Code: BCA-607 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 607 (I).1	3	3	2	3	3
BCA- 607 (I).2	3	2	3	3	3
BCA- 607 (I).3	2	3	3	3	2
BCA- 607 (I).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

Unit- I

Introduction: Image Processing & Computer Vision, What is Computer Vision - Low-level, Mid-level, High-level.
Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

Unit- II

Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading, Depth from Defocus, Construction of 3D model from images.

Unit- III

Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete), Edge detection. Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Unit- IV

Shape Representation and Segmentation : Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi resolution analysis

Text Books:

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Addison Wesley Longman, Inc.

Reference Books:

1. D. H. Ballard, C. M. Brown, Computer Vision, Prentice-Hall.
2. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA), Springer.
3. Sonka, Hlavac, and Boyle. Thomson, Image Processing, Analysis, and Machine Vision.
4. D. Forsyth and J. Ponce, Computer Vision - A modern approach, Prentice Hall.
5. E. Trucco and A. Verri, Introductory Techniques for 3D Computer Vision, Prentice Hall.

BCA-607 (II): INTERNET-OF-THINGS

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to make students aware to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Device.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 607 (II).1 Learn IoT techniques and deployment templates.
BCA- 607 (II).2 Acquire knowledge of domain specific IoT.
BCA- 607 (II).3 Learn IoT platform design methodology.
BCA- 607 (II).4 Understand design and development challenges in IoT.

CO-PO Mapping Matrix for Course Code: BCA-607 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 607 (II).1	3	3	2	2	3	2	2	2	3	1	2
BCA- 607 (II).2	2	2	2	3	2	2	3	2	2	2	2
BCA- 607 (II).3	2	1	2	2	3	2	2	2	3	1	2
BCA- 607 (II).4	3	2	2	3	3	2	3	2	2	2	2
Average	2.5	2	2	2.5	2.75	2	2.5	2	2.5	1.5	2

CO-PSO Mapping Matrix for Course Code: BCA-607 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 607 (II).1	3	2	2	3	3
BCA- 607 (II).2	2	2	1	2	2
BCA- 607 (II).3	2	3	3	3	2
BCA- 607 (II).4	3	2	2	2	3
Average	2.5	2.25	2	2.5	2.5

Unit- I

Introduction & Concepts: Introduction to Internet of things- Definition & Characteristics of IoT, Physical Design of IoT, Logical design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Templates. Functional blocks of IoT, Communication models & APIs.

Unit- II

Domain Specific IOTs: Introduction, Home Automation, Cities, Logistics, Agriculture, Industry, Health & Lifestyle. IoT and M2M: Machine to Machine, Difference between IoT and M2M, Software Define Network,
IoT systems management with NETCONF-YANG.

Unit- III IoT Platforms Design Methodology: Introduction, IoT Design Methodology, IoT physical Devices & Endpoints: IoT Device, Raspberry Pi Interfaces, Other IoT Devices. Network & Communication aspects: Wireless Medium Access Issues, MAC Protocol Survey, Survey Routing Protocols, Sensor Deployment & Node Discovery, Data Aggregation & Dissemination.
Unit- IV IoT Physical Servers & Cloud Offerings: Introduction, WAMP, Xively Cloud for IoT, Designing a RESTful Web API, Web Services for IoT, IoT Messaging Platform. Challenges in IoT: Design challenges, Development challenges, Security challenges, Other challenges.
Text Books: **1.** Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands on approach, Universities Press.
Reference Books: 1. Waltenegus Dargie,Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice. 2. Raj Kamal, Intenet of Things- Architecture and Design Principles, McGraw Hills. 3. Dimitrios Serpnos, Marilyn Wolf, Internet of Things (IoT) Systems, Architecture, Algorithms, Methodologies, Springer.

BCA-608 (I): DTP PACKAGES	
Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The objective of the course is to provide the students understanding of the techniques essential to build their career in desktop publishing.

Course Outcomes: At the end of this course, the student will be able to:
BCA- 608 (I).1 edit different types of photos and also create own photo album with different effects.
BCA- 608 (I).2 create the index of their books, create their I-cards and Magazines, etc.
BCA- 608 (I).3 develop different types of animations as well as animated multimedia presentations.
BCA- 608 (I).4 ineract with the idea of flash movies.

CO-PO Mapping Matrix for Course Code: BCA-608 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 608 (I).1	3	3	2	2	3	2	2	2	3	3	2
BCA- 608 (I).2	3	2	3	2	3	2	2	2	2	2	1
BCA- 608 (I).3	3	3	3	2	2	2	2	2	3	1	1
BCA- 608 (I).4	3	2	2	3	3	3	3	2	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2	2.5	2	1.5

CO-PSO Mapping Matrix for Course Code: BCA-608 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 608 (I).1	3	3	2	2	3
BCA- 608 (I).2	2	2	3	3	3
BCA- 608 (I).3	2	3	3	3	2
BCA- 608 (I).4	3	2	2	2	3
Average	2.5	2.5	2.5	2.5	2.75

Unit- I

Desktop Publishing (DTP): Introduction to DTP, Need and Features.
Adobe PhotoShop: Opening and Saving, Selection Modes, Color Modes, Color Models, Paintbrushes and Art Tools, Layers, Masks, Filters.

Unit- II

PageMaker: Basics, Publication, Drawing Tools, Text Tool, Transformations, Master Pages.
Corel Draw: Basics, Artistic Media tool, Advanced Drawing, Outline and Fill Tool, Interactive Tools.
Multimedia: Introduction to Multimedia, Multimedia application goals and objectives, Multimedia and the internet.

Unit- III

Macromedia Flash: Flash Concepts, Introducing Flash drawing tools, Panels, creating a new flash document, Movie properties, Scenes in flash, layers in flash, concept of frame, Saving a flash document, testing a flash movie, publishing a flash movie.

Advances Animation: Using Motion Tweening to create Animations, Using Shape Tweening to create Animations, Using the Onion Skin Feature, Creating a Masking effects: Masking a text using Motion Tweening, masking an image using shape tweening, Frame-by-Frame Animation.

Unit- IV

Interactivity to Flash Movie: Programming concepts in ActionScript, Object Oriented features in actionscript, Creation of an animated button, Assign actions to buttons, Play buttons, Rollover Menu, Test buttons and menus, Working with the movieclip class, date class and Timeline Control Actions, controlling movie clips with actions, Constructing a Hierarchical Menu.

Text Books:

1. Kevin Proot, Adobe Pagemaker 7.0, India Addition.
2. Satish Jain & Shashank Jain, Coreldraw 12 Training Guide, BPB Publication.
3. Shalini Gupta &Adity Gupta, Flash 8 in Simple Steps.

Reference Books:

1. Lauri Ulrich Fuller and Robert C. Fuller, PHOTOSHOP CS3 Bible, Wiley-India Addition.
2. John Villamil and Louis Molina, Multimedia – An Introduction, PHI Publication.
3. Denise Tyler, How to use Macromedia Flash Mx and ActionScript.

BCA-608 (II): SCILAB

Type: Discipline Specific Elective (DSE) Course Credits: 02 Contact Hours: 03 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 60 External Pass Marks: 24 (i.e. 40%) Internal Maximum Marks: 15 Total Max. Marks: 75 Total Pass Marks: 30 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The objective of the course is to make aware the students about SCILAB software environment.

Course Outcomes: At the end of this course, the student will be able to:
BCA-608 (II).1 work with matrices.
BCA-608 (II).2 learn expressions and get familiar with command window.
BCA-608 (II).3 understand flow control in Scilab and work with graphics.
BCA-608 (II).4 design by writing scripts and using functions.

CO-PO Mapping Matrix for Course Code: BCA-608 (II)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BCA- 608 (II).1	3	2	2	3	1	2	1	2	1	--	2
BCA- 608 (II).2	3	2	3	3	1	2	2	2	1	1	2
BCA- 608 (II).3	3	2	3	3	1	3	2	2	1	1	2
BCA- 608 (II).4	3	2	2	2	1	2	1	1	--	--	2
Average	3	2	2.5	2.75	1	2.25	1.5	1.75	1	1	2

CO-PSO Mapping Matrix for Course Code: BCA-608 (II)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
BCA- 608 (II).1	3	3	3	3	3
BCA- 608 (II).2	2	3	3	3	3
BCA- 608 (II).3	2	3	3	3	2
BCA- 608 (II).4	1	3	3	2	3
Average	2	3	3	2.75	2.75

Unit- I

Introduction to simulation software.
Matrices and arrays: entering matrices sum and transpose, subscripts, colon operator, magic function.
Working with matrices: generating matrices, the load function, m-files, concatenation, deleting rows and Columns, Linear Algebra, Arrays Multivariate Data, Scalar Expansion, Logical Subscripting, find Function.

Unit- II

Expressions: variables numbers, operators functions, expressions.
Command window: the format function, suppressing output, entering long statements, command line editing.

Unit- III Graphics: plotting process, editing process, preparing graphs, basic plotting functions, mesh & surface plot, and image reading & writing, printing graphics. Flow control: if, else, and else if, switch and case, for, while, continue, break try - catch, return.
Unit- IV Other data structure: multidimensional arrays, cell arrays, characters and text, structures. Scripts & functions: scripts, functions, global variables, passing string arguments to functions, eval function, Function Handles, Vectorization, Pre allocation.
Text Books: 1. Rachna Verma and Arvind Verma, Introduction to SCILAB.(available online at pdf driveF)
Reference Books: 2. Anil Kumar Verma, SCILAB—A Beginner's Approach. (available online at pdf drive)

SEC- 610 (I): STRESS MANAGEMENT

Type: Skill Enhancement Course (SEC) Course Credits: 02 Contact Hours: 02 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 40 External Pass Marks: 16 (i.e. 40%) Internal Maximum Marks: 10 Total Max. Marks: 50 Total Pass Marks: 20 (i.e. 40%)	Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to help students understand how to cope with stress at work place.

Course Outcomes: At the end of this course, the student will be able to:
SEC- 610 (I).1 understand about stress and causes of stress.
SEC- 610 (I).2 understand the stages of stress and strategies to cope up by the stress.
SEC- 610 (I).3 learn the causes of stress at work place and duties of an employer/ management to manage it.
SEC- 610 (I).4 know the civil implication and HSE management standards.

CO-PO Mapping Matrix for Course Code: SEC- 610 (I)

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC- 610 (I).1	3	3	2	2	3	3	2	2	3	3	2
SEC- 610 (I).2	3	2	3	2	3	2	2	2	3	2	2
SEC- 610 (I).3	3	3	3	2	2	3	2	2	3	1	3
SEC- 610 (I).4	3	2	2	3	3	2	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.5	2.25	2.25	2.75	2.5	2.25

CO-PSO Mapping Matrix for Course Code: SEC- 610 (I)

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
SEC- 610 (I).1	3	3	3	3	3
SEC- 610 (I).2	3	2	2	3	3
SEC- 610 (I).3	2	3	1	3	2
SEC- 610 (I).4	3	2	2	2	3
Average	2.75	2.5	2	2.75	2.75

Unit- I

Introduction to Stress: Definition, Evidence, Stress and Pressure, Physiology of stress, Model of human performance and stress, The effects of stress, Classification of the causes of stress, Factors contributing to stress, Sources of work stress, The home–work interface, Reducing stress at organizational level, bullying and harassment, Violence management.

Unit- II

Responses to Stress: Stages of the stress response, Stress indicators, Anxiety and depression, Personality and stress, Submission, Assertion and Aggression.
Evaluation of stress: Measurement and evaluation of stress, Stress levels in occupations. Coping with stress strategies, Better time management, Relaxation therapy, Ideas for managing stress.

Unit- III

Stress in the workplace: Recognizing stress in the workplace, Strategies for reducing stress, Human behavior and stress, Workplace indicators of stress, Stress and the potential for human.

Managing stress at work: Employers' responsibilities and duties in relation to stress, Duties of senior management: The human factors-related approach, Strategies for managing stress, Remedies for employers

Unit- IV

The civil implications: Principal areas of consideration, Court of Appeal guidelines: Employers' obligations, Violence, harassment and bullying at work, Court of Appeal general guidelines, The remedies for employers, HSE management standards.

Text Books:

1. Jeremy Stranks, Stress at Work Management and Prevention, Elsevier.

Reference Books:

1. Dutta, P.K., Stress Management, Himalaya Publication.
2. D.M. Pestonjee, Stress And Coping : An Indian Experience, Sage Publication.
3. Udai Pareek, Handbook of HRD Tools.

SEC-610(II): E-CRM

Type: Skill Enhancement Course (SEC) Course Credits: 02 Contact Hours: 02 hours/week. Examination Duration: 3 Hours Mode: Lecture External Maximum Marks: 40 External Pass Marks: 16 (i.e. 40%) Internal Maximum Marks: 10 Total Max. Marks: 50 Total Pass Marks: 20 (i.e. 40%)	**Instructions To Paper Setter For End Semester Exam:** Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: This aim of the course to enable the students to understand the technological and human issues relating to implementation of Customer Relationship Management in the organizations.

Course Outcomes: At the end of this course, the student will be able to:
BCA-610 (II).1 Learn the concept of CRM, obstacles, success factor and CRM packages.
BCA-610 (II).2 Understand technological and business issues of e-CRM and e-CRM architecture.
BCA-610 (II).3 Acquire the knowledge of e-CRM in call centers.
BCA-610 (II).4 Implement CRM in an organization.

CO-PO matrix for Course Code: SEC-610(II): E-CRM

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC-610 (II).1	3	3	2	2	3	2	2	2	3	3	2
SEC-610 (II).2	3	2	3	2	3	2	2	2	3	2	2
SEC-610 (II).3	3	3	3	2	2	2	2	2	3	1	1
SEC-610 (II).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75

CO-PSO matrix for the Course Code: SEC-610(II): E-CRM

COs#	PSO1	PSO2	PSO3	PSO4	PSO5
SEC-610 (II).1	3	3	2	3	3
SEC-610 (II).2	3	2	3	3	3
SEC-610 (II).3	2	3	3	3	2
SEC-610 (II).4	3	2	2	2	3
Average	2.75	2.5	2.5	2.75	2.75

Unit- I

Introduction to CRM: Evolution, CRM Pyramid, Components, Drivers, CRM and Telemarketing, Obstacles in CRM, Success factors of CRM, Internet’s Influence on CRM, CRM and Globalization, Major CRM packages.

Unit- II

About e-CRM: e-CRM versus CRM, Key e-CRM Features, Technological and Business Issues, Business Drivers, E-CRM Assessment, e-CRM Architecture, e-CRM Components, The Five Engines of e-CRM, Challenges in Delivering True e-CRM.

Unit- III Call Center: Meaning, Customer Interaction, Functionality, Technological Implementation, About ACD (Automatic Call Distribution), IVR (Interactive Voice Response), CTI (Computer Telephony Integration), Web Enabling the Call Center, Automated Intelligent Call Routing, Logging & Monitoring.
Unit- IV Implementation of CRM: Characteristics of Good CRM, Factors affecting CRM implementation, Key Challenges, Steps for Implementation, Implementation Phases, Post Implementation pitfalls.
Text Books: **1.** E-Customer Relationship Management, JNU Jaipur.
Reference Books: **2.** Customer Relationship Management by V Kumar, Werner J Reinartz, WILEY.

CO-PO-PSO Mapping Matrix for the Courses of:
BACHELOR OF COMPUTER APPLICATIONS (BCA)

Semester	Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
1	**BCA-101**	2.75	2.5	2.5	2.75	2.5	2.5	2.25	2.25	2	2	1.75	2.75	2.5	2.5	2.75	2.75
	BCA-102	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-104	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-105	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-107	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-108	2.75	2.5	2.5	2.75	2.25	2.25	2.25	2.5	2	2.5	2.25	2.75	2.5	2	2	2.25
2	**BCA-201**	2.75	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2	2	1.75	2.75	2.5	2.5	2.75	2.75
	BCA-202	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-204	2.75	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2	2	1.75	2.75	2.5	2.5	2.75	2.75
	BCA-205	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-207	2.75	2.5	2.5	3	2.5	2.25	2.25	2	2	2.5	1.75	2.5	2.75	2.25	2.25	2.75
	BCA-208	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
3	**BCA- 301**	2.75	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2	2	1.75	2.75	2.5	2.5	2.75	2.75
	BCA-302	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-304	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-305	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-307	3	2.5	2.5	2.75	2.75	2	1.75	2.25	2.25	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-308	2.75	2.75	2	2.75	2.75	1.5	2	3	1.25	1	2	2	3	2	3	3
	SEC- 310 (I)	3	2.25	2.5	2.5	2.5	2.5	2.25	2.25	2	2.5	2	3	2.25	2	2	2.5
	SEC-310 (II)	2.75	2.5	2.5	2.5	2.25	2.5	2.25	2.5	2.5	2.5	2.25	3	2.5	2.25	2.5	2.75
4	**BCA-401**	3	2.25	2.5	2.75	2.5	2.25	2.25	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-402	2.7	2.5	1.5	2	1.25	1.25	3	3	1	2.5	2	2.25	1.5	1	3	3
	BCA-404	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-405	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA- 407	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2.75	2.5	2.5	2.75	2.75
	BCA-408	3	2.75	2.25	2	1.5	1.5	2	3	1	1	2.5	2	3	2	3	3
	SEC-410 (I)	2.75	2.5	2.5	2.5	2.25	2.5	2.25	2	2.5	2.5	2	3	2.5	2.25	1.5	2.25
	SEC-410 (II)	3	2.5	2.25	2.75	2.75	2.5	2	2.5	2	2	2	2.5	2.5	2.5	2.5	2.5
5	**BCA- 501(I)**	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75	2.75	2.5	2.5	2.75	2.75

	BCA- 501(II)	3	2	2	2.5	2	2.25	2	2.75	2	-	1	2.75	2	2	2.75	2.75
	BCA- 502 (I)	3	2	3	1	2.5	2.5	2	3	2.25	0.75	2.5	2.75	1	2.5	3	2.75
	BCA- 502 (II)	3	2.5	2.5	2.25	2	2.75	2.25	2.25	2.25	2	1.75	2.5	2.5	2.75	2.5	2.5
	BCA- 504 (I)	2.5	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2.75	2.5	2.5	3	2.5	2.75	2.5	2.25
	BCA- 504 (II)	2.75	3	2.5	2.5	2.75	2.5	2.5	2.25	2.75	2	2.25	2.5	2.75	2.5	2.5	2.5
	BCA-505 (I)	3	2	2.5	2.75	1	2.25	1.5	1.75	1	1	2	2	3	3	2.75	2.75
	BCA- 505 (II)	3	3	2.75	3	1.5	3	2	2.5	2	1.25	2.25	2.75	2.5	2.5	2.75	2.75
	BCA- 507 (I)	3	2.25	3	2	2.5	2.25	1.75	2	1.75	1	2.5	2.75	2.5	2.5	2.5	2.5
	BCA- 507 (II)	3	2.75	2.25	2.5	2.5	2.25	2.25	2.5	2.5	2	1.75	2.75	2.5	2.5	2.5	2.75
	BCA-508 (I)	3	2.75	2.5	3	1.5	3	2	3	2.25	1	2.75	2.75	2.5	2.5	2.75	2.75
	BCA- 508 (II)	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	-	1.75	2.5	2	2.5	1	2.5
	SEC- 510 (I)	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75	2.75	2.5	2.5	2.75	2.75
	SEC- 510 (II)	3	2.25	2.75	2.25	2.5	2.25	1.75	2.25	2.5	2	1.75	2.75	2.5	2.5	2.75	2.75
6	**BCA- 601 (I)**	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75	2.75	2.5	2.5	2.75	2.75
	BCA- 601 (II)	3	2.75	2.75	2.25	2.5	2	2.5	2	2.75	1.5	1.75	3	2.5	2.75	2.5	2.5
	BCA-602 (I)	2.75	2.25	2.75	2	2.5	2.5	2.5	2.25	2	2	2	2.75	2.5	2.25	2.5	2
	BCA-602 (II)	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	2.5	2.75	2.5	2.5	2.75	2.75
	BCA-604 (I)	2.5	2.5	2.5	2.25	1.75	2.25	2.25	2.25	2.75	2	1.75	3	2.25	2.5	2.75	2.75
	BCA-604 (II)	3	2.5	2.5	2.25	2.5	2.25	2.25	2.25	2.5	2	1.75	2.5	2	1.5	2.75	2.75
	BCA- 605 (I)	3	2.75	2.5	2.5	2.75	2.5	2.25	2.25	2.75	2	2.25	3	2.75	2.25	2.5	2.75
	BCA-605 (II)	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75	2.75	2.5	2.5	2.75	2.75
	BCA-607 (I)	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75	2.75	2.5	2.5	2.75	2.75
	BCA-607 (II)	2.5	2	2	2.5	2.75	2	2.5	2	2.5	1.5	2	2.5	2.25	2	2.5	2.5
	BCA-608 (I)	3	2.5	2.5	2.25	2.75	2.25	2.25	2	2.5	2	1.5	2.5	2.5	2.5	2.5	2.75
	BCA-608 (II)	3	2	2.5	2.75	1	2.25	1.5	1.75	1	1	2	2	3	3	2.75	2.75
	SEC- 610 (I)	3	2.5	2.5	2.25	2.75	2.5	2.25	2.25	2.75	2.5	2.25	2.75	2.5	2	2.75	2.75
	SEC-610(II)	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75	2.75	2.5	2.5	2.75	2.75

Kurukshetra University, Kurukshetra
(Established by the State Legislature Act XII of 1956)
('A+' Grade, NAAC Accredited)

|| योगस्थ: कुरु कर्माणि ||
समबुद्धि व योग युक्त होकर कर्म करो
(Perform Actions while Stead fasting in the State of Yoga)

Scheme of Examination and Syllabus of Bachelor of Science (B.Sc.) Programme (Course Computer Science) (CBCS) in Phased Manner

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS

CBCS CURRICULUM (2020-21)
Program Name: Bachelor of Science (B.Sc.) Programme (Course Computer Science) (CBCS)
(For the Batches Admitted From 2020-2021)

Programme Outcomes (POs) for Three Year B.Sc. Programme (Course Computer Science)

PO1	Knowledge	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study
PO2	Communication	Ability to communicate effectively on general and scientific topics with the scientific community and with society at large
PO3	Problem Solving	Capability of applying knowledge to solve scientific and other problems
PO4	Individual and Team Work	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings'
PO5	Investigation of Problems	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions
PO6	Modern Tool usage	Ability to use and learn techniques, skills and modern tools for scientific practices
PO7	Science and Society	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices
PO8	Life-Long Learning	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout the life
PO9	Environment and Sustainability	Ability to design and develop modern systems which are environmentally sensitive and to understand the importance of sustainable development.
PO10	Ethics	Apply ethical principles and professional responsibilities in scientific practices
PO11	Project Management	Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects

Programme Specific Outcomes (PSOs) for Three Year B.Sc. Programme (Course Computer Science)

PSO1	Students will be able to acquire the basic understanding of the principles and working of the hardware and software aspects of computer systems.
PSO2	Explore technical knowledge in diverse areas of Computer Science and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies.
PSO3	Papers such as C++, JAVA, Python, Web designing give an effective and efficient real time solution in various domains.

SCHEME OF EXAMINATION FOR B.Sc. Programme (Course Computer Science) under CHOICE BASED CREDIT SYSTEM (CBCS) w.e.f. Academic Session 2020-21 in phased manner													
Semester	**Course Opted**	**Course Code**	**Course Name**	**Credits**	**Work load/ hours /week**	**Exam Time (Hrs.)**	**External Marks**		**Internal Marks**		**Total Marks**	
							Max	**Pass**	**Max**	**Pass**	**Max**	**Pass**
1	CORE COURSE-III	CC- IIIA	COMPUTER FUNDAMENTALS	3	3	3	60	24	15	6	75	30
		CC- III B	WEB DESIGNING USING HTML AND CSS	3	3	3	60	24	15	6	75	30
	CORE COURSE PRACTICAL	CC- III B (P)	S/W LAB BASED ON CC- III B	2	4	3	40	16	10	4	50	20
	TOTAL			**08**	**10**		**160**	**64**	**40**	**16**	**200**	**80**
2	CORE COURSE-VI	CC- VI A	C++ PROGRAMMING -I	3	3	3	60	24	15	6	75	30
		CC- VI B	LOGICAL ORGANIZATION OF COMPUTER	3	3	3	60	24	15	6	75	30
	CORE COURSE PRACTICAL	CC- VI B (P)	S/W LAB BASED ON CC- VI A	2	4	3	40	16	10	4	50	20
	TOTAL			**08**	**10**		**160**	**64**	**40**	**16**	**200**	**80**
3	CORE COURSE-IX	CC- IX A	C++ PROGRAMMING-II	3	3	3	60	24	15	6	75	30
		CC- IX B	DATA STRUCTURES	3	3	3	60	24	15	6	75	30
	CORE COURSE PRACTICAL	CC- IX B (P)	S/W LAB BASED ON CC- IX B	2	4	3	40	16	10	4	50	20
	TOTAL			**08**	**10**		**160**	**64**	**40**	**16**	**200**	**80**
4	CORE COURSE-XII	CC- XII A	PROGRAMMING IN JAVA	3	3	3	60	24	15	6	75	30
		CC- XII B	OPERATING SYSTEMS	3	3	3	60	24	15	6	75	30
	CORE COURSE PRACTICAL	CC- XII A (P)	S/W LAB BASED ON JAVA	2	4	3	40	16	10	4	50	20
	TOTAL			**08**	**10**		**160**	**64**	**40**	**16**	**200**	**80**

5	DISCIPLINE SPECIFIC ELECTIVE-III	DSE-III	ELECTIVE-I	4	4	3	80	32	20	8	100	40
		DSE-III(P)	S/W LAB BASED ON DSE-III	2	4	3	40	16	10	4	50	20
	SKILL ENHANCEMENT COURSE-III	SEC-III	ELECTIVE-II	2	2	3	40	16	10	4	50	20
	TOTAL			**08**	**10**		**160**	**64**	**40**	**16**	**200**	**80**
	ELECTIVE-I I. JAVASCRIPT II. DATABASE MANAGEMENT SYSTEM III. SOFTWARE ENGINEERING			**ELECTIVE-II** I. DATA WAREHOUSING AND MINING II. COMPUTER ORIENTED STATISTICAL METHODS III. COMPUTER NETWORKS								
6	DISCIPLINE SPECIFIC ELECTIVE-VI	DSE-VI	ELECTIVE-III	4	4	3	80	32	20	8	100	40
		DSE-VI(P)	S/W LAB BASED ON DSE-VI	2	4	3	40	16	10	4	50	20
	SKILL ENHANCEMENT COURSE-IV	SEC-IV	ELECTIVE-IV	2	2	3	40	16	10	4	50	20
	TOTAL			**08**	**10**		**160**	**64**	**40**	**16**	**200**	**80**
	ELECTIVE-III I. LINUX & SHELL PROGRAMMING II. PROGRAMMING USING PYTHON III. VISUAL PROGRAMMING USING C#			**ELECTIVE-IV** I. ARTIFICIAL INTELLIGENCE II. INFORMATION SECURITY III. E- COMMERCE								

Total Credits (B.Sc. Programme (Course Computer Science)): 8 + 8 + 8 + 8 +8 + 8 = 48

Total Contact Hours (B.Sc. Programme (Course Computer Science)): 10 + 10 + 10 + 10 + 10 + 10 = 60

1. **A student can opt for any one paper out of the list of elective papers provided against each paper code for respective semester.**
2. **One credit equivalent to 1 hour of teaching/2 hours of Practical work**
3. **One credit equivalent to 25 marks**
4. **Teaching workload will be calculated on the basis of teaching contact hours of the course.**

CC – III A: COMPUTER FUNDAMENTALS

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30

Instructions to paper setter for End semester examination:
Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the this course is to help students to enhance their basic concept of computer hardware, software, memory and operating environments along with the concepts of problem solving using programming languages which will lead to code generation in future for computer science job aspirants.

Course Outcomes: At the end of this course, the student will be able to:
CC – IIIA.1: understand the basic terminology of hardware and software components of a computer system;
CC – IIIA.2: understand the working of input/output device and storage devices;
CC – IIIA.3: develop program logic using algorithms, flowchart, decision tables, DFDs, etc.
CC – IIIA.4: develop sorting, searching, merging and other basic algorithms to solve problems;

CO-PO Mapping Matrix for Course Code: CC – III A											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**
CC – IIIA.1	3	3	2	3	3	2	2	2	2	3	2
CC – IIIA.2	3	2	3	3	3	2	2	2	2	2	2
CC – IIIA.3	3	3	2	3	3	2	2	2	2	3	2
CC – IIIA.4	3	2	3	3	3	2	2	2	2	2	2
Average	3	2.5	2.5	3	3	2	2	2	2	2.5	2

CO-PSO Mapping Matrix for Course Code: CC – III A			
COs	**PSO1**	**PSO2**	**PSO3**
CC – IIIA.1	3	3	2
CC – IIIA.2	2	3	3
CC – IIIA.3	3	3	2
CC – IIIA.4	2	3	3
Average	2.5	3	2.5

UNIT – I

Computer Fundamentals: Evolution of Computers through generations, Characteristics of Computers, Strengths and Limitations of Computers, Classification of Computers, Functional Components of a Computer System, Applications of computers in Various Fields; Software, Types of Software: System software, Application software, Utility Software, Shareware, Freeware, Firmware, Free Software. Hardware components of a computer system - processor, RAM, ROMs, motherboard, power supply etc

UNIT – II

Storage devices: Types of Storage devices, Magnetic tape, Hard disk, Optical disk, Flash memory
I/O Devices: I/O Ports, Device Controller, Device Driver
Input Devices: Classification and use, keyboard, Pointing devices - mouse, touch pad and track ball, Video digitizer, remote control, joystick, magnetic stripes, scanner, digital camera, microphone, sensor, and MIDI instruments
Output Devices: Monitor, printers –classification, laser, ink jet, dot-matrix, plotter, and speaker.

UNIT – III

Planning the Computer Program: Techniques of Problem Solving, Program, Types of Program Errors, Debugging a Program, Testing Program, Documentation: Need & Different Forms.

Developing Program Logic: Algorithm, Characteristics of Good Algorithm, Pseudo Code, Flowchart & its Symbols, Data Flow Diagrams (DFDs), Decision Tables & their types and Decision Trees.

UNIT – IV

Developing Algorithms: Time & space complexity of algorithms, Big-O Notation, Drawing Flowcharts and writing algorithms in pseudo code for basic problems.

Sorting Algorithms: bubble sort, selection sort, insertion sort, quick sort. Searching Algorithms – linear search, binary search. Merging Algorithm.

Text Books:

[1] Sinha, P.K. & Sinha, Priti, Computer Fundamentals, BPB.
[2] Dromey, R.G., How to Solve it By Computer, PHI.

Reference Books:

[1] Norton, Peter, Introduction to Computer, McGraw-Hill.
[2] Leon, Alexis & Leon, Mathews, Introduction to Computers, Leon Tech World.
[3] Rajaraman, V., Fundamentals of Computers, PHI.

CC- III B: WEB DESIGNING USING HTML AND CSS

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30

Instructions to paper setter for End semester examination:
Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of web as a tool in presenting information. Each and every product in e-world now needs a website, this course will make student knowing about the concept of web design in general.

Course Outcomes: At the end of this course, the student will be able to:
CC- III B.1: outline the idea of web and its components.
CC- III B.2: understand the theoretical steps for developing a website.
CC- III B.3: learn the skills that will enable him/her to design simple web pages.
CC- III B.4: learn CSS to specify style to web pages.

CO-PO Mapping Matrix for Course Code: CC – III B											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CC- III B.1	3	1	2	1	1	1	1	2	1	1	1
CC- III B.2	3	2	1	1	1	1	1	2	1	1	1
CC- III B.3	3	2	2	1	1	3	1	2	2	1	1
CC- III B.4	3	2	2	1	1	3	1	2	2	1	2
Average	3	1.75	1.75	1	1	2	1	2	1.5	1	1.3

CO-PSO Mapping Matrix for Course Code: CC – III B			
COs	**PSO1**	**PSO2**	**PSO3**
CC- III B.1	2	2	2
CC- III B.2	2	2	2
CC- III B.3	2	3	3
CC- III B.4	2	3	3
Average	2	2.5	2.5

UNIT – I

Introduction to Internet and World Wide Web (WWW); Evolution and History of World Wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Browsers; Hypertext Transfer Protocol, URLs; Searching and Web-Casting Techniques, Search Engines and Search Tools, Scripting Languages.

UNIT – II

Web Publishing: Hosting website; Internet Service Provider; Planning and designing website; Web Content Authoring, Web Graphics Design, Web Programming, Steps For Developing website, Choosing the Contents, Home Page, Domain Names, Creating a Website and Introduction to Mark up Languages (HTML and DHTML).

UNIT – III

Web Development: HTML Document Features, Fundamentals HTML Elements, Creating Links; Headers; Text styles; Text Structuring; Text colour and Background; Formatting text; Page layouts, Images; Ordered and Unordered lists; Inserting Graphics; Table Creation and Layouts; Frame Creation and Layouts; Working with Forms and Menus;

Working with Radio Buttons; Check Boxes; Text Boxes.

UNIT – IV

Introduction to CSS (Cascading Style Sheets): Features, Core Syntax, Types, Style Sheets and HTML, Style Rule Cascading and Inheritance, Text Properties, CSS Box Model, Normal Flow Box Layout, Positioning and other useful Style Properties; Features of CSS3.

Text Books:

[1] Raj Kamal, Internet and Web Technologies, Tata McGraw-Hill.
[2] Ramesh Bangia, Multimedia and Web Technology, Firewall Media.

REFERENCE BOOKS:

[1] Thomas A. Powell, Web Design: The Complete Reference, Tata McGraw-Hill
[2] Wendy Willard, HTML Beginners Guide, Tata McGraw-Hill.
[3] Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI.

CC- VI A : C++ PROGRAMMING -I

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30

Instructions to paper setter for End semester examination:
Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of C++ (high level language) as one of the programming tool and generating logical development using programming. This course will help students to learn about OOPS concepts and linking C++ as a powerful OOPS language.

Course Outcomes: At the end of this course, the student will be able to:
CC- VI A.1: understand basic concept of C++;
CC- VI A.2: acquire the knowledge of C++ operators, hierarchy and precedence and various control structures;
CC- VI A.3: learn to use arrays and string in C++ programs;
CC- VI A.4: get familiar with OOPS concepts with C++.

CO-PO Mapping Matrix for Course Code: CC – VI A											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CC- VI A.1	3	3	2	3	3	2	2	2	2	3	2
CC- VI A.2	3	2	3	3	3	2	2	2	2	2	2
CC- VI A.3	2	3	3	3	2	2	2	2	1	1	1
CC- VI A.4	3	2	2	2	3	3	3	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2	2	1.75

CO-PSO Mapping Matrix for Course Code: CC – VI A			
COs	**PSO1**	**PSO2**	**PSO3**
CC- VI A.1	3	3	2
CC- VI A.2	2	3	3
CC- VI A.3	3	3	3
CC- VI A.4	2	2	2
Average	2.5	2.75	2.5

UNIT – I

Introduction to C++: About C++, Character Set, Keywords, Identifiers, Constants, Punctuators, Date Types: User-Defined, Built-in, Derived Data Types, Access Modifiers, Unformatted and Formatted I/O Operations. I/O using extraction and extraction operators, Type Conversion, Type Casting.

UNIT – II

Operators in C++: Arithmetic, Relational, Logical, Ternary, Precedence & associativity of Operators. Control Structures: if statement, if-else statement, nested if, if-else-if ladder, switch...case statement, break and continue, goto statement, nested switch...case statement, Loops: while loop, do...while loop, for loop.

UNIT – III

Arrays and strings: Array definition, initialization, multidimensional arrays, Manipulation of array elements, String declaration and initialization, Manipulations, String handing functions. Functions: Declaration and Definition, return values, arguments, passing parameters by value, call by reference, call by pointer, Recursions, Inline and external linkage Functions, storage classes.

UNIT – IV

Object-Oriented Features of C++: Class and Objects, Data hiding & encapsulation, abstraction, constructors & destructors, Data Members and Member Functions, accessing class members, empty class, local class, global class, Scope Resolution Operator and its Uses, Static Data Members, Static Member Functions, Structure vs Class.

Text Books:

[1] Herbert Scildt, C++, The Complete Reference,Tata McGraw-Hill
[2] Robert Lafore, Object Oriented Programming in C++, SAMS Publishing

Reference Books:

[1] Bjarne Stroustrup, The C++ Programming Language, Pearson Education
[2] Balaguruswami, E., Object Oriented Programming In C++, Tata McGraw-Hill.
[3] Richard Johnson, An Introduction to Object-Oriented Application Development, Thomson Learning.

CC- VI B: LOGICAL ORGANIZATION OF COMPUTERS

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30

Instructions to paper setter for End semester examination:
Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of computer as a system and making student aware of internal mechanism of computer hardware and it's working.

Course Outcomes: At the end of this course, the student will be able to:
CC- VI B.1: understand number systems, error detecting & correcting code and character representations;
CC- VI B.2: understand computer arithmetic and Boolean algebra and simplification of Boolean expressions.
CC- VI B.3: design combinational circuits using logic gates.
CC- VI B.4: design sequential circuits such as registers and counters using flip-flops.

CO-PO Mapping Matrix for Course Code: CC – VI B											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CC- VI B.1	3	3	2	3	3	2	2	2	2	1	2
CC- VI B.2	3	2	3	3	1	2	2	3	2	2	2
CC- VI B.3	2	3	3	3	2	2	3	2	1	1	2
CC- VI B.4	3	2	2	2	3	3	2	3	3	2	3
Average	2.75	2.5	2.5	2.75	2.25	2.25	2.25	2.5	2	1.5	2.25

CO-PSO Mapping Matrix for Course Code: CC – VI B			
COs	**PSO1**	**PSO2**	**PSO3**
CC- VI A.1	2	1	2
CC- VI A.2	2	1	1
CC- VI A.3	2	2	1
CC- VI A.4	2	2	1
Average	2	1.5	1.25

UNIT – I

Number Systems: Binary, Octal, Decimal and Hexadecimal, Conversions from one number system to another, BCD Codes, Error Detecting and Correcting Codes, Character Representation – ASCII, EBCDIC and Unicode, Binary Arithmetic; Binary Addition, Binary Subtraction, Binary Multiplication, Binary Division, Complementary numbering systems: 1's and 2's Complements representations, Fixed-Point and Floating-Point Representation of Numbers.

UNIT – II

Boolean Algebra: Boolean Algebra Postulates, basic Boolean Theorems, Boolean Expressions, Boolean Functions, Truth Tables, Canonical Representation of Boolean Expressions: SOP and POS, Simplification of Boolean Expressions using Boolean Postulates & Theorems, Kaurnaugh-Maps (upto four variables), Tabular Method, Handling Don't Care conditions.

UNIT – III

Logic Gates: Basic Logic Gates – AND, OR, NOT, Universal Gates – NAND, NOR, Other Gates – XOR, XNOR etc. NAND, NOR. Their symbols, truth tables and Boolean expressions. Combinational Circuits: Design Procedures, Half Adder, Full Adder, Half Subtractor, Full Subtracor, Multiplexers, Demultiplexers, Decoder, Encoder, Comparators, Code Converters.

UNIT – IV

Sequential Circuits: Basic Flip- Flops and their working. Synchronous and Asynchronous Flip –Flops, Triggering of Flip-Flops, Clocked RS, D Type, JK, T type and Master-Slave Flip-Flops. State Table, State Diagram and State Equations. Flip-flops characteristics & Excitation Tables. Designing Registers & Counters: Asynchronous and Synchronous Binary Ripple Counter, Binary Synchronous Counter, Modulo-N Counters and Up-Down Counters.

Text Books:

[1] M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd.
[2] V. Rajaraman, T. Radhakrishnan, An Introduction to Digital Computer Design, Prentice Hall.

Reference Books:

[1] Andrew S. Tanenbaum, Structured Computer Organization, Prentice Hall of India Pvt. Ltd.
[2] Nicholas Carter, Schaum's Outlines Computer Architecture, Tata McGraw-Hill.

CC- IX A: C++ PROGRAMMING- II

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30

Instructions to paper setter for End semester examination:
Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of C++ (high level language) as one of the programming tool and generating logical development using programming. This course will help students to learn about OOPS concepts and linking C++ as a powerful OOPS language.

Course Outcomes: At the end of this course, the student will be able to:
CC- IX A.1: understand pointers, constructor and destructors in C++;
CC- IX A.2: acquire the detailed knowledge of polymorphism;
CC- IX A.3: learn to implement exception handling and template;
CC- IX A.4: learn File handling in C++.

CO-PO Mapping Matrix for Course Code: CC- IX A											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CC- IX A.1	3	3	2	3	3	2	2	2	2	3	2
CC- IX A.2	3	2	3	3	3	2	2	2	2	2	2
CC- IX A.3	3	2	3	3	2	2	2	2	1	1	2
CC- IX A.4	3	2	2	2	2	3	3	3	3	2	2
Average	3	2.25	2.5	2.75	2.5	2.25	2.25	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: CC- IX A			
COs	**PSO1**	**PSO2**	**PSO3**
CC- IX A.1	3	3	2
CC- IX A.2	2	3	3
CC- IX A.3	3	3	3
CC- IX A.4	2	2	2
Average	2.5	2.75	2.5

UNIT – I

Pointers & Runtime binding: pointer variable, address operator, void pointer, dynamic memory allocation & deallocation, Pointer arithmetic. Object Initialization and Cleanup: Constructors, types of constructors, destructors, constant objects and constructors. Friend Function & Class: defining friend function and friend class, defining member function of a class as friend function.

UNIT – II

Static Polymorphism: Function Overloading & Operator Overloading, over loadable operators, overloading unary & Binary Operators, Concatenating Strings using Operators overloading,
Inheritance: Definition, Need, derivation types, different Forms of Inheritance, overloading vs overriding.
Dynamic Polymorphism: Virtual and Pure Virtual Functions and their need, Virtual derivation, Virtual Destructor.

UNIT – III

Exception Handling in C++: Exception handling model, Exception handling constructs - try, throw, catch, Order of catch blocks, Catching all exceptions, Nested try blocks, handling uncaught exceptions, unexpected(), terminate() and standard exceptions. Generic Programming: Function template, Overloading of template functions, Member function templates, class templates.

UNIT – IV

File handling: Hierarchy of File Streams, opening & closing files, file modes, file pointers and their manipulation. Sequential access to a file, Text & Binary files, saving and retrieving objects in a file, random access to a file.

Text Books:

[1] Herbert Scildt, C++, The Complete Reference, Tata McGraw-Hill.
[2] Robert Lafore, Object Oriented Programming in C++, SAMS Publishing.

Reference Books:

[1] Bjarne Stroustrup, the C++ Programming Language, Pearson Education.
[2] Balaguruswami, E., Object Oriented Programming In C++, Tata McGraw-Hill.

CC- IX B: DATA STRUCTURE

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30

Instructions to paper setter for End semester examination:
Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Learning of data structure is like learning alphabets to learn any proper language. In this course student will be aware of memory management and use of data structure in computer programming.

Course Outcomes: At the end of this course, the student will be able to:
CC- IX B.1: learn basics of data structure and algorithm complexities;
CC- IX B.2: implement arrays and various searching, sorting techniques;
CC- IX B.3: understand the idea of implementation for stack, linked list and queue;
CC- IX B.4: learn tree traversal methods and graphs;

CO-PO Mapping Matrix for Course Code: CC – IX B											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CC- IX B.1	3	3	2	3	3	2	2	2	2	3	2
CC- IX B.2	3	2	3	3	3	2	2	2	2	2	2
CC- IX B.3	2	3	3	3	2	2	2	2	1	1	2
CC- IX B.4	3	2	2	2	3	3	2	3	3	2	2
Average	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2

CO-PSO Mapping Matrix for Course Code: CC – IX B			
COs	**PSO1**	**PSO2**	**PSO3**
CC- IX B.1	2	2	3
CC- IX B.2	2	3	3
CC- IX B.3	2	3	3
CC- IX B.4	2	2	3
Average	2	2.5	3

UNIT – I

Data Structure Definition, Data Type vs. Data Structure, Categories of Data Structures, Data Structure Operations, Applications of Data Structures, Algorithms Complexity and Time-Space Trade-off, Big-O Notation. Strings: Introduction, Strings, String Operations, Pattern Matching Algorithms.

UNIT – II

Arrays: Introduction, Linear Arrays, Representation of Linear Array in Memory, Traversal, Insertions, Deletion in an Array, Multidimensional Arrays, Sparse Matrix. Algorithm for Insertion, Deletion Addition and Multiplication in 2-D Array. Searching and Sorting Techniques, Sorting Techniques: Bubble Sort, Merge Sort, Selection Sort', Heap Sort, Insertion Sort. Searching Techniques: Sequential Searching, Binary Searching, Search Trees.

UNIT – III

Stacks & Queues: Representation of Stacks, Stack Operations, Applications, Queues, Operations on Queues, Circular Queues, Dequeue, Priority Queues, Applications.
Linked Lists: Introduction, Types, Operations (Insertion, Deletion, Traversal, Searching, Sorting), Applications,

Dynamic Memory Management, Implementation of Linked Representations.

UNIT – IV

Trees: Basic Terminology, Representation, Binary Trees, Tree Representations using Linked List, Basic Operation on Binary tree, Traversal of Binary Trees: In order, Pre-order & Post-order, Applications of Binary tree. Algorithm of Tree Traversal with and without Recursion. Graphs: Definitions and Basic Terminologies, Representation of Graphs, Graph Traversals, Shortest Path Problem, Applications.

Text Books:

[1] Seymour Lipschutz, Data Structures, Tata McGraw-Hill Publishing Company Limited, Schaum's Outlines.
[2] YedidyanLangsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, Data Structures Using C, Pearson Education.

Reference Books:

[1] Trembley, J.P. And Sorenson P.G., An Introduction to Data Structures With Applications, Mcgraw-Hill.
[2] Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Addison-Wesley.

CC- XII A: PROGRAMMING IN JAVA

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30

Instructions to paper setter for End semester examination:
Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of JAVA as a High level language as one of the programming tool and generating logical development using programming. Making student to learn about OOPS and linking JAVA as a powerful OOPs language. Also making student aware of property of JAVA as Platform independent.

Course Outcomes: At the end of this course, the student will be able to:
CC- XII A.1: demonstrate the basic programming constructs of Java and OOPs to develop Java programs.
CC- XII A.2: learn and develop various controls and branching of logics under various cases using language control structures.
CC- XII A.3: exemplify the usage to implement polymorphism and Inheritance in java programs.
CC- XII A.4: acquire knowledge of Packages, Interfaces, Exceptions and Multithreading in building efficient applications.

CO-PO Mapping Matrix for Course Code: CC – XII A

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CC- XII A.1	3	2	3	1	3	2	2	3	2	1	2
CC- XII A.2	3	2	3	1	2	3	2	3	2	1	3
CC- XII A.3	3	2	3	1	2	2	2	3	2	--	2
CC- XII A.4	3	2	3	1	3	3	2	3	3	1	3
Average	3	2	3	1	2.5	2.5	2	3	2.25	1	2.5

CO-PSO Mapping Matrix for Course Code: CC – XII A

COs	PSO1	PSO2	PSO3
CC- XII A.1	1	2	3
CC- XII A.2	1	3	3
CC- XII A.3	1	2	3
CC- XII A.4	1	3	3
Average	1	2.5	3

UNIT – I

Key Attributes of Object-Oriented Programming, Introduction to Java, History and Features of Java, Java Virtual Machine (JVM), JDK, Java Runtime Environment; Basic Elements: Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Data types, Operators, Assignments; Input/output in Java: Basics, I/O Classes, Reading Console Input.

UNIT – II

Control Structures in Java: Decision and Loop Control Statements.
Class and Object in Java: Class Fundamentals, creation of Objects, Defining Methods, Argument Passing

Mechanism, Constructors, Abstract Class, Static Members. Array in Java: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array.

UNIT – III

String: String Fundamentals, Operations on Array and String, String Constructors, Creating Strings using String Class and StringBuffer Class. Polymorphism in Java: Basic Concept, Types, Overriding vs Overloading, Inheritance: Benefits of Inheritance, Types of Inheritance

UNIT – IV

Interface : Implementing Interface, extending Interface; package: creating a package, import keyword; exception handling: catching multiple exception, throw/throws keyword, Finally keyword, user defined exception, Introduction to Multithreading

Text Books:

[1] Ivor Horton, Beginning JAVA 2, WROX Publications, New Delhi
[2] Patrick Naughton and Herbert Schlitz,JAVA-2 Complete Reference ,TMH, New Delhi
[3] Paul Deital & Harvey Deital, Java: How to Program, Pearson Education.

Reference Books:

[1] Balaguruswamy, Programming with Java, TMH, New Delhi.
[2] Java6 Programming, BlackBook,KoGenT, DreamtechPress.

CC-XII B: OPERATING SYSTEM

Type: Core Course (CC)
Course Credits: 03
Contact Hours: 03 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 60
External Pass Marks: 24
Internal Maximum Marks: 15
Total Max. Marks: 75
Total Pass Marks: 30

Instructions to paper setter for End semester examination:
Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide knowledge of Operating System (OS) as a system program. Making student to learn about OS and linking OS as a powerful tool to make system work. Student will be able to learn types of OS and learn about system operations using OS.

Course Outcomes: At the end of this course, the student will be able to:
CC-XII B.1: understand the basic concepts of operating systems and its services.
CC-XII B.2: understand concept of process management and scheduling.
CC-XII B.3: acquire knowledge of process synchronization along with deadlock handling.
CC-XII B.4: learn about memory management and distributed operating system.

CO-PO Mapping Matrix for Course Code: CC – XII B											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CC- XII B.1	3	3	2	3	3	2	2	2	2	-	2
CC- XII B.2	3	2	3	3	3	2	2	2	2	-	2
CC- XII B.3	2	3	3	3	2	2	2	2	2	1	2
CC- XII B.4	3	3	2	2	3	3	2	3	2	-	2
Average	2.75	2.75	2.5	2.75	2.75	2.25	2	2.25	2	1	2

CO-PSO Mapping Matrix for Course Code: CC – XII B			
COs	**PSO1**	**PSO2**	**PSO3**
CC- XII B.1	2	3	2
CC- XII B.2	2	3	3
CC- XII B.3	2	3	3
CC- XII B.4	2	2	2
Average	2	2.75	2.5

UNIT – I

Introductory Concepts: Operating System Functions and Characteristics, Historical Evolution of Operating Systems, Operating System Structure and Operations;
Types of Operating System: Real time, Multiprogramming, Multiprocessing, Batch processing;
Operating System Services, Operating System Interface, Methodologies for Implementation of Operating System, Service System Calls, System Programs.

UNIT – II

Process Management: Process Concepts, Operations on Processes, Process States and Process Control Block. Inter-Process Communication;
Multithreaded Programming: Multithreading Models, Threading Issues;
CPU Scheduling: Scheduling Criteria, Levels of Scheduling, Scheduling Algorithms, Multiple Processor Scheduling; Algorithm Evaluation.

UNIT – III

Synchronization: Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problem of Synchronization, Monitors, Atomic Transactions;
Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock

Avoidance, Deadlock Detection and Recovery.

UNIT – IV

Memory Management Strategies: Memory Management of Single-User and Multiuser Operating System, Partitioning, Swapping, Contiguous Memory Allocation, Paging and Segmentation;
Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing, Memory Mapped Files.
Distributed Operating Systems: Types of Network based Operating Systems, Network Structure, Design Issues;

Text Books:

[1] Silberschatz A., Galvin P.B.,and Gagne G., Operating System Concepts, John Wiley & Sons.
[2] Godbole, A.S., Operating Systems, Tata McGraw-Hill Publishing Company, New Delhi.

Reference Books:

[1] Deitel, H.M., Operating Systems, Addison-Wesley Publishing Company, New York.
[2] Tanenbaum, A.S., Operating System-Design and Implementation, Prentice Hall of India, New Delhi.

DSE-III (I): JAVASCRIPT

Type: Discipline Specific Elective (DSE)
Course Credits: 04
Contact Hours: 04 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 80
External Pass Marks: 32
Internal Maximum Marks: 20
Total Max. Marks: 100
Total Pass Marks: 40

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to develop the skill & knowledge of concepts commonly used in dynamic language programming. Student will also be able to learn about client side interfaces through the use of DOM.

Course Outcomes: At the end of this course, the student will be able to:
DSE-III (I).1: understand concept of Scripting.
DSE-III (I).2: acquire knowledge about basic fundamentals of JavaScript.
DSE-III (I).3: understand the applicability of various objects like window, document used in programming.
DSE-III (I).4: acquire the skills that will enable him to design and build high level web enabled applications.

CO-PO Mapping Matrix for Course Code: DSE-III (I)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
DSE-III (I).1	3	3	2	3	1	3	2	3	2	1	2
DSE-III (I).2	3	3	3	3	1	3	2	2	2	1	2
DSE-III (I).3	3	3	3	3	2	3	2	2	2	1	2
DSE-III (I).4	3	3	3	3	2	3	2	3	2	2	3
Average	3	3	2.75	3	1.5	3	2	2.5	2	1.25	2.25

CO-PSO Mapping Matrix for Course Code: DSE-III (I)			
COs	**PSO1**	**PSO2**	**PSO3**
DSE-III (I).1	2	3	3
DSE-III (I).2	2	3	3
DSE-III (I).3	2	3	3
DSE-III (I).4	2	3	3
Average	2	3	3

UNIT – I

The Nature of JavaScript: Evolution of Scripting Languages, JavaScript -Definition, Programming for Non-Programmers, Introduction to Client–Side Programming, Comparison between Java, JavaScript & VB Script. Enhancing HTML Documents with JavaScript. Static and Dynamic web pages.

UNIT – II

Introduction to JavaScript: Document Object Model (DOM), obtaining user inputs, memory concepts, Character set, case sensitivity, comments, Literals, Expression & Operators, Control Structures, looping constructs, break, continue statements, variables, Data types, Keywords.

UNIT – III

JavaScript types, merge multiple JavaScript into one, Running Scripts, Methods, and Events, Introduction to Objects: String, Date, Boolean, Window, document and various Object interaction,

UNIT – IV

Array declaration and allocation, passing arrays to function, Scoping rules, Recursion and iteration, cookies, Form Validation. Introduction to XML.

Text Books:

[1] David Flanagan, JavaScript: The Definitive Guide: The Definitive Guide.
[2] Chris Bates, Web Programming, building Internet applications, WILEY Dreamtech.

Reference Books:

[1] Kogent Learning, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.

DSE-III (II): DATABASE MANAGEMENT SYSTEM

Type: Discipline Specific Elective (DSE)
Course Credits: 04
Contact Hours: 04 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 80
External Pass Marks: 32
Internal Maximum Marks: 20
Total Max. Marks: 100
Total Pass Marks: 40

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Today almost all real life problems include data**.** The objective of this paper to get student aware about the basic concept of Data. In this paper student will learn database management and its implementation.

Course Outcomes: At the end of this course, the student will be able to:
DSE-III (II).1: learn basic concepts of data base along with its functions and components.
DSE-III (II).2: understand Relational data models.
DSE-III (II).3: understand SQL as query language and Learn the concept of relational algebra and calculus.
DSE-III (II).4: acquire knowledge of advanced concepts of DBMS.

CO-PO matrix for the Course Code: DSE-III (II)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
DSE-III (II).1	3	3	2	3	3	2	2	2	3	3	2
DSE-III(II) .2	3	2	3	3	3	1	2	2	2	2	2
DSE-III(II) .3	3	3	2	2	3	3	2	3	3	2	2
DSE-III(II) .4	2	3	3	3	2	2	2	2	1	1	2
Average	3	2.75	2.5	2.75	2.75	2	1.75	2.25	2.25	2	1.5

CO-PSO Mapping Matrix for Course Code: DSE-III (II)			
COs	**PSO1**	**PSO2**	**PSO3**
DSE-III (II).1	3	3	2
DSE-III(II) .2	2	3	3
DSE-III(II) .3	1	3	3
DSE-III(II) .4	1	3	3
Average	1.75	3	2.75

UNIT – I

Basic Concepts: File Systems vs. DBMS, Characteristics of Database Approach, Abstraction and Data Integration, Database users, Advantages and Disadvantages of DBMS.
Database Systems Architecture: Data Models, Schema and Instances, DBMS architecture and Data Independence, Database languages and Interfaces, DBMS functions.
Entity Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships Types & instances, Roles and Structural Constraints, E-R Diagrams

UNIT – II

Relational Data Model: Basic Concepts, Integrity Constraints over Relations, Relational Algebra: Basic Operations. Relational Database Design: Functional Dependencies, Decomposition, Normal forms based on primary keys- (1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies,5 NF, Domain Key Normal form.

UNIT – III

SQL: Meaning, Purpose and Need of SQL, Data Types, SQL Components: DDL, DML, DCL and DQL, Basic Queries, Join Operations and Sub-queries, Views, Specifying Indexes. Constraints and its Implementation in SQL.
Relational Algebra: Basic Operations: Select, Project, Join, Union, Intersection, Difference, and Cartesian Product etc. Relational Calculus: Tuple Relational and Domain Relational Calculus. Relational Algebra Vs. Relational Calculus.

UNIT – IV

Transaction Processing Concepts: Introduction to Transaction Processing, Transaction & System Concepts, Properties of Transaction, Schedules and Recoverability
Concurrency Control Techniques: Locking Techniques, Timestamp ordering, Multi-version Techniques, Optimistic Techniques, Granularity of Data items.
Recovery Techniques: Recovery concepts, Recovery Techniques in centralized DBMS.

Text Books:

[1] Elmasri & Navathe: Fundamentals of Database systems, Pearson Education.
[2] Thomas Connolly Carolyn Begg: Database Systems, Pearson Education.

Reference Books:

[1] Korth & Silberschatz: Database System Concept, McGraw Hill International Edition.
[2] Raghu Ramakrishnan & Johannes Gehrke: Database Management Systems, Mcgraw Hill.
[3] Ivan Bayross: SQL, PL/SQL- The Program Language of ORACLE, BPB Publication.

DSE-III (III): SOFTWARE ENGINEERING

Type: Discipline Specific Elective (DSE)
Course Credits: 04
Contact Hours: 04 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 80
External Pass Marks: 32
Internal Maximum Marks: 20
Total Max. Marks: 100
Total Pass Marks: 40

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The objective of this course is to educate the students about the different models of software development and metrics used in software engineering.

Course Outcomes: At the end of this course, the student will be able to:
DSE-III(III).1: understand concept of Software Engineering and various SDLC;
DSE-III(III).2: learn to calculate the cost of a software project for an Enterprise;
DSE-III(III).3: gather basic information of an enterprise to design a software;
DSE-III(III).4: understand the fundamentals of Software Testing and Software Maintenance;

CO-PO matrix for Course Code: DSE-III (III)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
DSE-III(III).1	3	3	2	3	3	2	2	2	2	3	2
DSE-III(III).2	3	2	3	3	3	2	2	2	2	2	2
DSE-III(III).3	2	3	3	3	2	2	2	2	1	1	2
DSE-III(III).4	2	3	3	3	2	2	2	2	1	1	2
Average	2.5	2.75	2.75	3	2.5	2	2	2	1.5	1.75	2

CO-PSO Mapping Matrix for Course Code: DSE-III (III)			
COs	**PSO1**	**PSO2**	**PSO3**
DSE-III(III).1	3	2	2
DSE-III(III).2	3	2	2
DSE-III(III).3	3	2	2
DSE-III(III).4	3	2	2
Average	3	2	2

UNIT – I

Introduction to Software Engineering, System Engineering Vs Software Engineering, Software Evolution, Software Characteristics, Components, Crisis–Problems and Causes, Software Feasibility, Software Process Models – V-Model, Waterfall, Iterative Enhancement, Incremental, RAD, Prototyping, Spiral, Concurrent Development, Rational Unified Process & AGILE. Challenges in Software Engineering.

UNIT – II

Software Project Management – Planning, Scope Management, Cost Estimation – LOC, Function Point Analysis & COCOMO, Putnam Resource Allocation Model, Project Scheduling & Resource Management Gantt-Chart, PERT & CPM, Histogram, Team Building and Organization Charts, Project Monitoring & Risk Management, Software Configuration Management, Software Quality Assurance, Project Monitoring& Techniques.
Software Requirement Analysis - Structured Analysis, Object Oriented Analysis and Data Modelling, Software

Requirement Specification, DFDs, Data Dictionaries, Decision Trees, Decision Tables & Structured English, ER Diagrams.

UNIT – III

Design and Implementation of Software – Basic Fundamentals, Design Methodology (Structured and Object Oriented), Design Approaches, User Interface Designing Tools & Techniques, Design Complexity, Monitoring and Control, Coding, Halstead's Software Science, McCabe's Cyclomatic Complexity

Software Reliability: Metric and Specification, Fault Avoidance and Tolerance, Exception Handling, Defensive Programming, Component Based Development.

UNIT – IV

Software Testing – Fundamentals, Validation & Verification, White-Box and Black-Box Testing Techniques (Control Flow, Data Flow, Loop, Mutation, Load, Stress, Performance, Boundary Value, Equivalence Class, Decision Table, Cause Effect Graph Testing) Testing Strategies: Unit, Integration, Validation and System Testing, Alpha & Beta Testing, Debugging, Static Testing Strategies.

Software & Maintenance: Maintenance Characteristics, Maintainability, Maintenance Tasks and Side Effects.

Text Books:

[1] Pressman S. Roger, Software Engineering, Tata McGraw Hill.
[2] Jalote Pankaj, An Integrated Approach to Software Engineering, Narosa Publ. House.

Reference Books:

[1] K. K. Aggarwal, Yogesh Singh, Software Engineering, New Age International.
[2] Sommerville, Software Engineering, Pearson Education.
[3] Fairley Richard, Software Engineering Concepts, Tata Mc-Graw Hill Ed.
[4] Rajib Mall, Fundamentals of Software Engineering, PHI Learning.

SEC-III (I): DATA WAREHOUSING & DATA MINING

Type: Skill Enhancement Course (SEC)
Course Credits: 02
Contact Hours: 02 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 40
External Pass Marks: 16
Internal Maximum Marks: 10
Total Max. Marks: 50
Total Pass Marks: 20

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to understand the classical models in data warehouses and data mining.

Course Outcomes: At the end of this course, the student will be able to:
SEC-III (I).1: understand the concept of OLTP system.
SEC-III (I).2: acquire the knowledge of various tools and methodology of data warehouse.
SEC-III (I).3: learn the basic fundamentals of data mining.
SEC-III (I).4: learn pre-process the data for mining applications.

CO-PO matrix for Course Code: SEC-III (I)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
SEC-III (I).1	3	2	3	2	2	1	1	2	1	1	2
SEC-III (I).2	3	2	3	2	3	3	2	2	2	1	3
SEC-III (I).3	3	2	3	2	2	2	2	2	2	1	2
SEC-III (I).4	3	3	3	2	3	3	2	2	2	1	3
Average	3	2.25	3	2	2.5	2.25	1.75	2	1.75	1	2.5

CO-PSO Mapping Matrix for Course Code: SEC-III (I)			
COs	**PSO1**	**PSO2**	**PSO3**
SEC-III (I).1	2	1	1
SEC-III (I).2	3	3	1
SEC-III (I).3	2	1	1
SEC-III (I).4	2	2	1
Average	2.25	1.75	1

UNIT – I

Introduction to Data Warehouse: OLTP Systems, Differences between OLTP Systems and Data Warehouse, Characteristics of Data Warehouse, Functionality of Data Warehouse, Advantages and Applications of Data Warehouse.

UNIT – II

Top- Down and Bottom-Up Development Methodology, Tools for Data warehouse development, Data Warehouse Types, Data Warehouse Architecture, and Components of Data Warehouse Architecture, Introduction to Federated Data Warehouse Architecture.

UNIT – III

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.

UNIT – IV

Data Preprocessing: Introduction to Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Text Books:

[1] Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier.

Reference Books:

[1] Data Warehousing in the Real World – Sam Aanhory & Dennis Murray Pearson Edn Asia.
[2] Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.
[3] Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley student Edition

SEC-III (II): COMPUTER ORIENTED NUMERICAL AND STATISTICAL METHODS

Type: Skill Enhancement Course (SEC)
Course Credits: 02
Contact Hours: 02 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 40
External Pass Marks: 16
Internal Maximum Marks: 10
Total Max. Marks: 50
Total Pass Marks: 20

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to have understanding of statistical and graphical techniques in Statistical applications. This course will make student knowing about the concept of fundamentals of Sampling.

Course Outcomes: At the end of this course, the student will be able to:
SEC-III (II).1: learn the concepts of algebraic methods and find solutions of polynomial equation.
SEC-III (II).2: apply numerical methods to obtain approximate solutions to mathematical problems.
SEC-III (II).3: fit curves & find correlations.
SEC-III (II).4: solve statistical problems probability distributions.

CO-PO matrix for Course Code: SEC-III (II)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
SEC-III (II).1	3	2	2	3	2	3	2	3	2	-	1
SEC-III (II).2	3	2	2	3	2	3	2	3	2	-	1
SEC-III (II).3	3	1	2	3	2	1	2	2	2	-	1
SEC-III (II).4	3	3	2	1	2	2	2	3	2	-	1
Average	3	2	2	2.5	2	2.25	2	2.75	2	-	1

CO-PSO Mapping Matrix for Course Code: SEC-III (II)			
COs	**PSO1**	**PSO2**	**PSO3**
SEC-III (II).1	3	2	1
SEC-III (II).2	3	2	1
SEC-III (II).3	3	2	1
SEC-III (II).4	3	2	1
Average	3	2	1

UNIT – I

Algebraic and Transcendental Equation: Bisection Method, Iteration method, Method of false position, Newton-Raphson method, Methods of finding complex roots, Rate of convergence of Iterative methods, Finding solution for Polynomial Equations, Developing algorithms for these methods.

UNIT – II

Numerical Integration: Introduction, Trapezoidal rule, Simpson's 1/3 and 3/8 rule; Interpolation: Lagrange's method, Newton's method; Developing algorithms for these methods.
Differential Equations: Picard's Method, Euler's Method, Taylor's Method, Runge- Kutta Methods, Predictor Corrector Methods, Automatic Error Monitoring and Stability of solution, Developing algorithms for these methods.

UNIT – III

Curve Fitting: Straight line fit, Quadratic fit, Exponential fit, Correlation: Range Correlation, Karl Pearson correlation; Regression; Developing algorithms for these methods.

UNIT – IV

Mean, Median, Mode, Variance, Standard Deviation, kurtosis, moments, skewness; Probability distribution: Binomial, Poission, Normal distribution; Developing algorithms for these methods

Text Books:

[1] Rajaraman V, Computer Oriented Numerical Methods, Pearson Education
[2] S C Gupta and V K Kapoor, Fundamentals of Mathematical Statistics, Khanna publications.

Reference Books:

[1] Goon, A.M., Gupta Fundamental of Statistics., B. Press. Calcutta.
[2] Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, Pearson Publishers.

SEC-III (III): COMPUTER NETWORKS

Type: Skill Enhancement Course (SEC)
Course Credits: 02
Contact Hours: 02 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 40
External Pass Marks: 16
Internal Maximum Marks: 10
Total Max. Marks: 50
Total Pass Marks: 20

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: Provide a comprehensive introduction to Computer Networks and its associated concepts and terminology along with the knowledge of Network architecture, design issues, and hardware components. Give exposure to the contemporary networking technologies and security issues for networks.

Course Outcomes: At the end of this course, the student will be able to:
SEC-III (III).1: understand and characterize various types of computer networks along with an overview of the standard OSI and TCP/IP reference models that illustrates the network architecture;
SEC-III (III).2: have a comprehensive understanding of data communication and basic terminology along with its hardware components.
SEC-III (III).3: conceptualize the various design issues related to data link layer.
SEC-III (III).4: get familiar with routing and security issues related to computer networks and the solutions for handling security related problems in networks;

CO-PO matrix for Course Code: SEC-III (III)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
SEC-III (III).1	3	3	2	3	3	2	2	2	2	1	2
SEC-III (III).2	3	2	3	3	3	2	2	2	2	1	2
SEC-III (III).3	2	3	3	3	2	2	2	2	1	-	2
SEC-III (III).4	3	3	3	3	3	3	3	3	3	2	3
Average	2.75	52.7	2.75	3	2.75	2.25	2.25	2.25	2	1.25	2.25

CO-PSO matrix for Course Code: SEC-III (III)			
COs	**PSO1**	**PSO2**	**PSO3**
SEC-III (III).1	3	1	1
SEC-III (III).2	1	1	1
SEC-III (III).3	1	1	1
SEC-III (III).4	3	1	2
Average	2	1	1.25

UNIT – I

Introduction to Computer Networks; Goals and applications; Types of Computer Networks; Network Design Issues and Protocols; Computer Communications and Networking Models; Communication Service methods and Data Transmission Modes; OSI Reference Model; OSI Service Types; Functions of layers of OSI Model; TCP/IP architecture; Purpose of major Protocols of TCP/IP;

UNIT – II

Physical layer: Analog and Digital Communication concepts; Copper Media; Fiber-Optic Media; Wireless Communications; Satellite Communication; Speed and Capacity of a communication channel; Network Hardware Components; Multiplexing; Switching;
Dialup Networking; Analog Modem Concepts; DSL Service; Cable Modems; Leased lines; Home Networking Concepts;

UNIT – III

Data Link layer: Framing Techniques; Flow Control; Sliding Window Protocols; Error Control: Error Detection and Correction Methods; Medium Access Control: Random Access protocols; Token passing protocols; IEEE LAN Standards; Introduction to Wireless LANs;

UNIT – IV

Network layer: Routing Algorithms: Flooding; Shortest path Routing; Distance-Vector Routing; Link-State Routing; Multicast Routing; Techniques for Congestion Control;
Network Security Issues: Security Goals; Threat Assessment; Network Attacks; Encryption Methods: Symmetric and Asymmetric-Key Ciphers; Firewalls, Digital Signatures, Authentication and Access Control Methods: Digital Certificates, Smart Cards, Kerberos;

Text Books:

[1] Michael A. Gallo, William M. Hancock, Computer Communications and Networking Technologies, CENGAGE learning.
[2] Behrouz A Forouzan, Data Communications and Networking, Mc-Graw Hill.

Reference Books:

[1] William Stallings, Data and Computer Communications, PHI.
[2] Andrew S. Tanenbaum, Computer Networks, PHI.

DSE-VI (I): LINUX AND SHELL PROGRAMMING

Type: Discipline Specific Elective (DSE)
Course Credits: 04
Contact Hours: 04 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 80
External Pass Marks: 32
Internal Maximum Marks: 20
Total Max. Marks: 100
Total Pass Marks: 40

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to enable students to **i**dentify and use UNIX/Linux commands and utilities to create and manage file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.

Course Outcomes: At the end of this course, the student will be able to:
DSE-VI (I).1: understand Linux architecture;
DSE-VI (I).2: ability to use various Linux commands that are used to manipulate system operations.
DSE-VI (I).3: acquire knowledge of Linux File System;
DSE-VI (I).4: understand and make effective use of I/O and shell scripting language to solve problems.

CO-PO matrix for Course Code: DSE-VI (I)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
DSE-VI (I).1	3	3	2	2	3	2	2	2	3	-	2
DSE-VI (I).2	3	2	3	2	3	2	2	2	3	-	2
DSE-VI (I).3	3	3	3	2	2	2	2	2	3	-	1
DSE-VI (I).4	3	2	2	3	3	3	3	3	2	-	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	-	1.75

CO-PSO Mapping Matrix for Course Code: DSE-VI (I)

COs	PSO1	PSO2	PSO3
DSE-VI (I).1	3	1	1
DSE-VI (I).2	3	1	1
DSE-VI (I).3	3	1	1
DSE-VI (I).4	3	1	1
Average	3	1	1

UNIT – I

Introduction to Linux: Linux distributions, Overview of Linux operating system, Linux architecture, Features of Linux, Accessing Linux system, Starting and shutting down system, Logging in and Logging out, Comparison of Linux with other operating systems.

UNIT – II

Commands in Linux: General-Purpose commands, File oriented commands, directory oriented commands, Communication-oriented commands, process oriented commands, etc. Regular expressions & Filters in Linux: Simple filters viz. more, wc, diff, sort, uniq, grep; Introducing regular expressions

UNIT – III

Linux file system: Linux files, inodes and structure and file system, file system components, standard file system, file system types. Processes in Linux: starting and stopping processes, initialization processes, mechanism of process creation, Job control in Linux using at, batch, cron & time

UNIT – IV

Shell Programming: vi editor, shell variables, I/O in shell, control structures, loops, subprograms, creating & executing shell scripts in Linux.

Text Books:

[1] Yashwant Kanetkar, UNIX & Shell programming – BPB.
[2] M.G.Venkateshmurthy, Introduction to UNIX & Shell Programming, Pearson Education.
[3] Richard Petersen, The Complete Reference – Linux, McGraw-Hill.

Reference Books:

[1] Stephen Prata, Advanced UNIX – A programmer's Guide, SAMS.
[2] Sumitabha Das, Your UNIX - The Ultimate Guide, Tata McGraw-Hill.

DSE-VI (II) : PROGRAMMING USING PYTHON

Type: Discipline Specific Elective (DSE)
Course Credits: 04
Contact Hours: 04 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 80
External Pass Marks: 32
Internal Maximum Marks: 20
Total Max. Marks: 100
Total Pass Marks: 40

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to understand the core principles of the Python Language. This course will make student to design effective GUI applications.

Course Outcomes: At the end of this course, the student will be able to:
DSE-VI (II).1: understand the basic concepts of python programming.
DSE-VI (II).2: learn various data structure used in python programming.
DSE-VI (II).3: develop the simple programs of python using arrays and functions.
DSE-VI (II).4: illustrate the process of data file manipulations using python.

CO-PO Mapping Matrix for Course Code: DSE-VI (II)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
DSE-VI (II).1	3	3	2	3	1	3	2	3	3	1	3
DSE-VI (II).2	3	3	2	3	1	3	2	3	2	1	2
DSE-VI (II).3	3	2	3	3	2	3	2	3	2	1	3
DSE-VI (II).4	3	3	3	3	2	3	2	3	2	1	3
Average	3	2.75	2.5	3	1.5	3	2	3	2.25	1	2.75

CO-PSO Mapping Matrix for Course Code: DSE-VI (II)			
COs	**PSO1**	**PSO2**	**PSO3**
DSE-VI (II).1	2	3	3
DSE-VI (II).2	2	3	3
DSE-VI (II).3	2	3	3
DSE-VI (II).4	2	3	3
Average	2	3	3

UNIT – I

Introduction to Python: Python Interpreter, Python as calculator, Python shell, Indentation, identifier and keywords, literals, strings, Operators: Arithmetic, Relational, Logical, comparison, Bitwise, Assignment, Identity operator and Membership operator; Input output statement; Control statements: Branching, looping, Conditional statement, Exit function

UNIT – II

String manipulations: Subscript operator, indexing, slicing a string, other functions on strings, string module. Strings and number system: Format functions, converting strings to numbers & Vice Versa. List, Tuples, Sets, Dictionaries: Basic list operators, replacing, inserting, removing an element, searching, Sorting lists, dictionary literals, adding & removing keys, accessing & replacing values, traversing dictionaries

UNIT – III

Array in Python, Design with Functions: hiding redundancy, complexity, arguments & return values; Formal/Actual arguments, named arguments, program structure and design, Recursive functions, scope & Global statements, Importing modules, Math modules & Random modules.

UNIT – IV

Exception Handling: Exceptions, except clause, try and finally clause, user defined exceptions.
File Handling: Manipulating files & directories, OS & SYS modules, Reading, Writing text & numbers from/to file.
Graphics: Turtle module, drawing colors, shapes, digital images, image file formats.

Text Books:

[1] Python Programming using problem solving approach by Reema Thareja, Oxford University Press.
[2] Learning Python by Mark Lutz

Reference Books:

[1] Introduction to Computation and Programming Using Python with application to understanding data byGuttag John V, PHI
[2] Introduction to Computer Science using Python by Charles Diorbach, Wiley.
[3] Programming Python by Mark Lutz

DSE-VI (III) : VISUAL PROGRAMMING USING C#

Type: Discipline Specific Elective (DSE)
Course Credits: 04
Contact Hours: 04 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 80
External Pass Marks: 32
Internal Maximum Marks: 20
Total Max. Marks: 100
Total Pass Marks: 40

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to get expertise in visual programming and understand the functionalities of middleware platform

Course Outcomes: At the end of this course, the student will be able to:
DSE-VI (III).1: get the knowledge of the structure and model of the programming language C #.
DSE-VI (III).2: develop various applications in C # classes and objects.
DSE-VI (III).3: understand and implement object oriented features in C # programming language to solve the given problem.
DSE-VI (III).4: learn LINQ that binds the gap between relational and object-oriented approaches.

CO-PO Mapping Matrix for Course Code: DSE-VI (III)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
DSE-VI (III).1	3	2	2	3	1	2	1	2	1	1	2
DSE-VI (III).2	3	2	3	3	1	2	2	2	1	1	2
DSE-VI (III).3	3	2	3	3	1	3	2	2	1	1	2
DSE-VI (III).4	3	2	2	2	1	2	1	1	1	1	2
Average	3	2	2.5	2.75	1	2.25	1.5	1.75	1	1	2

CO-PSO Mapping Matrix for Course Code: DSE-VI (III)			
COs	**PSO1**	**PSO2**	**PSO3**
DSE-VI (III).1	3	3	3
DSE-VI (III).2	2	3	3
DSE-VI (III).3	2	3	3
DSE-VI (III).4	1	3	3
Average	2	3	3

UNIT – I

Introduction to Object Technology: Introduction to C# Applications, creating a Simple Application in Visual C# Express, Formatting Text with Console. Write and Console, WriteLine, Operators: Arithmetic, Logical, Relational, Ternary, Unary, Bitwise and Bit Shift operator; Decision Making, Array and Strings manipulations

UNIT – II

Introduction to Classes and Objects: Classes, Objects, Methods, Properties and Instance Variables, Declaring Class with Method and Instantiating an Object of Class, declaring a Method with Parameters, set and get accessors, Initializing Objects with Constructors, Floating-Point Numbers and Type decimal, Control Statements.

UNIT – III

Constructors, Composition, Garbage Collection and Destructors, static Class Members, Data Abstraction and Encapsulation, Object Initializers, Delegates Object-Oriented Programming: Inheritance, Polymorphism, Interfaces and Operator Overloading-Exception Handling

UNIT – IV

Graphical User Interfaces with Windows Forms: Introduction to Windows Forms, Control Properties and Layout: Labels, TextBoxes and Buttons, GroupBoxes and Panels, CheckBoxes and RadioButtons, Numeric UpDown Control, Event Handling, Multiple Document Interface (MDI), User-Defined Controls, Data access using LINQ to SQL.

Text Book:

[1] Paul Deitel & Harvey Deitel, C# 2010 for Programmers, Pearson Education.

Reference Books:

[1] Rob Miles, C# yellow Book, Cheese Edition 8.1.
[2] RB Whitaker, The C# Player's Guide.

SEC-IV(I): ARTIFICIAL INTELLIGENCE

Type: Skill Enhancement Course (SEC)
Course Credits: 02
Contact Hours: 02 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 40
External Pass Marks: 16
Internal Maximum Marks: 10
Total Max. Marks: 50
Total Pass Marks: 20

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of this course is to help students to understand the concept of Artificial Intelligence, Knowledge Representation, Logic, NLP and Learning.

Course Outcomes: At the end of this course, the student will be able to:
SEC-IV(I).1: learn the basic concept of Artificial Intelligence (AI) and its application areas.
SEC-IV(I).2: acquire the knowledge of heuristic search and approaches for knowledge representations;
SEC-IV(I).3: understand the idea of natural language processing and predicate logic;
SEC-IV(I).4: gain the knowledge of learning techniques and expert system;

CO-PO matrix for Course Code: SEC-IV(I)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
SEC- IV(I).1	3	3	2	2	3	2	2	2	3	3	2
SEC- IV(I).2	3	2	3	2	3	2	2	2	3	2	2
SEC- IV(I).3	3	3	3	2	2	2	2	2	3	1	1
SEC- IV(I).4	3	2	2	3	3	3	3	3	2	2	2
Average	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75

CO-PSO matrix for Course Code: SEC-IV(I)			
COs	**PSO1**	**PSO2**	**PSO3**
SEC- IV(I).1	3	3	1
SEC- IV(I).2	2	3	--
SEC- IV(I).3	1	2	--
SEC- IV(I).4	2	2	1
Average	2	2.5	1

UNIT-I

Introduction to Artificial Intelligence (AI), Importance of AI, AI and its Related Field, AI Techniques, Criteria for success. Problem Space and Search: Problem as a State Space Search, Production System and its Characteristics, Issues in the Design of the Search Problem.

UNIT-II

Heuristic search techniques: Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction. Knowledge Representation: Definition and Importance of Knowledge, Knowledge Representation, Various Approaches Used in Knowledge Representation, Issues in Knowledge Representation.

UNIT-III

Using Predicate Logic: Representing Simple Facts in Logic, Representing Instances and is-a Relationship, Computable Function and Predicate, Natural Language Processing: Introduction Syntactic Processing, Semantic Processing, Discourse and Pragmatic Processing.

UNIT – IV

Learning: Introduction Learning, Rote Learning, learning by Taking Advice, learning in Problem Solving, learning from Example-Induction, Explanation Based Learning. Expert System: Introduction, Representing Using Domain Specific Knowledge, Expert System Shells.

Text Books:

[1] E. Rich and K. Knight, Artificial Intelligence, TMH.

Reference Books:

[1] D.W. Patterson, Introduction to AI and Expert Systems, PHI.
[2] Nils J Nilsson, Artificial Intelligence -A new Synthesis, Harcourt Asia Ltd.

SEC-IV(II): INFORMATION SECURITY

Type: Skill Enhancement Course (SEC)
Course Credits: 02
Contact Hours: 02 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 40
External Pass Marks: 16
Internal Maximum Marks: 10
Total Max. Marks: 50
Total Pass Marks: 20

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to provide an understanding of principal concepts, basic approaches of information security.

Course Outcomes: At the end of this course, the student will be able to:
SEC-IV (II).1: get the knowledge of the components of information security and security model.
SEC-IV (II).2: develop an understanding of various Laws in Information security.
SEC-IV (II).3: gain familiarity with risk identification and their control strategy.
SEC-IV (II).4: get the knowledge of information security policy.

CO-PO matrix for Course Code: SEC-IV(II)											
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
SEC- IV(II).1	3	2	2	2	3	2	1	2	2	1	2
SEC- IV(II).2	3	2	3	2	2	2	2	2	3	3	2
SEC- IV(II).3	3	3	3	2	2	2	2	2	2	2	1
SEC- IV(II).4	3	2	3	3	3	3	2	3	3	2	2
Average	3	2.25	2.75	2.25	2.5	2.25	1.75	2.25	2.5	2	1.75

CO-PSO matrix for Course Code: SEC-IV (II)			
COs	**PSO1**	**PSO2**	**PSO3**
SEC- IV(II).1	3	3	1
SEC- IV(II).2	1	2	1
SEC- IV(II).3	1	3	1
SEC- IV(II).4	1	3	1
Average	1.5	2.75	1

UNIT – I

Introduction: History of Information Security, CNSS Security Model, Components of Information Security, Approaches to Information Security and Implementation, Security Systems Development Life Cycle, Security Professionals and the Organization.

UNIT – II

The Need for Security: Introduction, Business Needs First: Threats and Attacks, Legal, Ethical, and Professional Issues in Information Security, Law and Ethics in Information Security: Relevant Laws, International Laws and Legal Bodies.

UNIT – III

Risk Management: An Overview of Risk Management, Risk Identification, Risk Assessment, Risk Control Strategies: Selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices

UNIT – IV

Planning for Security: Introduction to Information Security Planning and Governance, Information Security Policy, Standards, and Practices, Security Education, Training, and Awareness Program.

Text Book:

[1] Michael E. Whitman & Herbert J. Mattord, Principles of Information Security, Cengage Learning.

Reference Books:

[1] Steve G Watkins, An Introduction to Information Security and ISO 27001: 2013– A Pocket Guide.

SEC-IV (III): E-COMMERCE

Type: Skill Enhancement Course (SEC)
Course Credits: 02
Contact Hours: 02 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 40
External Pass Marks: 16
Internal Maximum Marks: 10
Total Max. Marks: 50
Total Pass Marks: 20

Instructions To Paper Setter For End Semester Exam: Examiner will be required to set NINE questions in all. Question No.1 will consist of objective type / short-answer type questions covering the entire syllabus. In addition to Question no. 1, the examiner is required to set EIGHT more questions selecting TWO from each UNIT. Student will be required to attempt FIVE questions in all. Question No.1 will be compulsory. In addition to compulsory question, student will have to attempt FOUR more questions selecting ONE question from each UNIT. All questions will carry equal marks.

Course Objectives: The aim of the course is to make students aware of e-commerce in general and use of sites in particular. E-commerce is latest trend in modern era and this paper will help students establish relation to real life.

Course Outcomes: At the end of this course, the student will be able to:
SEC-IV (III).1: learn the main components of e-commerce and its prerequisites.
SEC-IV (III).2: understand the architecture of EDI and learn the different mode of electronic payment.
SEC-IV (III).3: learn the implementation of b2c type of e-commerce in real life applications.
SEC-IV(III).4: understand the idea of commerce over mobile phones, security prospectus and legal aspects of e-commerce.

CO-PO Mapping Matrix for Course Code: SEC- IV (III)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
SEC-IV (III).1	3	3	2	3	2	3	2	2	3	3	2
SEC-IV (III).2	3	2	3	2	3	2	2	3	2	2	3
SEC-IV (III).3	2	3	3	3	2	2	2	2	2	3	2
SEC-IV (III).4	3	2	2	2	2	3	3	3	3	2	2
Average	2.75	2.5	2.5	2.5	2.25	2.5	2.25	2.5	2.5	2.5	2.25

CO-PSO Mapping Matrix for Course Code: SEC- IV (III)

COs	PSO1	PSO2	PSO3
SEC-IV (III).1	3	2	2
SEC-IV (III).2	2	3	3
SEC-IV (III).3	3	3	2
SEC-IV (III).4	2	2	2
Average	2.5	2.5	2.25

UNIT-I

Introduction to E-Commerce: Defining E-Commerce, Traditional Commerce and E-Commerce, Main Activities of E-Commerce, Benefits of E-Commerce, Broad Goals of E-Commerce, Components of E-Commerce, Functions of E-Commerce, Process of E-Commerce, Types of E-Commerce, Role of Internet and Web in E-Commerce, Pre-requisites of E-Commerce, Scope of E-Commerce.

UNIT-II

Electronic Data Interchange (EDI): Introduction and definition of EDI, EDI layered Architecture, EDI technology and standards, EDI communications and transactions, Benefits and applications of EDI.
Electronic Payment Systems: Electronic Funds Transfer. Digital Token Based E-Payment Systems, Modern Payment Systems, Steps for Electronic Payment, Payment Security, Net Banking credit/debit/smart cards, E-money.

UNIT-III

Products in B2C Model: Success Factors of E-brokers, Broker-based Services on-line, On-line Travel Tourism Services, Benefits and Impact of E-Commerce on Travel Industry, Deal Estate Market, Online Stock Trading and its Benefits, Online Banking and its Benefits, On-line Financial Services and their Future, E-auctions: Benefits, Implementation and impact of E-auctions.

Unit – IV

Mobile Commerce and Future of E-Commerce: Introduction to Mobile Commerce, Benefits of Mobile Commerce, Impediments of M-Commerce, M-Commerce framework.
Internet Security Issues, E-Business Risk Management Issues, Legal, Ethical and other public policy issues related to E-commerce, Emerging and future trends of E-commerce.

Text Books:

[1] Ravi Kalakota, Andrew B. Whinston: Frontiers of Electronic Commerce, Addison Wesley.
[2] Turban E., Lee J., King D. and Chung H.M, Electronic Commerce-A Managerial Perspective, Prentice-Hall International, Inc.

Reference Books:

[1] K.K.Bajaj & D.Nag, E-Commerce, Tata McGraw Hill, New Delhi.
[2] Bhatia V., E-commerce, Khanna Book Pub. Co. (P) Ltd., Delhi.

CO-PO-PSO MAPPING MATRIX FOR ALL THE COURSES OF:

Three Year B.Sc. Programme (Course Computer Science)

SEMESTER	COURSE CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3
I	CC – III A	3	2.5	2.5	3	3	2	2	2	2	2.5	2	2.5	3	2.5
	CC – III B	3	1.75	1.75	1	1	2	1	2	1.5	1	1.3	2	2.5	2.5
II	CC – VI A	2.75	2.5	2.5	2.75	2.75	2.25	2.25	2.25	2	2	1.75	2.5	2.75	2.5
	CC – VI B	2.75	2.5	2.5	2.75	2.25	2.25	2.25	2.5	2	1.5	2.25	2	1.5	1.25
III	CC- IX A	3	2.25	2.5	2.75	2.5	2.25	2.25	2.25	2	2	2	2.5	2.75	2.5
	CC – IX B	2.75	2.5	2.5	2.75	2.75	2.25	2	2.25	2	2	2	2	2.5	3
IV	CC – XII A	3	2	3	1	2.5	2.5	2	3	2.25	1	2.5	1	2.5	3
	CC – XII B	2.75	2.75	2.5	2.75	2.75	2.25	2	2.25	2	1	2	2	2.75	2.5
V	DSE-III (I)	3	3	2.75	3	1.5	3	2	2.5	2	1.25	2.25	2	3	3
	DSE-III (II)	3	2.75	2.5	2.75	2.75	2	1.75	2.25	2.25	2	1.5	1.75	3	2.75
	DSE-III (III)	2.5	2.75	2.75	3	2.5	2	2	2	1.5	1.75	2	3	2	2
	SEC-III (I)	3	2.25	3	2	2.5	2.25	1.75	2	1.75	1	2.5	2.25	1.75	1
	SEC-III (II)	3	2	2	2.5	2	2.25	2	2.75	2	-	1	3	2	1
	SEC-III (III)	2.75	2.75	2.75	3	2.75	2.25	2.25	2.25	2	1.25	2.25	2	1	1.25
VI	DSE-VI (I)	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	-	1.75	3	1	1
	DSE-VI (II)	3	2.75	2.5	3	1.5	3	2	3	2.25	1	2.75	2	3	3
	DSE-VI (III)	3	2	2.5	2.75	1	2.25	1.5	1.75	1	1	2	2	3	3
	SEC-IV(I)	3	2.5	2.5	2.25	2.75	2.25	2.25	2.25	2.75	2	1.75	2	2.5	1
	SEC-IV(II)	3	2.25	2.75	2.25	2.5	2.25	1.75	2.25	2.5	2	1.75	1.5	2.75	1
	SEC- IV (III)	2.75	2.5	2.5	2.5	2.25	2.5	2.25	2.5	2.5	2.5	2.25	2.5	2.5	2.25
I to VI	**Average**	**2.9**	**2.44**	**2.54**	**2.5**	**2.31**	**2.3**	**1.98**	**2.31**	**2.05**	**1.59**	**1.98**	**2.18**	**2.39**	**2.1**

Kurukshetra University, Kurukshetra
(Established by the State Legislature Act XII of 1956)
('A+' Grade, NAAC Accredited)

|| योगस्थः कुरु कर्माणि ||
समबुद्धि व योगयुक्त होकर कर्म करो
(Perform Actions while Stead fasting in the State of Yoga)

Scheme of Examination and Syllabus of

Master of Technology (M.Tech.) in Computer Science &Engineering(CSE) (CBCS) in Phased Manner

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS

CBCS CURRICULUM (2020-21)

Program Name: Master of Technology (M.Tech.) in Computer Science & Engineering(CSE)(CBCS)

(For the Batches Admitted From 2020-2021)

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

VISION

Pursue conducive advancement towards nurturing globally competent and ethically conscientious professionals and entrepreneurs in agile computing technologies and allied spheres for unceasing evolution of Nations IT affiliated commercial and research endeavours.

MISSION

Thrive to establish a strong foundation for technical competency in spheres concordant to software oriented design and development. Nurture skills and competency for administering expertise gained in computing discipline to a wide horizon of interdisciplinary application domains, thus supporting sustainable development of the society. Habituate the students to strive for technological innovations and successful endeavours ethically, supported by sustained learning continuance and problem solving proficiency that may promote nations welfare in terms of economic acceleration leading to the growth of society.

NAME OF THE PROGRAMME: MASTER OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)
DURATION :TWO YEARS

PROGRAMME OUTCOMES (POs)	
PO1	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study
PO2	Capability to ask relevant/appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis
PO3	Ability to communicate effectively on general and Technical topics with the engineering community and with society at large
PO4	Capability of applying knowledge to solve Engineering and other problems
PO5	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings.
PO6	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions
PO7	Ability to use and learn techniques, skills and modern tools for scientific and engineering practices
PO8	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional Engineering practices
PO9	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life
PO10	Capability to identify and apply ethical issues related to one’s work, avoid unethical behaviour such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work
PO11	Ability to demonstrate knowledge and understanding of the engineering principles and apply these to manage projects

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
PSO1	Supplement potential for pursuing advanced studies, engaging in research & technological development directed towards innovative activities, and nurturing entrepreneurial skills.
PSO2	Strengthen competency for innovating solutions to real-world problems by exercising data analysis skills and adopting contemporary technologies for demanding prospective applications.
PSO3	Inculcate the practice to administer Professional & Ethical virtues, along with Social and Environmental regulations.
PSO4	Stimulate the aptitude for problem analysis and programming skills for computer based system design and modeling in allied spheres related to Algorithmic, Computational, Architectural and Database environments, along with emerging technologies such as Machine Learning& Intelligent systems , Evolutionary Techniques and Optimization, Data Science & Analytics, Distributed and Wireless Communication in cognation with IoT and Cloud Computing , Web and Mobile application designing, and Real World Enhancement using Computer Vision & Augmented Reality.

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SCHEME OF EXAMINATION FOR MASTER OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING) CHOICE BASED CREDIT SYSTEM (CBCS) W. E. F. ACADEMIC SESSION 2020-21 IN PHASED MANNER

Paper Code	Nomenclature of Paper	Credits	Work load Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks	Total Marks	Pass Marks
					Max.	Pass			
First Semester									
MT-CSE-20-11	Mathematical Foundations of Computer Science	4	4	3	75	30	25	100	40
MT-CSE-20-12	Advanced Data Structures	4	4	3	75	30	25	100	40
MT-CSE-20-13	Elective- I	4	4	3	75	30	25	100	40
MT-CSE-20-14	Elective- II	4	4	3	75	30	25	100	40
MT-CSE-20-15	Research Methodology and IPR	3	3	3	75	30	25	100	40
MT-CSE-20-16	S/W Lab–I Based on MT-CSE-20-12	2.5	5	3	100	40	-	100	40
MT-CSE-20-17	S/W Lab-II Based on MT-CSE-20-13	2.5	5	3	100	40	-	100	40
	Total	**24**	**29**		**575**	**230**	**125**	**700**	**280**
Elective – I									
MT-CSE-20-13(i)	Machine Learning using Python	4	4	3	75	30	25	100	40
MT-CSE-20-13(ii)	Data Science using Python	4	4	3	75	30	25	100	40
MT-CSE-20-13(iii)	Wireless Sensor Networks	4	4	3	75	30	25	100	40
MT-CSE-20-13(iv)	Advanced Database Systems	4	4	3	75	30	25	100	40
Elective – II									
MT-CSE-20-14(i)	Intelligent Systems	4	4	3	75	30	25	100	40
MT-CSE-20-14(ii)	Distributed Systems	4	4	3	75	30	25	100	40
MT-CSE-20-14(iii)	Computer Vision and Augmented Reality	4	4	3	75	30	25	100	40
MT-CSE-20-14(iv)	Advanced Computer Architecture	4	4	3	75	30	25	100	40
Second Semester									
MT-CSE-20-21	Advances in Algorithms	4	4	3	75	30	25	100	40
MT-CSE-20-22	Soft Computing	4	4	3	75	30	25	100	40
MT-CSE-20-23	Elective – III	4	4	3	75	30	25	100	40
MT-CSE-20-24	Elective – IV	4	4	3	75	30	25	100	40
MT-CSE-20-25	S/W Lab –III Based on MT-CSE-20-21	2.5	5	3	100	40	-	100	40
MT-CSE-20-26	S/W Lab –IV Based on MT-CSE-20-23	2.5	5	3	100	40	-	100	40
*OE-CSE-20-27	Open Elective Based on MOOCs (The selected course should not be directly related with Computer Science) Or As per University Guidelines	2	2	3	35	14	15	50	20
	Total	**23**	**28**		**535**	**214**	**115**	**650**	**260**
Elective – III									
MT-CSE-20-23(i)	Data Preparation and Analysis	4	4	3	75	30	25	100	40
MT-CSE-20-23(ii)	Optimization Techniques	4	4	3	75	30	25	100	40

Paper Code	Nomenclature of Paper	Credits	Work load Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks	Total Marks	Pass Marks
					Max.	Pass			
MT-CSE-20-23(iii)	Advanced Wireless and Mobile Networks	4	4	3	75	30	25	100	40
MT-CSE-20-23(iv)	Networking and Administration in Linux / Unix	4	4	3	75	30	25	100	40
Elective – IV									
MT-CSE-20-24(i)	Mobile Applications and Services	4	4	3	75	30	25	100	40
MT-CSE-20-24(ii)	Advanced Web Technologies	4	4	3	75	30	25	100	40
MT-CSE-20-24(iii)	Object-Oriented Software Engineering	4	4	3	75	30	25	100	40
MT-CSE-20-24(iv)	Big Data and Pattern Recognition	4	4	3	75	30	25	100	40
Third Semester									
MT-CSE-20-31	Elective-V	4	4	3	75	30	25	100	40
MT-CSE-20-32	Dissertation-I / Industrial Project	10	20	-	200	80	50	250	100
*OE-CSE-20-33	Open Elective Based on MOOCs (The selected course should not be directly related with Computer Science) Or As Per University Guidelines	2	2	3	35	14	15	50	20
	Total	**16**	**26**		**310**	**124**	**90**	**400**	**160**
Elective – V									
MT-CSE-20-31(i)	Compiler for High Performance Computing	4	4	3	75	30	25	100	40
MT-CSE-20-31(ii)	Cloud Computing and IoT	4	4	3	75	30	25	100	40
MT-CSE-20-31(iii)	Information Retrieval System	4	4	3	75	30	25	100	40
MT-CSE-20-31(iv)	Digital Image Processing	4	4	3	75	30	25	100	40
Fourth Semester									
MT-CSE-20-41	Dissertation-II	16	32	-	300	120	100	400	160
	Total	**16**	**32**	**-**	**300**	**120**	**100**	**400**	**160**
	Grand Total	**79**	**115**	**-**	**1720**	**688**	**430**	**2150**	**860**

Note 1:<u>Instructions for Examiners to award marks/grades for Dissertation – II :-</u>

The marks shall be awarded on the basis of three aspects,
(i) Evaluation of Dissertation Report (ii) Viva-Voce and (iii) Publication/Presentation of Research Paper from the dissertation.

Part (i) and (ii) carries 75% of the total marks for both internal and external evaluation. Part (iii) carries 25% of the total marks for both internal and external evaluation.
Part (iii) marks shall be awarded using following criteria:

1. Marks 91% or above: Publication from Dissertation in SCI indexed journal.
2. Marks 81% to 90%: Publication from Dissertation in Scopus indexed or Web of Science Indexed journal.
3. Marks 71% to 80%: Publication from Dissertation in Proceedings of Conference which is Scopus indexed/IEEE/ACM/Elsevier indexed or Publication from Dissertation in UGC Care List journal.
4. Marks 61% to 70%: Presented paper in International Conference.
5. Marks 51% to 60%: Presented paper in National Conference.

***Note 2:** In addition to the credits earned by compulsory and elective courses, every student has to earn 2 more credits by selecting an open elective/MOOC course during second and third semester.

Note 3: The credits for the first year are 47(24+23) and for the second year are 32(16+16). Total credits of the courseshall be 47+32=79.

Note 4: For the purpose of computation of work-load the following mechanism shall be adopted:

- 1 Credit = 1 Theory period of one hour duration.
- 1 Credit = 1 Practical period of two hour duration.

Note 5: <u>Evaluation procedure for internal assessment marks:</u>
Two Mid Term Examinations should be conducted by the concerned teacher each of 10 marks. Five marks may be given by the concerned teacher on the basis of performance during the course (puzzles/ assignments/ interactions/ attendanceetc).

Note 6: Size of groups in all practical courses should not be more than thirty students.

MT-CSE-20-11: Mathematical Foundations of Computer Science

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester exam:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is make students understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Computer security, Software engineering, Computer architecture, distributed systems, Machine learning, etc.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-11.1	understand the basic notions of discrete and continuous probability;
MT-CSE-20-11.2	understand various sampling and classification problems;
MT-CSE-20-11.3	understand the methods of statistical inference, and the role that sampling distributions play in those methods;
MT-CSE-20-11.4	analyse graphs, permutation and combination and their use in various scenarios;

CO-PO Mapping Matrix for the Course Code : MT-CSE-20-11

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-11.1	3	2	1	2	1	1	1	1	2	1	1
MT-CSE-20-11.2	3	3	1	3	1	3	2	2	2	1	2
MT-CSE-20-11.3	3	3	1	3	1	3	2	2	2	1	2
MT-CSE-20-11.4	3	2	1	2	1	2	2	1	2	1	1
Average	**3**	**2.5**	**1**	**2.5**	**1**	**2.25**	**1.75**	**1.5**	**2**	**1**	**1.5**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-11

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-11.1	1	2	1	3
MT-CSE-20-11.2	3	2	2	3
MT-CSE-20-11.3	3	3	2	3
MT-CSE-20-11.4	2	2	1	3
Average	**2.25**	**2.25**	**1.5**	**3**

Unit – I Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate, Central Limit Theorem, Probabilistic inequalities, Markov chains.
Unit – II Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood, Recent Trends in various distribution functions in mathematical field of computer science for varying fields.
Unit – III Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, the problem of over fitting model assessment.
Unit – IV Graph Theory: Isomorphism, Planar graphs, graph colouring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition, Specialized techniques to solve combinatorial enumeration problems.
Text Books: 1. John Vince, Foundation Mathematics for Computer Science, Springer. **2.** K. Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
Reference Books: 1. M. Mitzenmacher and E. Upfal, Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge University Press 2.Alan Tucker, Applied Combinatorics, Wiley.

MT-CSE-20-12: Advanced Data Structures	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective is to make students able to understand the necessary mathematical abstraction to solve problems and to familiarize them with advanced paradigms and data structure used to solve algorithmic problems.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-12.1	understand the implementation of symbol table using hashing techniques;
MT-CSE-20-12.2	develop and analyse algorithms for red-black trees, B-trees and Splay trees;
MT-CSE-20-12.3	develop algorithms for text processing applications;
MT-CSE-20-12.4	identify suitable data structures and develop algorithms for computational geometry problems.

CO-PO Mapping Matrix for the Course Code : MT-CSE-20-12

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-12.1	3	3	1	3	1	3	3	1	3	1	2
MT-CSE-20-12.2	3	3	1	3	1	3	3	1	2	1	2
MT-CSE-20-12.3	3	3	2	3	1	3	2	2	3	1	3
MT-CSE-20-12.4	3	3	1	3	2	3	3	2	3	1	3
Average	**3**	**3**	**1.25**	**3**	**1.25**	**3**	**2.75**	**1.5**	**2.75**	**1**	**2.5**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-12

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-12.1	3	2	2	3
MT-CSE-20-12.2	3	1	1	2
MT-CSE-20-12.3	3	2	2	3
MT-CSE-20-12.4	3	2	2	3
Average	**3**	**1.75**	**1.75**	**2.75**

Unit – I

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Unit – II Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees. Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.
Unit – III Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.
Unit – IV Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, k-D Trees.
Text Books: 1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education. 2.M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley.
Reference Books: 1.Cormen, Leiserson, Rivest, “Introduction to Algorithms”, PHI India.

MT-CSE-20-13(i): Machine Learning using Python

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester exam:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to enable student to perform experiments in Machine Learning using real-world data using Python.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-13(i).1	construct and execute various programs using different data structures in Python;
MT-CSE-20-13(i).2	use the Python programming for machine learning;
MT-CSE-20-13(i).3	understand the machine learning along with concept learning and decision trees;
MT-CSE-20-13(i).4	understand Bayesian, Computational and Instance-based learning.

CO-PO Mapping Matrix for the Course Code : MT-CSE-20-13(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-13(i).1	3	3	2	3	2	3	3	1	3	1	3
MT-CSE-20-13(i).2	3	3	2	3	2	3	3	1	3	1	3
MT-CSE-20-13(i).3	3	3	2	2	1	2	2	3	3	1	2
MT-CSE-20-13(i).4	3	3	2	2	1	2	2	3	3	1	2
Average	**3**	**3**	**2**	**2.5**	**1.5**	**2.5**	**2.5**	**2**	**3**	**1**	**2.5**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-13(i)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-13(i).1	3	3	3	3
MT-CSE-20-13(i).2	3	3	3	3
MT-CSE-20-13(i).3	2	3	3	3
MT-CSE-20-13(i).4	2	3	3	3
Average	**2.5**	**3**	**3**	**3**

Unit – I

Python Programming: Strings - String slices, immutability, string functions and methods, string module; Lists, Tuples, Dictionaries: Lists - Lists as arrays Traversing a List, list operations, list slices, list methods, Map, Filter and Reduce, list loop, mutability, aliasing, cloning lists, list parameters; Dictionaries - operations and methods; advanced list processing - list comprehension; Tuples - tuple assignment, tuple as return value.
Files and Modules: Files and exception - text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules.

Unit – II

Packages in Python: PANDAS, NUMPY, SCIKIT-LEARN, MATPLOTLIB.

NumPy - Introduction,Ndarray Object ,Data types, Array Attributes,Array Creation Routines, Indexing & Slicing, Advanced Indexing,Broadcasting,Iterating Over Array,Array Manipulation,Binary Operators,String Functions,Mathematical Functions,Mathematical Functions,Arithmetic Operations,Statistical Functions,Linear Algebra,Matplotlib(Used for data visualization),Histogram Using Matplotlib.

Pandas: Performing data cleaning and analysis, Loading data with Pandas (data manipulation and analysis), Working with and Saving data with Pandas.

Using Scikit-Learn for Linear Regression, Logistic Regression, Decision Tree, Naive Bayes, KNN, SVN, k Mean Clustering, Random Forest.

Unit – III

Introduction to Machine Learning – Well defined learning problems, Designing a Learning System, Issues in Machine Learning.

The Concept Learning Task - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias

Decision Tree Learning - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning.

Unit – IV

Bayesian Learning: Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm.

Computational Learning Theory: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning.

Instance-Based Learning – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited.
2. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press.
3. John V Guttag, Introduction to Computation and Programming Using Python, MIT Press.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.

Reference Books:

1.Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press.

2.Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Updated for Python 3, Shroff/O„Reilly Publishers.

3.Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press.

4. Sebastian Raschka, Python Machine Learning.

MT-CSE-20-13 (ii) : Data Science using Python	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide you with the knowledge and expertise to become a proficient data scientist. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science. Student will learn Python code to statistically analyse a dataset.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-13 (ii).1	learn data collection, management and storage methods for data science;
MT-CSE-20-13 (ii).2	understand the implementation of machine learning algorithms;
MT-CSE-20-13 (ii).3	acquire knowledge of visualization techniques used by data scientists;
MT-CSE-20-13 (ii).4	implement data collection and management scripts using Python.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-13 (ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-13 (ii).1	3	3	3	3	2	2	3	3	2	2	1
MT-CSE-20-13 (ii).2	3	3	3	3	3	1	2	3	3	3	2
MT-CSE-20-13 (ii).3	3	2	2	1	2	2	1	3	2	3	1
MT-CSE-20-13 (ii).4	3	3	3	2	3	3	1	2	3	2	1
Average	**3**	**2.75**	**2.75**	**2.25**	**2.5**	**2**	**1.75**	**2.75**	**2.5**	**2.5**	**1.25**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-13 (ii)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-13 (ii).1	3	2	1	3
MT-CSE-20-13 (ii).2	3	3	2	2
MT-CSE-20-13 (ii).3	3	2	1	3
MT-CSE-20-13 (ii).4	3	3	3	2
Average	**3**	**2.5**	**1.75**	**2.5**

Unit – I

Introduction to core concepts and technologies: Introduction, Data Science Process, Data Science Toolkit, Types of Data, Example Applications. Data Collection and Management: Sources of data, Data collection and APIs, Exploring and Fixing Data, Data Storage and Management, Using Multiple Data Sources.

Unit – II

Data Analysis: Introduction, Terminology and Concepts, Introduction to Statistics, Central Tendencies and Distributions, Variance, Distribution Properties and Arithmetic, Samples/CLT, Basic Machine Learning Algorithms, Linear Regression, SVM, Naive Bayes, Applications of Data Science.

Unit – III
Data Visualisation: Introduction, Types of Data Visualisation, Data for Visualisation: Data Types, Data Encodings, Retinal Variables, Mapping Variables to Encodings, Visual Encodings, Technologies for Visualisation, Recent Trends in Various Data Collection and Analysis Techniques. Application Development Methods of Used in Data Science.
Unit – IV
Python Programming: Python Strings, Operators, Functions, Control Structures, Mutable and Immutable Objects, Recursion, Files and Exception, Classes, List Manipulation, Applications of Python.
Text Books: 1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2. SheetalTaneja, Naveen Kumar, Python Programming, Pearson.
References Books: 1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2. G Dong and J Pei, Sequence Data Mining, Springer.

MT-CSE-20-13(iii): Wireless Sensor Networks

Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of the course is to provide a comprehensive understanding of the fundamental concepts and architecture of WSNs along with major issues, and effective solutions in wireless sensor networking.

Course Outcomes: At the end of this course, the student will be able to:

MT-CSE-20-13(iii).1	understand the fundamental concepts of wireless sensor networks and have a basic knowledge of its components, characterization and categorization, along with design objectives, challenges, applications and technological background of Wireless Sensor Networks;
MT-CSE-20-13(iii).2	get familiar with the Media Access Control and Transport Protocols for Wireless Sensor Networks;
MT-CSE-20-13(iii).3	get research directions for pertinent design issues of Wireless Sensor Networks such as Routing and energy efficiency;
MT-CSE-20-13(iii).4	have an insight into the directions for carrying out research activities to explore and solve issues related to data aggregation, node localization, synchronization and security in Wireless Sensor Networks.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-13(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-13(iii).1	3	3	3	2	2	2	2	2	3	-	2
MT-CSE-20-13(iii).2	3	3	3	3	2	3	3	2	3	-	2
MT-CSE-20-13(iii).3	3	3	3	3	2	3	3	2	3	-	2
MT-CSE-20-13(iii).4	3	3	3	3	2	3	3	2	3	-	2
Average	**3**	**3**	**3**	**2.75**	**2**	**2.75**	**2.75**	**2**	**3**	**-**	**2**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-13(iii)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-13(iii).1	3	2	1	3
MT-CSE-20-13(iii).2	3	2	1	3
MT-CSE-20-13(iii).3	3	2	1	3
MT-CSE-20-13(iii).4	3	2	1	3
Average	**3**	**2**	**1**	**3**

Unit – I

Introduction: Overview of Wireless Sensor Networks – Characteristics, Applications, Design objectives & challenges; Basic Components; Operating Systems for Wireless Sensor Networks; Quality of a Sensor Network: Coverage, Exposure.

Technological Background – MEMS Technology, Hardware and Software Platforms, Evolving Standards for Wireless Sensor Networks; Sensor Node Structure; Network Architectures for Wireless Sensor Networks –

Layered (UNPF) & Clustered (LEACH) ; Classification of Wireless Sensor Networks; Protocol Stack for Wireless Sensor Networks.
Unit – II **Media Access Control:** Fundamental MAC protocols; MAC design issues for Wireless Sensor Networks; MAC Protocols for Wireless Sensor Networks; Contention–Free Protocols; Hybrid Protocols. **Transport Protocols:** Transport ProtocolDesignIssues and Transport Protocols for Wireless Sensor Networks.
Unit – III **Routing and Data Dissemination:** Fundamentals & Challenges; Taxonomy of Routing and Data Dissemination Protocols; Location-Aided Protocols; Layered and In-Network processing Based Protocols; Data-Centric Protocols; Multipath-Based Protocols; Mobility-based & Heterogeneity-Based Protocols ; QoS Based Protocols; Data gathering. **Broadcasting, Multicasting, and Geocasting:** Concepts, Major Challenges & Mechanisms. **Energy Efficiency:** Need for Energy Efficiency; MAC layer and Higher Layers Power Conservation Mechanisms.
Unit – IV **Data Aggregation in Wireless Sensor networks:** Challenges & techniques; Node Clustering and its Algorithms in Wireless Sensor Networks. **Node Localization:** Concepts, Challenges, &Algorithms; Ranging Techniques. **Time Synchronization:** Need and Requirements of Synchronization in Wireless Sensor Networks; Synchronization Protocols for Wireless Sensor Networks. **Security Issues in Wireless Sensor networks:** Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security. Future Trends in Wireless Sensor Networks.
Text Books: 1. Jun Zheng, Abbas, Wireless Sensor Networks A Networking Perspective, Wiley. 2. KazemSohraby, Daniel Minoli, &TaiebZnati, Wireless Sensor Networks-Technology, Protocols, and Applications, Wiley
Reference Books: 1. W. Dargie and C. Poellabauer, Fundamentals of Wireless Sensor Networks –Theory and Practice, Wiley. 2. Thomas Haenselmann, Wireless Sensor Networks: Design Principles for Scattered Systems, OldenbourgVerlag 3. WaltenegusDargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, Wiley 4. Mohammad S. Obaidat, SudipMisra, Principles of Wireless Sensor Networks, Cambridge, 5. C. Sivarm Murthy & B.S. Manoj, Adhoc Wireless Networks, PHI.

MT-CSE-20-13 (iv) : Advanced Database Systems	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week. **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide an in- depth knowledge of SQL and PL/SQL to design database for an organization. This course focuses on advance topics of the database including EER model, object oriented database, and emerging concepts of database.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-13 (iv).1	understand overall process of database modeling & design, Implementation;
MT-CSE-20-13 (iv).2	learn to write complex queries in SQL and to design PL/SQL blocks for database implementation;
MT-CSE-20-13 (iv).3	acquire technical knowhow of the EER modelling, Query Optimization, Transaction management, database backup and recovery along with emerging databases management systems;
MT-CSE-20-13 (iv).4	undertake various projects and job profiles on database applications.

CO-PO Mapping Matrix for the Course Code : MT-CSE-20-13 (iv)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-13 (iv).1	3	3	1	3	1	3	2	3	3	1	2
MT-CSE-20-13 (iv).2	3	2	1	3	1	3	2	3	3	1	2
MT-CSE-20-13 (iv).3	3	3	1	3	3	3	2	3	3	1	3
MT-CSE-20-13 (iv).4	3	2	1	3	3	3	2	3	3	1	3
Average	**3**	**2.5**	**1**	**3**	**2**	**3**	**2**	**3**	**3**	**1**	**2.5**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-13 (iv)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-13 (iv).1	2	3	2	3
MT-CSE-20-13 (iv).2	2	3	2	3
MT-CSE-20-13 (iv).3	2	3	3	3
MT-CSE-20-13 (iv).4	2	3	3	3
Average	**2**	**3**	**2.5**	**3**

Unit – I

Database System Concepts and Architecture: Three - Schema Architecture and Data Independence, Entity Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships Types & Instances, ER Diagrams, Naming conventions and Design Issues. Relational Model Constraints, Enhanced Entity Relationship Model: Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization.

Unit – II

SQL: Data Definition and Data Types, DDL, DML, and DCL, Views & Queries in SQL, Specifying Constraints & Indexes in SQL. PL/SQL: Architecture of PL/SQL, Basic Elements of PL/SQL, PL/SQL Transactions, Cursors and Triggers.

Relational Database Design: Functional Dependencies, Decomposition, Normal Forms Based on Primary Keys-(1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF, Domain Key Normal Form.

Unit – III

Query Processing and Optimization: Query Processing, Query Decomposition, Stages of Query Processing, Query Tree, Using Heuristics in Query Optimization, Semantic Query Optimization, Transaction Processing: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Concurrency Control Techniques: Two-Phase Locking Techniques, Timestamp Ordering, Serializability. Database Backup and Recovery: Recovery facilities, Recovery Techniques.

Unit – IV

Object Model: Overview of Object-Oriented concepts, Object identity, Object structure, Type constructors, Databases for Advance Applications: Architecture for Parallel Database, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Active Database Concept, Temporal Databases Concepts, Spatial and Multimedia Databases, XML Schema, XQuery and Approaches for XML query processing.

Text Books:

1. Elmasri&Navathe, Fundamentals of Database systems, Pearson Education.
2. Ivan Bayross, SQL, PL/SQL- The Program Language of ORACLE, BPB Publication.
3. Alexis Leon & Mathews Leon, Database Management System, Leon Vikas Publication.

Reference Books:

1. Korth&Silberschatz, Database System Concept, McGraw Hill International Edition.
2. Raghu Ramakrishnan& Johannes Gehrke, Database Management Systems, McGraw Hill.
3. Peter Rob, Carlos Colonel, Database system Design, Implementation, and Measurement, Cengage Learning.
4. Abbey, Abramson & Corey: Oracle 8i-A Beginner's Guide, Tata McGraw Hill.

MT-CSE-20-14 (i) : Intelligent Systems	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach and to explore the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-14 (i).1	understand the concepts of neural networks and fuzzy logic;
MT-CSE-20-14 (i).2	learn to use the concepts of artificial intelligence in state space serach;
MT-CSE-20-14 (i).3	acquire technical knowhow about the knowledge representation;
MT-CSE-20-14 (i).4	Understand and use the concepts of reasoning in artificial intelligence.

CO-PO Mapping Matrix for the Course Code : MT-CSE-20-14 (i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-14 (i).1	3	3	1	3	1	3	2	3	3	1	2
MT-CSE-20-14 (i).2	3	2	1	3	1	3	2	3	3	1	2
MT-CSE-20-14 (i).3	3	3	1	3	3	3	2	3	3	1	3
MT-CSE-20-14 (i).4	3	2	1	3	3	3	2	3	3	1	3
Average	**3**	**2.5**	**1**	**3**	**2**	**3**	**2**	**3**	**3**	**1**	**2.5**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-14 (i)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-14 (i).1	2	3	2	3
MT-CSE-20-14 (i).2	2	3	2	3
MT-CSE-20-14 (i).3	2	3	3	3
MT-CSE-20-14 (i).4	2	3	3	3
Average	**2**	**3**	**2.5**	**3**

Unit – I

Biological foundations to intelligent systems: Artificial neural networks, Back-Propagation networks, Radial basis function networks, and recurrent networks.

Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

Unit – II
Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill-climbing search. Optimization and search such as stochastic annealing and genetic algorithm.
Unit – III
Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.
Unit – IV
Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning. Recent trends in Fuzzy logic, Knowledge Representation
Text Books: 1. Luger G.F. and Stubblefield W.A., Artificial Intelligence: Structures and strategies for Complex Problem Solving. Addison Wesley.
Reference Books: 1. Russell S. and Norvig P., Artificial Intelligence: A Modern Approach. Prentice-Hall.

MT-CSE-20-14 (ii) : Distributed Systems	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To introduce the fundamental concepts and issues of managing large volume of shared data in a distributed environment.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-14 (ii).1	learn fundamental concept and architecture of distributed databases;
MT-CSE-20-14 (ii).2	learndifferent strategies of distributed database design and integration strategies;
MT-CSE-20-14 (ii).3	implement distributed query processing and optimization in distributed environment;
MT-CSE-20-14 (ii).4	understand concurrency control schemes and database reliability.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-14 (ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-14 (ii).1	3	3	3	3	2	2	3	2	2	2	1
MT-CSE-20-14 (ii).2	3	2	3	1	3	1	2	3	3	1	3
MT-CSE-20-14 (ii).3	3	3	1	3	1	2	2	2	2	3	1
MT-CSE-20-14 (ii).4	3	3	3	2	3	3	1	2	3	2	3
Average	**3**	**2.75**	**2.5**	**2.25**	**2.25**	**2**	**2**	**2.25**	**2.5**	**2**	**2**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-14 (ii)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-14 (ii).1	3	3	3	3
MT-CSE-20-14 (ii).2	2	2	1	2
MT-CSE-20-14 (ii).3	3	2	2	1
MT-CSE-20-14 (ii).4	3	3	1	2
Average	**2.75**	**2.5**	**1.75**	**2**

UNIT – I

Introduction to Distributed Data Processing and Distributed Database System; Features of Distributed Databases, An Example of Distributed DBMS, Types of DDBS, Promises and Complications in a Distributed DBMS; Functions and Objectives of Distributed DBMS, Distributed DBMS Architecture: Client/Server System, Peer-to-Peer Distributed System, Multi Database System (MDBS).

UNIT – II

Distributed Database Design: Top-down Design Process, Designing Process and Issues, Data Fragmentation:

Benefits, Correctness Rules and Types of Fragmentation, Allocation: Measures of Cost and Benefits for Fragment Allocation, Database Integration: Schema Matching, Schema Integration, Schema Mapping. Data and Access Control: View Management, Data Security, Semantic Integrity Control.

UNIT – III

Distributed Query Processing: Concept and Objectives of Query Processing; Phases/ Layers of Query Processing: Query Decomposition, Query Fragmentation; Global Query Optimization; Local Query Optimization, Join Strategies in Fragmented Relations, Global Query Optimization Algorithms. Distributed Database Security and Catalog Management.

UNIT –IV

Concurrency Control In Centralized Database Systems; Concurrency Control InDDBMS; Distributed Concurrency Control Algorithms; Deadlock Management,Reliability Issues In DDBMS; Types of Failures; Reliability Techniques; CommitProtocols; Recovery Protocols.

Text Books:

1. M.T. Ozsu and P. Valduriez , Principles of Distributed Database Systems, Prentice-Hall.
2. D. Bell and J. Grimson, Distributed Database Systems, Addison-Wesley.
3. Chhanda Ray, Distributed Database Systems, Pearson.

Reference Books:

1. Stefano Ceri, Giuseppe Pelagatti, Distributed Databases Principles and Systems, McGraw Hill Education.
2. SunitaMahajan, Seema Shah, Distributed Computing, Oxford Higher Education.

MT-CSE-20-14(iii): Computer Vision and Augmented Reality	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an overview of theory and practicable methods in Computer Vision and Augmented Reality, with applications. The aspiration is to develop ability to create image-based models related to real-world applications and blend real world imagery with computational visionary techniques.

Course Outcomes: At the end of this course, the student will be able to:	
MT-CSE-20-14(iii).1	understand and use basic concepts in computer vision related to geometric image formation, image processing, and feature detection and matching;
MT-CSE-20-14(iii).2	gain exposure and perform image segmentation for changing the representation of images, feature based alignment for estimating the motion between two or more sets of points, and motion understanding and recognition of images;
MT-CSE-20-14(iii).3	get familiar with the concepts of Augmented Reality along with its related hardware and software and will learn how to create visual and audio content;
MT-CSE-20-14(iii).4	acquire skills necessary to actualize applications correlated to Augmented Reality.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-14(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-14(iii).1	3	2	3	2	1	2	2	2	3	-	2
MT-CSE-20-14(iii).2	3	2	3	2	1	3	2	2	3	-	3
MT-CSE-20-14(iii).3	3	2	3	1	1	2	2	2	3	-	2
MT-CSE-20-14(iii).4	3	3	3	3	1	3	3	2	3	-	3
Average	**3**	**2.25**	**3**	**2**	**1**	**2.5**	**2.25**	**2**	**3**	**-**	**2.5**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-14(iii)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-14(iii).1	3	3	1	3
MT-CSE-20-14(iii).2	3	3	1	3
MT-CSE-20-14(iii).3	3	2	1	3
MT-CSE-20-14(iii).4	3	3	1	3
Average	**3**	**2.75**	**1**	**3**

Unit – I

Computer Vision: Introduction; Research and Applications; Representation of a Three-Dimensional Moving Scene.

Image Formation: Geometric Primitives and Transformations, Image Model; Lighting, Reflectance & Shading; Imaging Devices for Computer Vision.

Image Processing: Recovering Intrinsic Structure, Range Information from Geometry, Surface Orientation from Reflectance Models, Filtering the Image; Fourier Transforms; Image Pyramids & Wavelets.
Feature Detection and Matching: Point features & patches; Edge Detection & Linking; Hough Transforms; Applications.

Unit – II

Segmentation: Active Contours & Application; Split & Merge; Mean Shift & Mode Finding; Normalized Cuts; Graph Cuts & Energy Based methods with application.
Feature Based Alignment: 2-D & 3-D Feature Based Alignment; Pose estimation and Application to Augmented Reality; Calibration and its Application.
Structure from Motion: Motion Understanding , Understanding Optical Flow and Image Sequences; Triangulation; Two-Frame structure from motion and application; Factorization; Bundle adjustment and its applications; Dense Motion Estimation; Image Stitching.
Recognition: Object Detection; face Recognition; Instance Recognition; Category Recognition.

Unit – III

Augmented Reality: Overview, AR Components and Working; Augmented Reality Related Concepts: Computer Graphics, Dimensionality, Depth Cues, Registration & Latency; Ingredients of an Augmented Reality Experience; Tracking for Augmented Reality; Coordinate Systems; AR Hardware & Software; Displays; Display Techniques.
Augmented Reality Content: Creating Visual & Audio Content.

Unit – IV

Interaction in Augmented Reality: introduction & Categories; Interaction in Projected Augmented Reality Environments.
Mobile Augmented Reality: Architectures; Advantages & Disadvantages.
Visualization Issues; Augmented Reality Technologies, Computer Vision in Augmented Reality; AR Interfaces.
Augmented Reality Applications: Issues for a good Augmented Reality Application; Application Areas; Collaborative Augmented Reality; Steps for applying Augmented Reality; Evaluating Augmented Reality Applications; Example Augmented Reality Applications.

Text Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer
2. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall
3. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann

Reference Books:

1. D. Forsyth and J. Ponce, Computer Vision - A modern approach, Prentice Hall
2. E. Trucco and A. Verri, Introductory Techniques for 3D Computer Vision, Prentice Hall.
3. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press
4. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press
5. BoguslawCyganek, J.Paul Siebert, An Introduction to 3D Computer Vision Techniques and Algorithms, Wiley
6. Dieter Schmalstieg and Tobias Höllerer, Augmented Reality: Principles & Practice, Pearson Education.

MT-CSE-20-14 (iv) : Advanced Computer Architecture	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To learn architecture and organization of high performance computers, principles of pipeline processing, instruction level, data level, thread level & request level parallelism and advanced techniques of cache and virtual memory optimization, MIMD architectures and quantitative analysis of interconnection networks.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-14 (iv).1	understand the various techniques to enhance a processors ability to exploit Instruction-level level parallelisms;
MT-CSE-20-14 (iv).2	understand various architectures for data level parallelism and find differences among them;
MT-CSE-20-14 (iv).3	exploit request level parallelism and learn advanced techniques to improve cache and virtual memory performance;
MT-CSE-20-14 (iv).4	understand various MIMD architectures and evaluate performances of interconnection network used in them.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-14 (iv)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-14 (iv).1	3	1	3	3	3	1	1	2	3	1	1
MT-CSE-20-14 (iv).2	3	2	3	3	3	1	1	2	3	1	1
MT-CSE-20-14 (iv).3	3	2	3	3	3	2	1	2	3	1	2
MT-CSE-20-14 (iv).4	3	3	3	3	3	2	1	2	3	1	2
Average	**3**	**2**	**3**	**3**	**3**	**1.5**	**1**	**2**	**3**	**1**	**1.5**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-14 (iv)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-14 (iv).1	3	2	1	3
MT-CSE-20-14 (iv).2	3	2	1	3
MT-CSE-20-14 (iv).3	3	3	2	3
MT-CSE-20-14 (iv).4	3	3	2	3
Average	**3**	**2.5**	**1.5**	**3**

Unit – I

Instruction Level Parallelism (ILP): Data dependences and hazards – data dependences, control dependences; Basic Compiler Techniques for Exposing ILP – basic pipeline scheduling and loop unrolling, reducing branch costs with advanced branch prediction, overcoming data hazardous with dynamic scheduling, Tomasulo's approach, hardware based speculation; Exploiting ILP using Multiple issue and Static Scheduling – VLIW & Superscalar processors, Advanced techniques for Instruction Delivery and Speculation; Limitations of ILP.

Unit – II

Data Level Parallelism in Vector, SIMD & GPU Architectures: Vector Architecture – working of vector processors, vector execution time, multiple lanes, vector registers, memory banks, stride, gather-scatter; SIMD Instruction Set Extensions for Multimedia; Graphics Processing Units, Vector architecture vs. GPUs, Multimedia SIMD v/s GPUs; detecting and enhancing Loop-Level Parallelism – finding dependences, eliminating dependent computations

Thread-Level Parallel Parallelism: Multiprocessor Architecture – centralized shared-memory architectures, cache coherence problem, schemes enforcing coherence, snooping coherence protocol; Extensions to basic coherence protocol; Distributed Shared-Memory and Directory-Based Coherence.

Unit – III

Warehouse-Scale Computers (WSC) to Exploit Request-Level and Data-Level Parallelism: Programming models and workloads for WSC, architecture of warehouse-scale computers, physical infrastructure and costs of WSC; Cloud Computing.

Memory Hierarchy: Cache performance – average memory access time & processor performance, miss penalty and out-of-order execution processors, cache optimizations; Virtual Memory – fast address translation, selecting page size, protection of virtual memory.

Unit – IV

MIMD Architectures: Architectural concepts of Distributed & Shared Memory MIMD architectures (UMA, NUMA, COMA, CC-NUMA); Interconnection Networks – direct interconnection networks (Linear Array, Ring, Star, 2D Mesh, Hyper cubes), switching techniques; dynamic interconnection networks (shared bus, crossbar, multistage networks); Specifications of top three super computers of Top500 list.

Text Books:

1. J.D. Hennessy, D.A. Patterson, Computer Architecture A Quantitative Approach, Elsevier India.
2. Sima D., Fountain T., Kasuk P., Advanced Computer Architecture-A Design space Approach, Pearson Education.

Reference Books:

1. Hesham El-Rewini, MostafaAbd-El-Barr, Advanced Computer Architecture and Parallel Processing, Wiley India Pvt. Ltd.
2. Kai Hwang, Advanced computer architecture – Parallelism, Scalability, Programmability, Tata McGraw Hill.
3. Rajaraman V. & Murthy C.S.R., Parallel Computer: Architecture & Programming, PHI Learning.
4. David Culler, Parallel Computer Architecture, Elsevier India.
5. Stallings W., Computer Organization and Architecture, Pearson Education.

MT-CSE-20-15 : Research Methodology and IPR	
Type: Compulsory **Course Credits:** 03 **Contact Hours:** 3 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To understand that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular. To understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-15.1	understand what is research;
MT-CSE-20-15.2	understand how to formulate a research problem;
MT-CSE-20-15.3	analyze the need of IPR;
MT-CSE-20-15.4	learn about patent and new developments in the field of IPR.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-15

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-15.1	3	3	3	3	3	3	2	3	3	3	2
MT-CSE-20-15.2	3	3	3	3	3	3	2	3	3	3	2
MT-CSE-20-15.3	3	3	2	2	2	2	3	3	3	3	2
MT-CSE-20-15.4	3	3	2	2	2	2	3	3	3	3	2
Average	**3**	**3**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**3**	**3**	**3**	**2**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-15

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-15.1	3	2	3	2
MT-CSE-20-15.2	3	2	3	2
MT-CSE-20-15.3	3	2	3	2
MT-CSE-20-15.4	3	2	3	2
Average	**3**	**2**	**3**	**2**

Unit – I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.
Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

Unit – II

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

Unit – III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit – IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Computer Software.

Text Books:

1. Stuart Melville and Wayne Goddard, Research methodology: An introduction for science & engineering students, Juta& Co Ltd Publishers
2. Wayne Goddard and Stuart Melville, Research Methodology: An Introduction, Juta& Co Ltd Publishers
3. Ranjit Kumar, Research Methodology: A Step by Step Guide for beginners, SAGE Publishers
4. Halbert, Resisting Intellectual Property, Taylor & Francis Ltd.

Reference Books:

1. Niebel , Product Design, McGraw Hill.
2. Asimov, Introduction to Design, Prentice Hall.
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, Intellectual Property in New Technological Age.
4. T. Ramappa, Intellectual Property Rights Under WTO, S. Chand.
5. Mayall , Industrial Design, McGraw Hill.

MT-CSE-20-21: Advances in Algorithms	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to introduce the students to recent developments in the area of algorithmic design so that students are able to choose appropriate algorithms and use it for a specific problem.

Course Outcomes (COs)	After the course the students are expected to be able to
MT-CSE-20-21.1	familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems;
MT-CSE-20-21.2	analyse the complexity/performance of different algorithms such as graphs;
MT-CSE-20-21.3	learn and apply the various mathematical algorithms useful in various applications in computer science;
MT-CSE-20-21.4	classify and solving the computational problems.

CO-PO Mapping Matrix for the Course Code : MT-CSE-20-21

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-21.1	3	3	1	3	1	3	2	1	3	1	2
MT-CSE-20-21.2	3	2	1	3	1	3	2	1	3	1	2
MT-CSE-20-21.3	3	2	1	3	1	3	2	1	3	1	2
MT-CSE-20-21.4	3	3	1	3	2	3	2	1	3	1	2
Average	**3**	**2.5**	**1**	**3**	**1.25**	**3**	**2**	**1**	**3**	**1**	**2**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-21

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-21.1	3	3	2	3
MT-CSE-20-21.2	3	2	1	3
MT-CSE-20-21.3	3	2	1	3
MT-CSE-20-21.4	3	3	2	3
Average	**3**	**2.5**	**1.5**	**3**

Unit – I

Sorting: Review of various sorting algorithms, topological sorting

Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Unit – II
Flow-Networks: Maxflow-Mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.
Unit – III
Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.
Unit – IV
Linear Programming: Geometry of the feasibility region and Simplex algorithm. NP-completeness: Examples, proof of NP-hardness and NP-completeness. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.
Text Books: **1.** Cormen, Leiserson, Rivest, Stein, Introduction to Algorithms, MIT Press.
Reference Books: 1. Aho, Hopcroft, Ullman, The Design and Analysis of Computer Algorithms, Pearson Education. 2.Kleinberg and Tardos, Algorithm Design, Pearson Education.

MT-CSE-20-22: Soft Computing

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Introduce fundamental soft computing concepts with an exposure to non-traditional techniques for problem solving and optimization. Provide Soft Computing based research oriented direction for solving imprecisely defined problems. Provide a comprehensive introduction to nature-inspired metaheuristic methods for search and optimization, including the latest trends in evolutionary algorithms and other forms of natural computing.

Course Outcomes: At the end of this course, the student will be able to:

MT-CSE-20-22.1	have a knowledge of soft computing techniques along with their applications and non-traditional metaheuristic optimization and data clustering techniques & algorithms for obtaining optimized solutions to optimization, computational intelligence, and design/scheduling applications;
MT-CSE-20-22.2	apply fuzzy logic theory to imprecisely defined problems;
MT-CSE-20-22.3	use Neural Networks concepts to find solutions to problems where normally algorithmic methods do not exist or are costly;
MT-CSE-20-22.4	design high-quality solutions using Genetic Algorithms for optimization and search problems and have exposure to MATLAB environment for implementing solutions to problems using soft computing techniques.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-22

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-22.1:	3	3	3	3	2	3	3	2	3	-	3
MT-CSE-20-22.2:	3	3	3	3	2	3	3	2	3	-	3
MT-CSE-20-22.3:	3	3	3	3	2	3	3	2	3	-	3
MT-CSE-20-22.4:	3	3	3	3	2	3	3	2	3	-	3
Average	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**-**	**3**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-22

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-22.1:	3	3	1	3
MT-CSE-20-22.2:	3	3	1	3
MT-CSE-20-22.3:	3	3	1	3
MT-CSE-20-22.4:	3	2	1	3
Average	**3**	**2.75**	**1**	**3**

Unit – I

Soft Computing: Conventional AI to Computational Intelligence; Soft Computing Constituents and Applications.
Introduction toNon-traditional Metaheuristic Optimization Techniques: Random Optimization, Simulated Annealing, Tabu Search, Ant Colony Optimization, Particle Swarm Optimization, Harmony Search, Memetic Algorithms, Other Evolutionary Algorithms such as Firefly Algorithm, Bee Algorithm, Shuffled Frog Leap

algorithm, Bat algorithm etc.
Data Clustering Algorithms: K-Means, Fuzzy C-Means, Mountain Clustering, Subtractive Clustering.

Unit – II

Fuzzy Set theory: Fuzzy Sets & Classical Sets; Operations on Fuzzy Sets, Fuzzy Relations, Linguistic Variables.
Membership Functions: Introduction, Features, &Fuzzification, Methods of Membership Value Assignment; Defuzzification.
Fuzzy Systems: Crisp Logic, Predicate Logic, Fuzzy Logic; Fuzzy Rule Base and Approximate Reasoning, Fuzzy Quantifiers; Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy Logic Control System; Fuzzy Expert Systems.

Unit – III

Neural Networks: Fundamental Concepts, Basic Models and Architecture; Machine Learning Using Neural Networks; Associative Memory Networks and their Applications.
Supervised Learning Neural Networks: Perceptron Networks, Radial Basis Function Networks: Back Propagation Neural Network: Architecture, Learning, Applications, & Research Directions; The Boltzman Machine.
Unsupervised Learning Networks: Competitive Learning networks; Kohonen Self-Organizing Networks; Hebbian learning; The Hopfield Network; Counterpropagation Networks; Adaptive Resonance Theory: Introduction, Architecture, & Applications; Feed forward Networks; Reinforcement Learning.

Unit – IV

Genetic Algorithms: Introduction to Genetic Algorithms (GA) and their Terminology; Traditional Optimization and Search Techniques vs. Genetic Algorithm ; Operators in Genetic Algorithms; Problem Solving using Genetic Algorithm; Classification of Genetic Algorithms; Holland's Classifier Systems; Genetic Programming; Advantages and Limitations of Genetic Algorithm; Applications of Genetic Algorithm; Applications of GA in Machine Learning.
Introduction to Hybrid Systems; MATLAB Environment for Soft Computing Techniques.

Text Books:

1. S. N. Sivanandam& S. N. Deepa, Principles of Soft Computing, Wiley - India.
2. JyhShing Roger Jang, ChuenTsai Sun, EijiMizutani, NeuroFuzzy and Soft Computing, Prentice Hall

Reference Books:

1. S.Rajasekaran and G.A.VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, Prentice-Hall of India Pvt. Ltd.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall.
3. George J. Klir, Ute St. Clair, Bo Yuan, Fuzzy Set Theory: Foundations and Applications, Prentice Hall.
4. Simon O. Haykin, Neural networks: a comprehensive foundation, Pearson Education.
5. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall
6. Goldberg D. E., Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education.
7. Ahmad Lotfi, Jonathan Garibaldi, Applications and Science in Soft Computing, Springer.
8. Rajkumar Roy, Mario Koppen Soft Computing and Industry: Recent Applications, Springer.
9. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India.
10. Du, Ke-Lin, Swamy, M. N. S., Search and Optimization by Metaheuristics: Techniques and Algorithms, Springer

11. OmidBozorg-Haddad, Mohammad Solgi, Hugo A. Loaiciga, Meta-heuristic and Evolutionary Algorithms for Engineering Optimization, Wiley

MT-CSE-20-23 (i) : Data Preparation and Analysis	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives:
Students will learn how to prepare data for analysis, perform exploratory data analysis, and develop meaningful Data Visualizations. Students will learn to perform analysis using R programming language.

Course Outcomes (COs)	After the course the students are expected to be able to
MT-CSE-20-23 (i).1	understand the stages and strategies for data preparation;
MT-CSE-20-23 (i).2	learn data pre-processing methods to remove data anomalies;
MT-CSE-20-23 (i).3	perform exploratory analysis of processed data;
MT-CSE-20-23 (i).4	implement R Language and be self-competent to acquire job as business analytics.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-23 (i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-23 (i).1	3	3	3	3	2	2	3	2	2	2	1
MT-CSE-20-23 (i).2	3	2	3	2	3	3	2	3	3	3	1
MT-CSE-20-23 (i).3	3	2	2	3	1	2	3	3	2	3	1
MT-CSE-20-23 (i).4	3	3	3	2	3	1	1	2	3	2	3
Average	**3**	**2.5**	**2.75**	**2.5**	**2.25**	**2**	**2.25**	**2.5**	**2.5**	**2.5**	**1.5**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-23 (i)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-23 (i).1	3	3	1	3
MT-CSE-20-23 (i).2	3	2	2	2
MT-CSE-20-23 (i).3	3	1	2	3
MT-CSE-20-23 (i).4	2	3	1	2
Average	**2.75**	**2.25**	**1.5**	**2.5**

Unit- I

Data Exploration as a Process, Data Mining, Motivation behind data mining, Data Preparation: Inputs, Outputs, Data Anomalies: Missing Value, Noise, Inconsistency, Incomplete, Modelling Tools and data preparation, Stages of Data Preparation, Data Discovery, Data Characterization, Data Set Assembly.

Unit- II

Data Cleaning: Knowledge Discovery Process, Consistency Checking, Heterogeneous and Missing Data, Missing Values Replacement Policies, Types of Missing Data, Techniques of Dealing with Missing Data,

Data Transformation, Data Transformation Process , Types of Data Transformation, Benefits and Limitations, Data Segmentation.
Unit- III Exploratory Analysis: Descriptive and Comparative Statistics, Clustering and Association, Visualization:Designing Visualizations, Time Series, Geolocated Data, Correlations and Connections, Hierarchies and Networks, Interactivity.
Unit- IV R: Advantages of R over other Programming Languages, Working with Directories and Data Types in R, Control Statements, Loops, Data Manipulation and integration in R, Exploring Data in R: Data Frames, R Functions for Data in Data Frame, Loading Data Frames, Decision Tree packages in R, Issues in Decision Tree Learning, Hierarchical and K-means Clustering functions in R, Mining Algorithm interfaces in R.
Text Books: 1. Glenn J. Myatt., Wayne P. Johnson Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, Wiley. 2. Dorian Pyle, Data Preparation for Data Mining, Morgan Kaufmann Publishers, Inc. 3. S. Acharya, Data Analytics Using R, McGraw Hill Education (India) Private Limited.
References Books: 1. Hector Cuesta, Practical Data Analysis, PACKT Publishing (Open Source). 2. Edwin Moses, R Data Analysis and Visualization, PACKT Publishing (Open Source)

MT-CSE-20-23 (ii): Optimization Techniques	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various linear programming problems and their solution techniques. It focuses on various optimization techniques and their applications in problem solving.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-23(ii).1	understand the role and principles of optimization techniques in business world using LPP;
MT-CSE-20-23(ii).2	understand the techniques to solve and use IPP and Analyse the optimization techniques in strategic planning;
MT-CSE-20-23(ii).3	analyse the optimization techniques for optimal gain;
MT-CSE-20-23(ii).4	understand the techniques to solve networking and queuing problems;

CO-PO Mapping Matrix for the Course Code : MT-CSE-20-23(ii)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
MT-CSE-20-23(ii).1	3	3	2	3	1	3	1	2	2	1	1
MT-CSE-20-23(ii).2	3	3	2	3	2	3	1	2	2	1	3
MT-CSE-20-23(ii).3	3	3	2	3	2	3	1	2	2	1	3
MT-CSE-20-23(ii).4	3	3	2	3	3	3	2	2	2	1	3
Average	**3**	**3**	**2**	**3**	**2**	**3**	**1.25**	**2**	**2**	**1**	**2.5**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-23(ii)

COs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
MT-CSE-20-23(ii).1	3	2	1	2
MT-CSE-20-23(ii).2	3	2	1	2
MT-CSE-20-23(ii).3	3	2	1	2
MT-CSE-20-23(ii).4	3	3	1	2
Average	**3**	**2.25**	**1**	**2**

Unit – I

Introduction: The Historical development, Nature, Meaning and Management Application of Operations research. Modelling, Its Principal and Approximation of O.R. Models, Main characteristic and phases, General Methods of solving models, Scientific Methods, Scope, Role on Decision Making and Development of Operation Research in India.

Linear Programming: Two-phase Simplex method, Degeneracy. Duality in LPP: Definition of Dual Problem, General Rules for converting any Primal into its Dual, Dual Simplex method and its flow chart.
Unit – II Integer Programming: Importance, Applications and Classification, Gomory's all integer programming problem technique and its flow chart, Branch and Bound Method. Transportation Models: Formulation of problem, Obtaining Initial Basic feasible solution, Optimality tests, Progressing towards optimal solution, Unbalanced Transportation Problems.
Unit – III Assignment Models: Formulation of problem, Hungarian Method for Assignment Problems, Unbalanced Assignment Problems. Inventory theory: Costs involved in inventory problems - single item deterministic models-economic lot size models without shortages and with shortages having production rate infinite and finite.
Unit – IV PERT and CPM: Basic steps in PERT/CPM, Techniques, Network Diagram Representation, Forward and Backward Pass-computation, Representation in Tabular form, Determination of Critical path, Critical activity, Floats and Slack Times, Implementation in any programming language. Queuing Theory: Introduction; Basic Definitions and Notations; Arrival& Departure in Poisson Queue. Pure Birth and Death Models; Poisson Queue Models: M/M/1: ∞ /FIFO and M/M/1: N/ FIFO.
Text Books: 1. Sharma, S.D., Operations Research, KedarNath and Ram Nath, Meerut. 2. Gupta P.K., Hira and D.S., Operation Research, Sultan Chand & Sons, New Delhi.
Reference Books: 1. KantiSwarup, Gupta P.K. & Man Mohan, Operation Research, Sultan Chand & sons, New Delhi. 2. Rao S.S., Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi. 3. Taha, H.A., Operation Research – An Introduction, McMillan Publishing Co, New York. 4.Gillet, B.E., "Introduction to Operations Research: A Computer Oriented Algorithmic Approach". Tata McGraw Hill, New York.

MT-CSE-20-23(iii): Advanced Wireless and Mobile Networks

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide a comprehensive knowledge of the key concepts of wireless and mobile networks, standards, technologies and their basic operations

Course Outcomes: At the end of this course, the student will be able to:

MT-CSE-20-23(iii).1	have fundamental knowledge of wireless and mobile communication technologies and their applications along with an exposure to the architectural issues related with the contemporary wireless LAN and PAN technologies;
MT-CSE-20-23(iii).2	get acquainted with the contemporary wireless WAN and MAN technologies along with their architectural and mobility issues;
MT-CSE-20-23(iii).3	get an insight into the research perspective related to Adhoc wireless networks and their routing and media access control mechanisms;
MT-CSE-20-23(iii).4	gain intuitive knowledge of Multicast Routing, energy management and Transport Layer issues of Ad Hoc networks along with the security issues related to Wireless and Mobile Networks that may form a basis for innovative advancements towards research and development.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-23(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-23(iii).1	3	2	3	2	1	1	2	2	3	-	2
MT-CSE-20-23(iii).2	3	2	3	3	1	1	3	2	3	-	3
MT-CSE-20-23(iii).3	3	3	3	3	1	3	3	2	3	-	3
MT-CSE-20-23(iii).4	3	3	3	3	1	3	3	2	3	-	3
Average	**3**	**2.5**	**3**	**2.75**	**1**	**2**	**2.75**	**2**	**3**	**-**	**2.75**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-23(iii)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-23(iii).1	3	2	1	3
MT-CSE-20-23(iii).2	3	2	1	3
MT-CSE-20-23(iii).3	3	2	1	3
MT-CSE-20-23(iii).4	3	2	1	3
Average	**3**	**2**	**1**	**3**

Unit – I

Fundamentals of Wireless Communication Technology: Overview and Applications/types of Wireless and Mobile Networks;Evolution and Challenges of Wireless Networks ; The Electromagnetic Spectrum; Spread Spectrum; Frequency Reuse; Radio Propagation Mechanisms, Signals, Antennas; Characteristics of Wireless

Channels; Modulation Techniques and Multiple Access Techniques for Wireless Systems.

Wireless LANs & PANs: Use and Design Goals for WLANs; IEEE802.11 standard: Architecture, Infrastructure vs. Ad-hoc Modes,Physical & MAC layer, CSMA/CA mechanism; HIPERLAN 1/2 standards; Technical features of HOMERF; BLUETOOTH specifications and architecture; Introduction to other PAN technologies and their applications.

Unit – II

Wireless WANs & MANs: The Cellular Concept; Call Set-up; Frequency Reuse Channel Allocation Algorithms; Handoffs;Mobility Management.

Telecommunication Systems: GSM and IS-95 architecture, channels and Call Establishment; Wireless Data Service; Generations in Wireless Cellular Networks and their features; DECT, TETRA, UMTS; Satellite Systems.

WiMAX : Physical layer, Media Access Control, Mobility and Networking, Overview of IEEE 802.22 Wireless Regional Area Networks.

Wireless Internet: Address Mobility; Mobile IP; IP and TCP for Wireless Domains; WAP.

Unit – III

AdHoc Wireless Networks: Introduction; Applications & Design Issues.

MAC Protocols for Ad Hoc Wireless Networks: Issues, design Goals and Classification; Contention Based Protocols; Contention Based MAC Protocols with Reservation and Scheduling Mechanism; Other MAC Protocols.

Routing Protocols for Ad Hoc Networks: Introduction, Issues; Classification; Table-Driven Routing Protocols; On-Demand Routing Protocols; Hybrid Routing Protocols; Routing Protocols with Efficient Flooding Mechanisms; Hierarchical Routing Protocols.

Unit – IV

Multicast Routing in Ad Hoc Networks: Introduction; Issues; Operation of Multicast Routing Protocols; Classification; Tree-Based Multicast Routing Protocols; Mesh-Based Multicast Routing Protocols; Energy Efficient Multicasting.

Energy Management in Ad Hoc Wireless Networks: Need and classification of energy management schemes.

Transport Layer for Ad Hoc Wireless Networks: Introduction and Design Issues; TCP over Ad Hoc Wireless Networks.

Security Requirements in wireless networks: Issues and challenges; Network Security Attacks; Key Management; Secure Routing in Ad Hoc Wireless Networks; WEP protocol.

Text Books:

1. C.Siva Ram Murthy and B.S.Manoj, Ad Hoc Wireless Networks- Architecture and Protocols, Pearson Education
2. Schiller J., Mobile Communications, Addison Wesley.

Reference Books:

1. Stallings W., Wireless Communications and Networks, Pearson Education
2. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc
3. Yi Bing Lin and ImrichChlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc
4. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI
5. SipraDasBit, Biplab K. Sikdar, Mobile Computing, PHI.
6. William C.Y.Lee, “Mobile Cellular Telecommunications”, McGraw-Hill.
7. Theodore S. Rapparort, Wireless Communications- Principles and Practice, Pearson Education.
8. HazysztofWesolowshi, Mobile Communication Systems, Wiley India.

MT-CSE-20-23(iv): Networking and Administration in Linux / Unix

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question, there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objectives of this course are to provide the in-depth coverage of various concepts of Linux. Linux administration and communication is an essential course for the students.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-23(iv).1	understand the basic concepts, commands and file management in Linux / Unix;
MT-CSE-20-23(iv).2	understand the manipulation of processes and system calls in Linux / Unix;
MT-CSE-20-23(iv).3	learn the interprocess communication, system administration and networking concepts in Linux / Unix;
MT-CSE-20-23(iv).4	developshell programs in Linux / Unix.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-23(iv)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-23(iv).1	3	2	3	3	3	2	1	1	3	1	2
MT-CSE-20-23(iv).2	3	2	3	3	3	2	2	1	3	1	2
MT-CSE-20-23(iv).3	3	2	3	3	3	2	2	1	3	1	2
MT-CSE-20-23(iv).4	3	2	3	3	3	3	2	1	3	1	2
Average	**3**	**2**	**3**	**3**	**3**	**2.25**	**1.75**	**1**	**3**	**1**	**2**

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-23(iv).1	3	3	2	3
MT-CSE-20-23(iv).2	3	3	2	3
MT-CSE-20-23(iv).3	3	3	2	3
MT-CSE-20-23(iv).4	3	3	2	3
Average	**3**	**3**	**2**	**3**

UNIT – I

Introduction: Basic features & architecture.
File System: Files, Organization, Assessing File systems, Structure - boot block, super block, inode block, and data block.
Commands: Basic and Advancedcommands, File access permissions: chmod, umask, chgrp, groups.
File management and Compression: Computer devices, Disk related commands: dd, du, df, dfspace, fdisk, compressing and uncompressing files.

UNIT – II

Manipulating Processes and Signals: Basics, process states and transitions, zombie and orphan processes, process oriented commands. Handling foreground and background jobs. Process scheduling using cron, crontab, at, batch. Changing priority. Signal generation and Handling.

System calls: Files related system calls for opening, creating, reading, writing, relocating file descriptors, closing, duplicating file descriptors, linking, unlinking, accessing file status information, checking permissions, changing ownership, groups and permissions of files. Process related system calls: exec, fork, wait, exit.

UNIT – III

Interprocess Communication: Pipes,messages, sockets, shared memory.

System Administration: Booting and shutting down process. Acquiring super user status, Creating, mounting and unmounting file systems. Managing User accounts**:** creating, modifying & deleting user accounts and groups. Maintaining security, password administration, rc scripts used by init, terminal management.

Networking Tools: Communication oriented commands. ping, nslookup, telnet, arp, netstat, route, ftp, trivial file transfer protocol, finger, rlogin.

UNIT – IV

Filters: Connecting processes with pipes, redirecting input and output. Filters: sort, grep, egrep, fgrep, uniq, more, pr, cut, paste, tr.

Shell Programming: Shell meaning & types; Introduction to shell scripting, shell variables, exporting shell variables, Escape mechanisms, Shell meta characters, read command, conditional statements, looping and case statements, expr statement, command line arguments, sleep and basename commands, Bourne Shell Commands, string handling, arrays, shell functions, shell programs to automate system tasks.

Text Books:

1. Harwani B.M., Unix and Shell Programming, Oxford University Press.
2. Das Sumitabha, Your Unix – The Ultimate Guide, Tata Mcgraw Hill.

Reference Books:

1. Matthew Neil, Stones Richjard, Beginning Linux Programming, Wiley India Pvt. Ltd.
2. Christopher Negus, Linux Bible, Wiley India Pvt. Ltd.
3. Goerzen John, Linux Programming Bible, IDG Books, New Delhi.

MT-CSE-20-24 (i):Mobile Application and Services	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various concepts of mobile application development especially android based applications. This course will help the students in learning to develop and publish their own mobile applications.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-24(i).1	know the components and structure of mobile application development frameworks for Android based mobiles
MT-CSE-20-24(i).2	design and implement the user interfaces of mobile applications;
MT-CSE-20-24(i).3	implement fragments and location based services in Android application;
MT-CSE-20-24(i).4	understand the basics of SQLite and develop interactive graphics in mobile applications.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-24(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-24(i).1	3	1	2	3	2	2	1	1	1	1	1
MT-CSE-20-24(i).2	3	1	2	2	2	3	2	2	1	1	1
MT-CSE-20-24(i).3	3	1	2	3	2	3	2	2	1	1	1
MT-CSE-20-24(i).4	3	1	2	3	2	3	2	2	1	1	1
Average	**3**	**1**	**2**	**2.75**	**2**	**2.75**	**1.75**	**1.75**	**1**	**1**	**1**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-24(i)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-24(i).1	3	2	1	3
MT-CSE-20-24(i).2	3	3	1	3
MT-CSE-20-24(i).3	1	3	1	3
MT-CSE-20-24(i).4	3	3	2	3
Average	**2.5**	**2.75**	**1.25**	**3**

Unit – I

Introduction: Mobile Applications, Characteristics and Benefits, Application Models, Mobile devices Profiles. Basics of Android, Importance and scope, Android Versions, Features of Android, Android Architecture, Android Stack, Android Applications Structure, Android Emulator, Android SDK, Overview of Android Studio, Android and File Structure, Android Virtual Device Manager, DDMS, LogCat, Understanding Activities.

Android User Interface: Measurements – Device and pixel density independent measuring units. Layouts – Linear, Relative, Grid and Table Layouts.

Unit – II

User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers, List View, Spinner View.

Event Handling – Handling clicks or changes of various UI components.

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit

Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Services- Callbacks and Override in application, Application Signing, API keys for Google Maps, Publishing application to the Android Market.

Unit – III

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

Location and Mapping: location based services, Mapping, Google Maps activity, Working with MapView and MapActivity; Playing and Recording of Audio and Video in application; Sensors and Near Field Communication; Native libraries and headers, Building client server applications.

Unit – IV

Using Graphics: Canvas Drawing, Shadows, and Gradients.

Persisting Data to files: Saving to Internal Storage, Saving to External Storage

Introduction to SQLite database: creating and opening a database, creating tables,
inserting retrieving and deleting data, Registering Content Providers, Using content Providers
(insert, delete, retrieve and update)

Text Books:

1. ZigurdMednieks, Laird Dornin, G,BlakeMeike and Masumi Nakamura, Programming Android, O'Reilly Publications.
2. Wei-Meng Lee, Beginning Android Application Development, Wiley India Ltd.

Reference Books:

1. James C.S., Android Application development for Java Programmer, CENGAGE Learning.
2. Pradeep Kothari, Android Application Development: Black Book, Wiley India Ltd.
3. Gargenta M., Nakamura M., Learning Android, O'Reilly Publications.

MT-CSE-20-24(ii): Advanced Web Technologies	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the coverage of advanced technologies used in the design and development of web based applications such as Ajax/Node JS/Angular JS etc.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-24(ii).1	apply various jQuerymethods in building UI projects;
MT-CSE-20-24(ii).2	design single-page applications using Angular JS;
MT-CSE-20-24(ii).3	handle the HTTP request by using Node JS.
MT-CSE-20-24(ii).4	Manage and optimize the web applications.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-24(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-24(ii).1	3	1	3	2	3	1	3	2	3	1	1
MT-CSE-20-24(ii).2	3	2	3	2	3	2	3	2	3	1	2
MT-CSE-20-24(ii).3	3	2	3	2	3	2	3	2	3	1	2
MT-CSE-20-24(ii).4	3	3	2	3	3	2	1	2	3	1	2
Average	**3**	**2**	**2.75**	**2.25**	**3**	**1.75**	**2.5**	**2**	**3**	**1**	**1.75**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-24(ii)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-24(ii).1	3	3	1	3
MT-CSE-20-24(ii).2	2	3	1	3
MT-CSE-20-24(ii).3	2	3	1	3
MT-CSE-20-24(ii).4	3	3	3	2
Average	**2.5**	**3**	**1.5**	**2.75**

Unit – I

Advanced Client side programming: Fundamentals of jQuery, Element Selector, Document ready function, Events, jQuery UI, Unobtrusive client validation, working with AJAX and jQuery.
Feature detection: Browser detection, Feature detection, Modernizer.

Unit – II

Introduction to AngularJS: Controllers, Models, Directives and Services, Single Page Applications, Angular User Interfaces: Angular Forms, Using Angular with Angular UI and Angular Bootstrap, Angular Services, Developing Custom Directives, Enhanced End-to End Testing

Unit – III

Introduction to Node JS: Node JS process model, Advantages, Traditional web server model. Setup Install Node.js on windows, REPL, Node JS console, Node JS modules, Events: Event Emitter class, inheriting events, Node Package Manager, Creating web server: handling http requests, sending requests, File System, Debugging Node JS application, Database Connectivity.

Unit – IV

Search engines: Searching techniques used by search engines, keywords, advertisements, Search engine optimization for individual web pages: header entries, tags, selection of URL, alt tags, Search engine optimization for entire website: Hyperlinks and link structure, page rank of Google, click rate, residence time of website, frames, scripts, content management system, cookies, robots, Pitfalls in Optimization: optimization and testing, keyword density, doorway pages, duplicate contents, quick change of topics, broken links, poor readability, rigid layouts, navigation styles.

Text Books:

1. ShyamSeshadri& Brad Green, AngularJS: Up and Running, O'Relly.
2. Peter Smith,Professional Website performance, Wiley India Pvt. Ltd.

Reference Books:

1. Brad Dayley, Node.js, MongoDB, and AngularJS Web Development (Developer's Library), Addison Wesley.
2. Simon Holmes, Getting MEAN with Mongo, Express, Angular, and Node, Manning Publications.
3. HTML5 Black Book by Dreamtech Press
4. Maro Fischer, Website Boosting: Search Engine, Optimization, Usability, Website Marketing, Firewall Media, New Delhi.

MT-CSE-20-24(iii) :Object Oriented Software Engineering	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: In depth knowledge of software life cycle process using object oriented concept. Design and construction of modular, reusable, extensible and portable software using object-oriented concepts. Object oriented testing of software and its maintenance phase. Impact of object oriented programming on the software life cycle.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-24(iii).1	learn use of UML for object–oriented methodologies;
MT-CSE-20-24(iii).2	perform object oriented analysis for developing software systems;
MT-CSE-20-24(iii).3	understand the concept of planning and software estimation with object oriented approach;
MT-CSE-20-24(iii).4	demonstrate the ability to apply the knowledge of object oriented methods for designing software systems.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-24(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-24(iii).1	3	2	3	3	3	2	2	2	3	2	2
MT-CSE-20-24(iii).2	3	2	3	2	3	3	2	3	2	2	2
MT-CSE-20-24(iii).3	3	3	2	3	3	2	2	3	3	2	2
MT-CSE-20-24(iii).4	3	3	2	2	3	3	2	2	2	2	2
Average	**3**	**2.5**	**2.5**	**2.5**	**3**	**2.5**	**2**	**2.5**	**2.5**	**2**	**2**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-24(iii)

COs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
MT-CSE-20-24(iii).1	3	2	3	2
MT-CSE-20-24(iii).2	3	3	3	2
MT-CSE-20-24(iii).3	3	3	3	2
MT-CSE-20-24(iii).4	3	2	3	2
Average	**3**	**2.5**	**3**	**2**

Unit – I

Object Oriented Concepts and Modeling: Object Orientation, Importance of Modeling; Object Oriented Modeling, Object oriented analysis, Identifying the elements of an object model, Introduction to UML, Conceptual Model of UML, Architecture, Object Oriented methodologies, Basic and Advanced Structural Modeling, Classes Relationship, Class diagram, Advanced Relationship, Interface, Packages, Object Diagram, Basic BehavioralModeling, Use cases, Use Case Diagram, Interaction Diagram, Activity Diagram, State chart Diagram.

Unit – II **Analysis:** Software Requirement: Functional and Non-functional Requirements, Known and Unknown Requirements. Characteristics of a Good Requirement, Software Requirements Specification Document: Nature of the SRS Document, Organization of the SRS Documents, Requirements Change Management, Overview of Analysis, Analysis Object Models and Dynamic Models, Entity, Boundary, and Control Objects, Structured Analysis versus Object-Oriented Analysis, Identification of Classes: Entity Classes, Interface Classes, Control Classes, Identification of Relationships: Association, Aggregation, Multiplicity, Composition, Dependency, Generalization, Modeling Relationships.
Unit – III **Planning and Software Estimation;** planning of software process, components of a software project management plan, software project management plan frame work, planning of object oriented projects, Need of Object-Oriented Software Estimation, Use Case Points Method: Classification of Actors and Use Cases, Calculating Environmental Complexity Factors, Calculating Use Case Points, Object-Oriented Function Point: Relationship between Function Points and Object Points, Counting Internal Classes, External Classes and Services, Risk Management: What is Risk, Framework for Managing Risks, Risk Identification, Risk Analysis and Prioritization, Risk Avoidance and Mitigation Strategies, Risk Monitoring Estimating Risk Based on Schedule.
Unit – IV **Object Oriented Design:** Interaction Diagrams, Refinement of Use Case Description, Construction of Detailed Class diagram, Development of Detailed Design and Creation of Software Design Document, Generating Test Cases from Use Cases, Object-Oriented Design Principles for Improving Software Quality, Commonly Used Testing Terminology, and Deriving Test Cases from Use Cases. Frameworks and design patterns.
Text Books: 1. Ivar Jacobson - Object Oriented Software Engineering - Addison Wesley. 2. Grady Booch, James Raumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide.
Reference Books: 1. Stephen R. Schach, Classical and Object Oriented Software Engineering, McGraw Hill 2. Bernd Bruegge, Allen H. Dutoit, Object-Oriented Software Engineering Using UML, Patterns, and Java, Pearson Education.

MT-CSE-20-24 (iv): Big Data and Pattern Recognition	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to help students learn, understand and practice the basic and advanced methods to big data technology and tools required to manage and analyse big data including MapReduce, NoSQL and Hadoop. The course provides an idea about pattern recognition approaches and gives the practical exposure of NoSQL.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-24 (iv).1	understand big data and big data analytics lifecycle;
MT-CSE-20-24 (iv).2	learn HDFS and MapReduce analytics using Hadoop;
MT-CSE-20-24 (iv).3	understand pattern recognition strategies in big data environment;
MT-CSE-20-24 (iv).4	develop solutions of big data environment in NoSQL.

CO-PO Mapping Matrix for the Course Code : MT-CSE-20-24 (iv)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-24 (iv).1	3	3	3	3	2	2	3	2	1	2	2
MT-CSE-20-24 (iv).2	3	2	3	2	3	1	2	3	3	3	1
MT-CSE-20-24 (iv).3	3	3	2	3	2	2	1	2	2	2	1
MT-CSE-20-24 (iv).4	3	3	3	3	3	3	1	2	3	2	1
Average	**3**	**2.75**	**2.75**	**2.75**	**2.5**	**2**	**1.75**	**2.25**	**2.25**	**2.25**	**1.25**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-24 (iv)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-24 (iv).1	3	3	1	1
MT-CSE-20-24 (iv).2	3	2	2	2
MT-CSE-20-24 (iv).3	1	3	1	3
MT-CSE-20-24 (iv).4	2	3	1	2
Average	**2.25**	**2.75**	**1.25**	**2**

UNIT – I

Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data, Identifying Data Characteristics, Business Motivations and Drivers for Big Data Adoption: Business Architecture, Business Process Management, Information and Communication Technology, Big Data Analytics Lifecycle, Enterprise Technologies and Big Data Business Intelligence, Industry examples of big data.

UNIT – II

Big Datasets, Big Data Oversight,Data format, Analyzing Data with Hadoop, Scaling Out, HDFS Concepts, Hadoop I/O, Hadoop Streaming, Design of Hadoop Distributed File System (HDFS), MapReduce Workflows, Unit Tests with MRUnit, Test Data and Local Tests, Anatomy of MapReduce Job Run, Classic Map-Reduce, An Overview of YARN, Zookeeper, HBase, HIVE, Pig, Mahout. Big Data Failure and Legalities.

UNIT – III

Pattern Recognition: Bigotry and Inductive Learning, Bigotry and Inductive Learning, Quantitative and Qualitative Analysis, Pattern Recognition Systems, Fundamental Problems in Pattern Recognition, Feature Extraction and Reduction, Paradigms, Pattern Recognition Approaches, Importance and Applications. Data Domain for Pattern Recognition. Pattern Recognition using Nearest Neighbour Classifier, Classifying using Decision Trees, Obtaining Patterns Rules from Decision Trees.

UNIT – IV

An Introduction to NoSQL, Characteristics of NoSQL, Drawbacks, NoSQL Storage Types, Aggregate Data Models, key-value and document data models, relationships, graph databases, schema less databases, materialized views, Data Management for Big Data: Schema Less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph databases, The CAP Theorem, NoSQL Misconceptions..

Text Books:

1. Thomas Erl, WajidKhattak and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques Prentice Hall.
2. David Loshin, Big Data Analytics from Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Morgan Kaufmann.
3. Jules J. Berman, Principles of Big Data Preparing, Sharing and Analyzing Complex Information, Morgan Kaufmann.
4. GauravVaish, Getting Started with NoSQL, Packt Publishing.
5. RajjanShinghal, Pattern Recognition Techniques and Applications, Oxford Higher Education.

Reference Books:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer.
2. Jay Liebowitz, Big Data and Business Analytics Auerbach Publications, CRC press.
3. Pete Warden, Big Data Glossary, O’Reily.
4. Michael Mineli, Michele Chambers, AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications.

MT-CSE-20-31 (i): Compiler for High Performance Computing	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To introduce structure of compilers and high performance compiler design for students and to discuss concepts of cache coherence and parallel loops in compilers.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-31 (i).1	understand the structure of compiler;
MT-CSE-20-31 (i).2	implement data dependency in compiler;
MT-CSE-20-31 (i).3	learn aboutparallel loopsin compilers;
MT-CSE-20-31 (i).4	analyze and understand exception handling and debugging in compilers.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-31 (i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-31 (i).1	3	3	2	2	1	2	3	2	3	1	2
MT-CSE-20-31 (i).2	3	3	2	2	1	2	3	2	3	1	2
MT-CSE-20-31 (i)3	3	3	2	2	1	2	3	2	3	1	2
MT-CSE-20-31 (i).4	3	3	2	2	1	2	3	2	3	1	2
Average	**3**	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**3**	**1**	**2**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-31 (i)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-31 (i).1	3	2	2	2
MT-CSE-20-31 (i).2	3	2	2	2
MT-CSE-20-31 (i).2	3	2	2	2
MT-CSE-20-31 (i).4	3	2	2	2
Average	**3**	**2**	**2**	**2**

Unit – I

High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance, Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph.

Unit – II

Scalar Analysis with Factored Use-Def Chains: Constructing Factored UseDef Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, and Data Dependence for Scalars. Data Dependence Analysis for Arrays. Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis.

Unit – III

Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations. Optimizing for Locality: Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality.

Unit – IV

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from for all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

Text Books:

1. Michael Wolfe, High-Performance Compilers for Parallel Computing, Pearson Education.

Reference Books:

1. John Levesque, Gene Wagenbreth, High Performance Computing: Programming and Applications, Chapman& Hall/CRC Computational Science.

MT-CSE-20-31 (ii): Cloud Computing and IoT	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To study the fundamental concepts of cloud computing, enabling technologies, cloud service models and security concerns. To learn core issues of Internet of Things, IOT communication protocols and security concerns.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-31 (ii).1	understand core issues of cloud computing and enabling technologies;
MT-CSE-20-31 (ii).2	design services based on cloud computing platforms;
MT-CSE-20-31 (ii).3	understand concepts, architecture, applications and design principles for connected devices in IoT;
MT-CSE-20-31 (ii).4	explain, analyze and design IoT-oriented communication protocols and security concerns.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-31 (ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-31 (ii).1	3	2	3	3	3	2	2	2	3	2	1
MT-CSE-20-31 (ii).2	3	3	3	3	3	2	3	3	3	2	3
MT-CSE-20-31 (ii).3	3	2	3	3	3	2	2	2	3	2	1
MT-CSE-20-31 (ii).4	3	3	3	3	3	2	3	3	3	2	3
Average	**3**	**2.5**	**3**	**3**	**3**	**2**	**2.5**	**2.5**	**3**	**2**	**2**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-31 (ii)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-31 (ii).1	2	2	3	3
MT-CSE-20-31 (ii).2	3	3	3	3
MT-CSE-20-31 (ii).3	2	2	3	3
MT-CSE-20-31 (ii).4	3	3	3	3
Average	**2.5**	**2.5**	**3**	**3**

Unit – I

Cloud Computing: Definition, roots of cloud computing, characteristics, cloud architecture, deployment models, service models.

Virtualization:Benefits & drawbacks of virtualization, server virtualization,virtualization of - operating system, platform, CPU, network, application, memory and I/O devicesetc.

Unit – II

Cloud Computing Service Platforms – Compute services, storage services,database services, applicationservices, queuing services, e-mail services, notification services, media services, content delivery services, analytics services, deployment& management services, identity& access management services and their case studies.

Security in cloud computing: issues, threats, data security and information security

Unit – III

Internet of Thing (IoT): overview, conceptual framework, architecture, major components, common applications

Design principles for connected devices: Modified OSI Model for IoT/M2M systems, ETSI M2M Domains and High-level capabilities, wireless communication technologies - NFC, RFID, Bluetooth BR/EDR and Bluetooth low energy, ZigBee, WiFi, RF transceiver and RF modules. Data enrichment, data consolidation & device management at gateway.

Unit – IV

Design principles for web connectivity: web communication protocols for connected devices: constrained application protocol, CoAP Client web connectivity, client authentication, lightweight M2M communication protocol. Message communication protocols for connected devices - CoAP-SMS, CoAP-MQ, MQTT, XMPP.

IoT privacy, security and vulnerabilities and their solutions.

Text Books:

1. ArshdeepBahga, Vijay Madisetti, Cloud Computing – A Hands-on Approach, University Press.
2. RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing – Principles and Paradigms, Wiley India Pvt. Ltd.
3. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hills

Reference Books:

1. Kai Hwang, Geoffrey C.Fox, and Jack J. Dongarra, Distributed and Cloud Computing, Elsevier India Private Limited
2. Saurabh Kumar, Cloud Computing, Wiley India Pvt. Ltd.
3. Shailendra Singh, Cloud Computing, Oxford
4. Coulouris, Dollimore and Kindber, Distributed System: Concept and Design, Addison Wesley
5. Michael Miller, Cloud Computing, Dorling Kindersley India
6. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud computing: A practical Approach, McGraw Hill
7. DimitriosSerpnos, Marilyn Wolf, Internet of Things (IoT) Systems, Architecture, Algorithms, Methodologies, Springer
8. VijayMadisetti and ArshdeepBahga, Internet of Things (A Hands-on Approach), VPT
9. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications

MT-CSE-20-31 (iii): Information Retrieval System

Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The main objective of this course is to present the scientific support in the field of information search and retrieval.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MT-CSE-20-31 (iii).1	understand the basics of information retrieval along with models used in information retrieval;
MT-CSE-20-31 (iii).2	learn management and types of information retrieval;
MT-CSE-20-31 (iii).3	categorize, filter and indexing the information;
MT-CSE-20-31 (iii).4	Implement the concepts of information retrieval systems to sentiment analysis.

CO-PO Mapping Matrix for Course Code: MT-CSE-20-31 (iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-31 (iii).1	3	3	3	3	3	3	3	3	3	2	2
MT-CSE-20-31 (iii).2	3	3	3	3	3	3	3	3	3	2	2
MT-CSE-20-31 (iii).3	3	3	3	3	3	3	3	3	3	2	2
MT-CSE-20-31 (iii).4	3	3	3	3	3	3	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2.25**

CO-PSO Mapping Matrix for the Course Code : MT-CSE-20-31 (iii)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-31 (iii).1	3	3	3	3
MT-CSE-20-31 (iii).2	3	3	2	3
MT-CSE-20-31 (iii).3	3	3	2	3
MT-CSE-20-31 (iii).4	3	3	3	3
Average	**3**	**3**	**2.5**	**3**

Unit – I

Introduction: Text analysis, Types of text analysis, Information retrieval, IR system architecture: Text processing (Text format, Tokenization, stemming, lemmatization, Language modelling), Indexes and query matching.
Informational Retrieval: Query processing models. Probabilistic models (Binary independence model, Robertson/Spark Jones weighting formula, Two-Poisson model), Relevance feedback (Term selection, Pseudo relevance feedback); language models: Unigram, Bigram language models, Generating queries from documents, Language models and smoothing, Ranking with language models, KullbackLeibler divergence, Divergence from randomness, Passage retrieval and ranking.

Unit – II
Management of Information Retrieval Systems: Knowledge management, Information management, Digital asset management, Network management, Search engine optimization, Records compliance and risk management, Version control, Information system failure. Types of information retrieval systems: Web retrieval and mining, Semantic web, XML information retrieval, Recommender systems and expert locators, Knowledge management systems, Decision support systems, Geographic information system(GIS).
Unit – III
Indexing: Inverted indices, Index components and Index life cycle, Interleaving Dictionary and Postings lists, Index construction, Query processing for ranked retrieval, Compression: General purpose data compression, Symbol-wise data compression, Compressing posting lists, Compressing the dictionary. Information categorization and filtering: Classification, Probabilistic classifiers, linear classifiers, Similarity-based classifiers, Multi category ranking and classification, learning to rank, Introduction to the clustering problem, Partitioning methods, Clustering versus classification, Reduced dimensionality/spectral methods.
Unit – IV
Sentiment Analysis: Introduction to sentiment analysis, Document-level sentiment analysis, Sentence-level sentiment analysis, Aspect-based sentiment analysis, Comparative sentiment analysis, baseline algorithm, Lexicons, Corpora , Tools of Sentiment analysis, Applications.
Text Books: 1. Butcher S., Clarke C.L.A., Cormack G. Information Retrieval, MIT 2. Bates M.J., Understanding Information Retrieval Systems, CRC press
Reference Books: 1. Manning C.D., Raghavan P. and Schütze H. Introduction to Information Retrieval, Cambridge University Press. 2. David A. Grossman, OphirFrieder, Information Retrieval – Algorithms and Heuristics, Springer, Distributed by Universal Press. 3. Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer 4. SoumenChakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers

MT-CSE-20-31 (iv): Digital Image Processing	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an introduction to the basic concepts and methodologies for Digital Image Processing. To develop a foundation that can be used as a basis for further studies and research. Introduce the fundamental techniques and algorithms used for acquiring, processing and extracting useful information from digital images.

Course Outcomes: At the end of this course, the student will be able to:

MT-CSE-20-31.1	get acquainted with digital image fundamentals and its applications and get acquainted with the image representation and description methods
MT-CSE-20-31.2	Learn and perform image pre-processing and enhancement to improve the image for further processing
MT-CSE-20-31.3	reconstruct photometric properties degraded by the imaging process and partition a digital image into multiple segments
MT-CSE-20-31.4	represent and analyze images at different resolutions , process images according to their shapes, and apply compression techniques to reduce the storage space of images

CO-PO Mapping Matrix for Course Code: MT-CSE-20-31 (iv)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MT-CSE-20-31.1	3	2	3	2	1	1	2	1	3	-	2
MT-CSE-20-31.2	3	3	3	2	1	2	2	1	3	-	2
MT-CSE-20-31.3	3	3	3	3	1	2	2	1	3	-	2
MT-CSE-20-31.4	3	3	3	3	1	2	2	1	3	-	2
Average	**3**	**2.75**	**3**	**2.5**	**1**	**1.75**	**2**	**1**	**3**	**-**	**2**

CO-PSO Mapping Matrix for Course Code: MT-CSE-20-31 (iv)

COs	PSO1	PSO2	PSO3	PSO4
MT-CSE-20-31.1	3	2	1	3
MT-CSE-20-31.2	3	3	1	3
MT-CSE-20-31.3	3	3	1	3
MT-CSE-20-31.4	3	3	1	3
Average	**3**	**2.75**	**1**	**3**

Unit – I

Digital Image Fundamentals: Introduction to Digital Image Processing and its applications; Components of an Image Processing System.

Image Representation and Description: Image Representation ; Digital Image Properties; Boundary descriptors; Regional descriptors; Phases in Digital Image Processing; Elements of Visual perception; Image Sensing and

Acquisition; Image Sampling and Quantization; Relationship between Pixels; Color Representation.

Data Structures for Image Analysis: Levels of Image Data Representation; Traditional Image Data Structures: Matrices, Chains, Topological Data Structures, Relational Structures; Hierarchical Data Structures: Pyramids, Quadtrees, Other Pyramidal Structures.

Unit – II

Image Pre-Processing: Pixel Brightness Transformations: Position-Dependent Brightness Correction, Gray-Scale Transformation; Geometric Transformations: Pixel Co-ordinate Transformations, Brightness Interpolation; Local Pre-Processing.

Image Enhancement: Spatial Domain: Gray level transformations; Histogram processing; enhancement using arithmetic and logic operators; Basics of Spatial Filtering; Smoothing and Sharpening Spatial Filtering.

Frequency Domain: Introduction to Fourier Transform; Filtering in the Frequency Domain; Smoothing and Sharpening frequency domain filters; Homomorphic Filtering.

Unit – III

Image Restoration and Segmentation: Noise models; Mean Filters; Order Statistics; Adaptive filters; Noise Reduction by Frequency Domain Filtering; Inverse and Wiener filtering; Constrained Least Squares Filtering.

Segmentation: Point, line, and Edge Detection; Edge Linking and Boundary detection; Thresholding; Region based segmentation; Edge based Segmentation; Segmentation by Morphological Watersheds; Matching.

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing.

Unit – IV

Wavelets And Multiresolution Processing: Background: Image Pyramids; Subband coding; Multiresolution expansions.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.

Compression – Fundamentals ; Image Compression models; Error-Free Compression; Variable Length Coding , LZW coding, Bit-Plane Coding, Lossless Predictive Coding; Lossy Compression: Lossy Predictive Coding, Transform Coding, wavelet Coding; Image Compression Standards.

Text Books:

1. Rafael C. Gonzales, Richard E. Woods, Digital Image Processing, Pearson Education

Reference Books:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, Tata McGraw Hill
2. Anil Jain K., Fundamentals of Digital Image Processing, PHI
3. Willliam K Pratt, Digital Image Processing, John Willey.
4. Malay K. Pakhira, Digital Image Processing and Pattern Recognition, PHI
5. S. Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing, McGraw Hill
6. B. Chanda , D.DuttaMajumder, Digital Image Processing and Analysis, PHI
7. Vipula Singh, Digital Image Processing with MATLAB and LABVIEW, Elsevier India.

CO-PO-PSO MAPPING MATRIX FOR ALL THE COURSES OF

MASTER OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING)

SEMESTER	COURSE CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
I	MT-CSE-20-11	3	2.5	1	2.5	1	2.25	1.75	1.5	2	1	1.5	2.25	2.25	1.5	3
	MT-CSE-20-12	3	3	1.25	3	1.25	3	2.75	1.5	2.75	1	2.5	3	1.75	1.75	2.75
	MT-CSE-20-13 (i)	3	3	2	2.5	1.5	2.5	2.5	2	3	1	2.5	2.5	3	3	3
	MT-CSE-20-13 (ii)	3	2.75	2.75	2.25	2.5	2	1.75	2.75	2.5	2.5	1.25	3	2.5	1.75	2.5
	MT-CSE-20-13 (iii)	3	2.75	3	2	1.75	2	2.25	2	3	-	2	3	2.25	1	3
	MT-CSE-20-13 (iv)	3	2.5	1	3	2	3	2	3	3	1	2.5	2	3	2.5	3
	MT-CSE-20-14 (i)	3	2.5	1	3	2	3	2	3	3	1	2.5	2	3	2.5	3
	MT-CSE-20-14 (ii)	3	2.75	2.5	2.25	2.25	2	2	2.25	2.5	2	2	2.75	2.5	1.75	2
	MT-CSE-20-14 (iii)	3	2.5	3	2	1	2.5	2	2	3	-	2.25	3	2.5	1	3
	MT-CSE-20-14 (iv)	3	2	3	3	3	1.5	1	2	3	1	1.5	3	2.5	1.5	3
	MT-CSE-20-15	3	3	2.5	2.5	2.5	2.5	2.5	3	3	3	2	3	2	3	2
II	MT-CSE-20-21	3	2.5	1	3	1.25	3	2	1	3	1	2	3	2.5	1.5	3
	MT-CSE-20-22	3	2.75	3	2.5	1.75	2.5	3	2	3	-	2.25	3	2.75	1	3
	MT-CSE-20-23 (i)	3	2.5	2.75	2.5	2.25	2	2.25	2.5	2.5	2.5	1.5	2.75	2.25	1.5	2.5
	MT-CSE-20-23 (ii)	3	3	2	3	2	3	1.25	2	2	1	2.5	3	2.25	1	2
	MT-CSE-20-23 (iii)	3	2.5	3	2.75	1	2	2.25	2	3	-	2.75	3	2.25	1	3
	MT-CSE-20-23 (iv)	3	2	3	3	3	2.25	1.75	1	3	1	2	3	3	2	3
	MT-CSE-20-24 (i)	3	1	2	2.75	2	2.75	1.75	1.75	1	1	1	2.5	2.75	1.25	3
	MT-CSE-20-24 (ii)	3	2	2.75	2.25	3	1.75	2.5	2	3	1	1.75	2.5	3	1.5	2.75
	MT-CSE-20-24 (iii)	3	2.5	3	2.5	3	2.5	1.5	2.25	2.5	2	1.5	2.5	2.5	2	3
	MT-CSE-20-24 (iv)	3	2.75	2.75	2.75	2.5	2	1.75	2.25	2.25	2.25	1.25	2.25	2.75	1.25	2
III	MT-CSE-20-31 (i)	3	3	2	2	1	2	3	2	3	1	2	3	2	2	2
	MT-CSE-20-31 (ii)	3	2.5	3	3	3	2	2.5	2.5	3	2	2	2.5	2.5	3	3
	MT-CSE-20-31 (iii)	3	3	3	3	3	3	3	3	3	2	2.25	3	3	2.5	3

SEMESTER	COURSE CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2	PSO3	PSO4
	MT-CSE-20-31 (iv)	3	3	3	2.75	2.25	2.5	2.25	2	3	-	2.75	3	2.5	1	3
I to III	**Average**	**3.00**	**2.57**	**2.37**	**2.63**	**2.07**	**2.38**	**2.13**	**2.13**	**2.72**	**1.51**	**2**	**2.74**	**2.53**	**1.75**	**2.74**

Note : 4th Semester is not included as it comprises of Dissertation only.

Kurukshetra University, Kurukshetra
(Established by the State Legislature Act XII of 1956)
('A+' Grade, NAAC Accredited)

|| योगस्थ: कुरु कर्माणि ||
समबुद्धि व योगयुक्त होकर कर्म करो
(Perform Actions while Stead fasting in the State of Yoga)

Scheme of Examination and Syllabus of

Master of Computer Application(MCA)(CBCS) in Phased Manner

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS

CBCS CURRICULUM (2020-21)

Program Name: Master of Computer Applications(MCA)(CBCS)

(For the Batches Admitted From 2020-2021)

10(3441)

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

VISION

Pursue conducive advancement towards nurturing globally competent and ethically conscientious professionals and entrepreneurs in agile computing technologies and allied spheres for unceasing evolution of Nations IT affiliated commercial and research endeavours.

MISSION

Thrive to establish a strong foundation for technical competency in spheres concordant to software oriented design and development. Nurture skills and competency for administering expertise gained in computing discipline to a wide horizon of interdisciplinary application domains, thus supporting sustainable development of the society. Habituate the students to strive for technological innovations and successful endeavours ethically, supported by sustained learning continuance and problem solving proficiency that may promote nations welfare in terms of economic acceleration leading to the growth of society.

NAME OF THE PROGRAMME: MASTER OF COMPUTER APPLICATIONS
DURATION : TWO YEARS

PROGRAMME OUTCOMES (POs)	
PO1	Knowledge Capable of demonstrating comprehensive disciplinary knowledge gained during course of study.
PO2	Research Aptitude Capability to ask relevant/appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis.
PO3	Communication Ability to communicate effectively on general and scientific topics with the scientific community and with society at large.
PO4	Problem Solving Capability of applying knowledge to solve scientific and other problems.
PO5	Individual and Team Work Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings.
PO6	Investigation of Problems Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions.
PO7	Modern Tool usage Ability to use and learn techniques, skills and modern tools for scientific practices.
PO8	Science and Society Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices.
PO9	Life-Long Learning Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life.
PO10	Ethics Capability to identify and apply ethical issues related to one's work, avoid unethical behaviour such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work.
PO11	Project Management Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects.

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
PSO1	Develop competency to administer knowledge and awareness in the computing discipline along

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
	with learning aptitude for lifelong endurance in professional realm.
PSO2	Develop proficiency to adapt to contemporary technologies, skills and models for computing practice.
PSO3	Acquire expertise to adopt skills realized during research, experimentation and trending technology cognizance to solve industrial problems.
PSO4	Promote professional competence to aspire careers in Commercial/ Government Sectors, Academics/ consultancy/ Research and Development for technological innovations, and collateral fields related to Computer Science and Information Technology.
PSO5	Foster analytical skills for programming and adept computer based designing of systems in the domains concordant to Algorithm Design, System Software, Web and Application Designing, Data Science & Analytics, Artificial Intelligence & Machine Intelligence, Graphics and Visualization, and Networking Services.

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SCHEME OF EXAMINATIONS FOR
MASTER OF COMPUTER APPLICATIONS
CHOICE BASED CREDIT SYSTEM (CBCS)
W. E. F. ACADEMIC SESSION 2020-21 IN PHASED MANNER

Paper Code	Nomenclature of Paper	Credits	Workload Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks	Total Marks	Pass Marks
					Max.	Pass			
First Semester									
MCA-20-11	Programming in Java	4	4	3	75	30	25	100	40
MCA-20-12	Data Structures using C++	4	4	3	75	30	25	100	40
MCA-20-13	Operating Systems	4	4	3	75	30	25	100	40
MCA-20-14	Data Communication and Computer Networks	4	4	3	75	30	25	100	40
MCA-20-15	Object-Oriented Analysis and Design using UML	4	4	3	75	30	25	100	40
MCA-20-16	S/W Lab – I Based on MCA-20-11	2.5	5	3	100	40	-	100	40
MCA-20-17	S/W Lab – II Based on MCA-20-12	2.5	5	3	100	40	-	100	40
	Total	**25**	**30**		**575**	**230**	**125**	**700**	**280**
Second Semester									
MCA-20-21	Web Technologies	4	4	3	75	30	25	100	40
MCA-20-22	Linux and Shell Programming	4	4	3	75	30	25	100	40
MCA-20-23	Advanced Data Base Systems	4	4	3	75	30	25	100	40
MCA-20-24	Elective-I	4	4	3	75	30	25	100	40
MCA-20-25	Elective-II	4	4	3	75	30	25	100	40
MCA-20-26	S/W Lab – III Based on MCA-20-21 and MCA-20-23	2.5	5	3	100	40	-	100	40
MCA-20-27	S/W Lab – IV Based on MCA-20-22	2.5	5	3	100	40	-	100	40
*OE-20-28	Open Elective Based on MOOCs (The selected course should not be directly related with Computer Science) Or As Per University Guidelines	2	2	3	35	14	15	50	20
	Total	**27**	**32**		**610**	**244**	**140**	**750**	**300**
Elective – I									
MCA-20-24(i)	Principles of Programming Languages	4	4	3	75	30	25	100	40
MCA-20-24(ii)	High Performance Networks	4	4	3	75	30	25	100	40
MCA-20-24(iii)	Compiler Design	4	4	3	75	30	25	100	40
Elective – II									
MCA-20-25(i)	Theory of Computation	4	4	3	75	30	25	100	40
MCA-20-25(ii)	Design and Analysis of Algorithms	4	4	3	75	30	25	100	40
MCA-20-25(iii)	Security in Computing	4	4	3	75	30	25	100	40
Third Semester									
MCA-20-31	Computer Architecture and Parallel Processing	4	4	3	75	30	25	100	40

Paper Code	Nomenclature of Paper	Credits	Workload Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks	Total Marks	Pass Marks
					Max.	Pass			
MCA-20-32	Data Mining and Integration using R	4	4	3	75	30	25	100	40
MCA-20-33	Artificial Intelligence	4	4	3	75	30	25	100	40
MCA-20-34	Elective-III	4	4	3	75	30	25	100	40
MCA-20-35	Elective-IV	4	4	3	75	30	25	100	40
MCA-20-36	S/W Lab – V Based on MCA-20-32	2.5	5	3	100	40	-	100	40
MCA-20-37	S/W Lab –VI Based on MCA-20-35	2.5	5	3	100	40	-	100	40
MCA-20-38	Summer Training / Internship(Industry Based)	8	-	Viva Voce	150	60	50	200	80
*OE-20-39	Open Elective Based on MOOCs (The selected course should not be directly related with Computer Science) Or As Per University Guidelines	2	2	3	35	14	15	50	20
	Total	**35**	**32**		**760**	**304**	**190**	**950**	**380**
	Elective – III								
MCA-20-34(i)	Cloud Computing and IoT	4	4	3	75	30	25	100	40
MCA-20-34(ii)	Cyber Security	4	4	3	75	30	25	100	40
MCA-20-34(iii)	Digital Marketing	4	4	3	75	30	25	100	40
	Elective – IV								
MCA-20-35(i)	Advances in Java	4	4	3	75	30	25	100	40
MCA-20-35(ii)	Advanced Web Technologies	4	4	3	75	30	25	100	40
MCA-20-35(iii)	Programming with Kotlin	4	4	3	75	30	25	100	40
	Fourth Semester								
MCA-20-41	Big Data and Pattern Recognition	4	4	3	75	30	25	100	40
MCA-20-42	Computer Graphics and Animation	4	4	3	75	30	25	100	40
MCA-20-43	Mobile Application Development	4	4	3	75	30	25	100	40
MCA-20-44	Elective-V	4	4	3	75	30	25	100	40
MCA-20-45	Elective-VI	4	4	3	75	30	25	100	40
MCA-20-46	S/W Lab – VII Based on MCA-20-41 and MCA-20-42	2.5	5	3	100	40	-	100	40
MCA-20-47	Project Based on MCA-20-43	2.5	5	3	75	30	25	100	40
	Total	**25**	**30**		**550**	**220**	**150**	**700**	**280**
	Grand Total	**112**	**124**		**2495**	**998**	**605**	**3100**	**1240**
	Elective – V								
MCA-20-44(i)	Soft Computing	4	4	3	75	30	25	100	40
MCA-20-44(ii)	Machine Learning	4	4	3	75	30	25	100	40
MCA-20-44(iii)	Digital Image Processing	4	4	3	75	30	25	100	40
	Elective – VI								
MCA-20-45(i)	Optimization Techniques	4	4	3	75	30	25	100	40
MCA-20-45(ii)	Information Systems	4	4	3	75	30	25	100	40
MCA-20-45(iii)	BlockchainTechnology	4	4	3	75	30	25	100	40

***Note 1:** In addition to the credits earned by compulsory and elective courses, every student has to earn 2 more credits by selecting an open elective/MOOC course during second and third semester.

**Note 2: Summer Training / Internship will be held immediately after 2nd Semester Examination and will be having a minimum duration of 45 days and maximum duration of 60 days. Students have to submit the Summer Training / Internship Report latest by 30th August. Evaluation of the Report and Viva-Voce shall be held during 3rd Semester. The Evaluation and Viva-Voce shall be held by one External and one Internal examiner.

Note 3: The credits for the first year are 52(25+27) and for the second year are 60(35+25). Total credits of the course will be 60+52 = 112.

Note 4: For the purpose of computation of work-load the following mechanism shall be adopted:

- 1 Credit = 1 Theory period of one hour duration.
- 1 Credit = 1 Practical period of two hour duration.

Note 5: Evaluation procedure for internal assessment marks:

Two Mid Term Examinations should be conducted by the concerned teacher each of 10 marks. Five marks may be given by theconcernedteacher on the basis of performance during the course (puzzles/ assignments/ interactions/ attendance etc.).

Note 6: Size of groups in all practical courses should not be more than thirty students.

MCA-20-11: Programming in JAVA

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30(i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40(i.e. 40%)

Instructions to paper setter for End semester exam:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The course aims is to equip the students with JAVA programming language concepts with object-oriented programming principles.In this course student will be able to learn the basic syntax and semantics of the Java language and programming environment; build robust applications using Java's object-oriented features; implement the interface and inheritance; understand exceptional handling and multi-threading concepts along with Applets, AWT and Event Handling.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-11.1	learn the basic features of Java;
MCA-20-11.2	develop program using different concepts of OOPs;
MCA-20-11.3	develop programming using Java I/O and Applet Programming;
MCA-20-11.4	design and Implement Graphics programming using AWT and Layouts.

CO-PO Mapping Matrix for Course Code: MCA-20-11

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-11.1	3	1	3	3	3	2	2	2	3	1	1
MCA-20-11.2	3	2	3	3	3	2	2	2	2	2	2
MCA-20-11.3	3	2	3	3	3	2	2	2	3	2	2
MCA-20-11.4	3	3	3	3	3	2	2	2	2	2	2
Average	**3**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**2.75**	**1.75**	**1.75**

CO-PSO Mapping Matrix for Course Code: MCA-20-11

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-11.1	3	2	2	3	2
MCA-20-11.2	3	3	2	3	2
MCA-20-11.3	3	3	2	3	2
MCA-20-11.4	3	3	2	3	2
Average	**3**	**2.75**	**2**	**3**	**2**

Unit – I

Java History: Java features, How Java differs from C++, Java Program Structure, Java Tokens, Java virtual machine, Constants, variables and data types, operators & expressions, control structures, arrays, class & object, garbage collection, finalize() method, Inheritance, method overriding, Abstract class, Multiple inheritance, Interfaces, extending Interfaces, Accessing Interface variables.

UNIT – II

Packages, Exception Handling & Multithreading: API Packages, Creating packages, Accessing a package,

Adding a class to a package, use of super and final keywords, Wrapper classes, Exception types, uncaught exceptions, multiple catch clauses, nested try statements, built-in exceptions, creating your own exceptions, Multithreading; Java thread model, thread priorities, threads synchronization, thread suspending, resuming and stopping threads. **UNIT – III** I/O Streams & Applet: Console I/O – reading console input, writing console output, Files I/O-Byte Streams, Character Streams, Collection of inbuilt Interfaces & Classes, Applet programming, Applet life Cycle, creating executable Applet, Applet Tag, Running an applet, passing parameters to applet, Graphics programming, GUI Concepts in Java, managing Input/Output in Applet. **UNIT – IV** Event Handling: AWT Classes, AWT Button, AWT Label, AWT TextField, AWT TextArea, AWT Checkbox, Event Listeners, Java ActionListener, Java MouseListener, MouseMotionListener, Adapter Classes as Helper Classes in Event Handling. Layout managers- Grid Layout, Flow Layout, Card Layout, Border Layout, Menus.
Text Books: 1. E. BalaguruswamyProgramming with JAVA- A Primer, Tata Mc-Graw Hill publication. 2. Patrick Naughton, Herbert, Schild, The Complete reference Java 2, Tata Mc-Graw Hill.
Reference Books: 1. Patrick Nieaneyer and Joshna Peck, Exploring Java, O, Reilley. 2. HareliyHahn,Teacher the Internets, P.H.I. 3. Barry Boone, William Stanck, Java 2 exam Guide, Tata Mc-Graw Hill.

MCA-20-12: Data Structures using C++	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this paper is to make the students familiar with the commonly used data structures and understand their applications in real life problems.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-12.1	understand and apply the array data structure along with various operations on it;
MCA-20-12.2	understand and apply the concepts of linked list, stacks and queue data structures;
MCA-20-12.3	understand and apply the tree data structure in various fields;
MCA-20-12.4	design and analyze the algorithms for graph, sorting, searching, and hashing.

CO-PO Mapping Matrix for CourseCode : MCA-20-12

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-12.1	3	2	1	3	1	3	2	1	3	1	3
MCA-20-12.2	3	1	1	3	1	3	2	2	3	1	3
MCA-20-12.3	3	2	1	3	1	3	2	3	3	1	3
MCA-20-12.4	3	3	1	3	1	3	2	3	3	1	3
Average	**3**	**2**	**1**	**3**	**1**	**3**	**2**	**2.25**	**3**	**1**	**3**

CO-PSO Mapping Matrix for Course Code : MCA-20-12

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-12.1	3	3	3	2	3
MCA-20-12.2	3	3	3	2	3
MCA-20-12.3	3	3	3	2	3
MCA-20-12.4	3	3	3	2	3
Average	**3**	**3**	**3**	**2**	**3**

Unit – I

Introduction to Data Structures: Classification of Data Structures, Complexity of Algorithms, Abstract Data Types, Arrays, Representation of Arrays in Memory, Operations on Array, Strings and its Representation in Memory, Operations on Strings, Pointers, Sparse Matrices.
Sorting: Bubble Sort, Selection Sort, and Insertion Sort.
Searching: Linear Searching, Binary Searching.
Implementation of Arrays, String, Sorting and Searching in C++.

Unit – II Linked Lists: Introduction, Types and Operations (Insertion, Deletion, Traversal, Searching, Sorting), Applications, Dynamic Memory Management, Polynomial Representation and Addition, Implementation of Linked Representations in C++. Stacks & Queues: Representation of Stacks, Stack Operations, Applications, Recursion, Queues, Operations on Queues, Circular Queues, Dequeue, Priority Queues, Applications, Implementation of Stacks and Queues in C++.
Unit – III Trees: Definition and Basic Terminologies, Representation of Trees, Binary Trees, Types of Tree, Representation of Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Binary Search Trees and Operations, AVL Trees, Heap, Heap-Sort, M-Way Search Trees, B-Trees, B^+ Trees, Applications, Implementation of trees in C++.
Unit – IV Graphs: Definitions and Basic Terminologies, Representation of Graphs, Graph Traversals, Operations on Graphs, Shortest Path Problem (Warshall's Algorithm and Dijkstra's Algorithm), Minimum Spanning Tree (Prim's and Kruskal's Algorithm), Applications, Implementation of Graphs using C++. Sorting and Searching: Recursive Binary Search, Types of Sorting, Implementation of Different Sorting Techniques in C++: Merge Sort, Radix Sort, Counting Sort, Bucket Sort. Hashing: Hash functions, Collision Resolution, Implementation using Linear and Quadratic Probing, Chaining using C++.
Text Books: 1. G.A.V Pai, Data Structures and Algorithms, Tata McGraw-Hill. 2. Drozdek, Data Structure and Algorithms in C++, Cengage Learning.
Reference Books: 1. Seymour Lipschutz, Data Structures, Tata McGraw-Hill, Schaum's Outlines, New Delhi. 2. Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education. 3. Goodrich, Data Structures & Algorithms in C++, Wiley India Pvt. Ltd. 4. S. Sahni, Data structures, Algorithms, and Applications in C++", University Press (India) Pvt. Ltd. 5. Walter Savitch, Problem solving with C++, Pearson education. 6. John R. Hubbard, Data Structures with C++, Tata McGraw-Hill, Schaum's Outlines, New Delhi.

MCA-20-13: Operating Systems

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30(i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40(i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question, there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with different functions performed by operating systems.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-13.1	learn the concept of Operating Systems, processes and the CPU scheduling;
MCA-20-13.2	understand the concept of concurrent processes and deadlocks in operating systems;
MCA-20-13.3	understand the file, memory and device managementin operating systems.
MCA-20-13.4	appreciate the need of protection & security along with distributed operating systems.

CO-PO Mapping Matrix for Course Code: MCA-20-13

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-13.1	3	2	3	3	3	2	1	2	3	1	2
MCA-20-13.2	3	2	3	3	3	2	1	2	3	1	2
MCA-20-13.3	3	2	3	3	3	2	1	2	3	1	2
MCA-20-13.4	3	2	3	3	3	1	1	1	3	1	2
Average	**3**	**2**	**3**	**3**	**3**	**1.75**	**1**	**1.75**	**3**	**1**	**2**

CO-PSO Mapping Matrix for Course Code: MCA-20-13

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-13.1	3	2	2	3	2
MCA-20-13.2	3	3	2	3	2
MCA-20-13.3	3	3	2	3	2
MCA-20-13.4	3	2	2	3	2
Average	**3**	**2.5**	**2**	**3**	**2**

Unit – I

Introductory Concepts: Operating system functions, structure, types viz. Batch processing systems, multi-programming systems,Time-sharing systems, desktop systems, multi-processor systems, distributed systems, clustered systems, real-time systems, handheld systems, open-source operating systems.
Operating System Structures: System Components, Operating system services, system calls, system programs.
CPU Scheduling: Process concepts, process operations, inter-process communication, scheduling criteria, scheduling algorithms, Comparative study of scheduling algorithms, Multiple processor scheduling.

Unit – II Concurrent Processes: Critical section problem, Semaphores, Classical process co-ordination problems and their solutions, monitors. Deadlocks: Deadlock characterization, Deadlock handling, Deadlock prevention and avoidance, Deadlock detection and recovery.
Unit – III Memory Management: Swapping, Paging, Segmentation, Virtual memory concepts: Demand Paging, Page replacement Algorithms, Thrashing. Storage Management: File concepts, File access methods, Directory Structure, File-system mounting, File sharing, Protection, File system structure and implementation, Directory implementation, File allocation methods, Recovery. Disk scheduling criteria and algorithms.
Unit – IV Protection & Security: Goals of protection, domains of protection, access matrix. Security: Security problem, threats, security tools, classification. Distributed Systems: Types of network-based OS, Network structure and topologies, Communication structure & Protocol, design issues. Distributed File-system: Remote file access, File replication. Distributed synchronization: Mutual exclusion, Concurrency control, deadlock handling.
Text Books: 1.Silberschatz A., Galvin P. B., Gagne G., Operating System Concepts, Wiley India Pvt. Ltd. 2. ChauhanNaresh, Principles of Operating Systems, Oxford University Press. 3. Tanenbaum A.S., Operating System- Design and Implementation, PHI Learning.
Reference Books: 1. Deitel H.M., Operating Systems, Pearson Education. 2. Stallings William, Operating System, PHI Learning. 3. Godbole A.S., Operating Systems, Tata McGraw-Hill, New Delhi.

MCA-20-14 Data Communication and Computer Networks	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an in-depth coverage of various concepts, components, and technologies of Computer Networks and Data Communication. Provide the architectural overview of the Internet. Expose the students to the current trends in wired and wireless communication technologies and real-world networking scenario.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-14.1	characterize various types of computer networks and standards along with an insight into the principles of networking by using protocol layering of the Internet and the TCP/IP protocol suite;
MCA-20-14.2	comprehend the notion of data communication and its related functional components and aspects;
MCA-20-14.3	understand design issues related to Local area Networks and get acquainted with the prevailing wired and wireless LAN technology standards;
MCA-20-14.4	get versed with the routing, addressing and congestion control issues in Networks and the Internet architecture.

CO-PO Mapping Matrix for Course Code: MCA-20-14

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-14.1	3	1	3	3	2	1	1	2	3	-	1
MCA-20-14.2	3	1	3	3	2	2	1	2	3	-	2
MCA-20-14.3	3	2	3	3	2	2	2	2	3	-	2
MCA-20-14.4	3	3	3	3	2	2	2	2	3	-	2
Average	**3**	**1.75**	**3**	**3**	**2**	**1.75**	**1.5**	**2**	**3**	**-**	**1.75**

CO-PSO Mapping Matrix for Course Code: MCA-20-14

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-14.1	3	2	1	3	2
MCA-20-14.2	3	3	1	3	2
MCA-20-14.3	3	3	1	3	2
MCA-20-14.4	3	3	2	3	2
Average	**3**	**2.75**	**1.25**	**3**	**2**

Unit – I

Network Characterization: Goals and Applications; Categorization according to Size, Purpose, Design issues & Transmission Technologies; Network Architecture and Service Models; Design issues for the Layers; OSI and TCP/IP Reference Models; Functions of layers and protocols of TCP/IP; Comparison of OSI & TCP/IP ;

Data Transmission using TCP/IP.
Networking Models & Applications: Centralized, Decentralized, and Distributed; Client-Server and Peer-to-Peer; File sharing & Web- based; Content Distribution Networks.
Introduction to Example Networks: The Internet and its Conceptual View ; Accessing The Internet; Connection-Oriented Networks: X.25, Frame Relay and ATM.

Unit – II

Data Communication Concepts & Components: Digital and Analog Data and Signals, Asynchronous and Synchronous transmission; bit rate, baud, bandwidth& Channel Capacity; Nyquist Bit Rate, Shannon Capacity; Network Performance Parameters; Transmission Impairment.
Connecting Devices & Transmission Media: Network Interface Cards, Connectors, Hubs, Transceivers & Media Connectors; Link-Layer Switches, Bridge, Routers, Gateways, Virtual LANs; Guided Transmission Media; Wireless transmission; Satellite communication.
Data Encoding & Modulation Techniques: NRZ, NRZ-I, Manchester and Differential Manchester encoding; 4B/5B ; Pulse Code Modulation & Delta Modulation; Digital to Analog encoding.
Switching and Bandwidth Utilization: Methods of Switching; Virtual Circuit & Datagram Networks; Multiplexing; Spread Spectrum.
Wired Networks and The Local Loop: Telephone Networks; Modems and Modulation Techniques; Broadband and ADSL; Internet over Cable; ADSL Versus Cable; Hybrid Fiber-Coaxial Network;Fiber-to-the-Home Broadband.

Unit – III

Data Link Layer: Communication at the Data Link Layer; Nodes and Links; Link Layer Addressing; Examples of Data Link layer protocols.
Design Issues: Framing techniques: Byte Oriented and Bit Oriented Protocols; Error Control: Error Detection and Correction; Sliding Window Flow Control Protocols.
Media Access Control: Aloha, CSMA, CSMA/CD, CSMA/CA; Collision free protocols with Controlled Access; Limited Contention Protocols; Channelization: FDMA, TDMA, CDMA; Wavelength Division Multiple access for Fiber-Optic Data Communication.
IEEE LAN standards: Ethernet (Physical specifications, Encoding, Frame Format & MAC protocol); Binary Exponential Backoff algorithm; Token Ring and FDDI.
Introduction to Wireless Networks: IEEE 802.11 Wireless LAN; Wi-Max; Bluetooth and other wireless PAN technologies & their applications; Cellular Networks: Generations; GSM & CDMA Technologies.

Unit – IV

Transport layer: Addressing, Services and Protocols; TCP and UDP services & header formats.
Network Layer: Services, Routing Algorithms: Shortest path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Multi Cast Routing, Routing for Mobile hosts.
Network layer in TCP/IP: Basic characteristics of IP protocol; addressing and header format of IPv4 ; IPv6: Major goals& features.
Congestion Control & Quality of Service: General Principals; Congestion control in Virtual – Circuit Subnets; Congestion Control in Datagram Subnets: Choke packets, Load Shedding; Random Early Detection, Jitter Control; Over provisioning, Buffering, Traffic Shaping, Leaky bucket, token bucket, Resource Reservation, Admission Control, Packet Scheduling.

Text Books:

1. Andrew S. Tanenbaum, Computer Networks, PHI.
2. Behrouz A Forouzan, Data Communications and Networking, Mc-Graw Hill Education.

Reference Books:

1. Michael A. Gallo, William M. Hancock, Computer Communications and Networking Technologies, CENGAGE learning.
2. William Stallings, Data and Computer Communications, PHI.

MCA-20-15: Object Oriented Analysis and Design Using UML	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To understand the concepts of UML and its use for class modeling, state modeling, use case modeling, interactionmodeling, activity modeling etc. and to analyse & design software systems using object-oriented approach.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-15.1	understand basics of modeling and fundamentals of UML such as things, relationships, diagrams, extensibility mechanisms and views;
MCA-20-15.2	to practically apply knowledge of class modeling and state modeling using object-oriented analysis and design methods with a clear emphasis on UML;
MCA-20-15.3	to practically apply knowledge of use case modeling, interaction modeling and activity modelling using UML;
MCA-20-15.4	have a working ability and grasping attitude to analyse and design software systems based on object-oriented thinking using UML.

CO-PO Mapping Matrix for Course Code: MCA-20-15

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-15.1	3	2	3	3	3	2	2	2	3	1	2
MCA-20-15.2	3	2	3	3	3	2	2	2	3	1	2
MCA-20-15.3	3	2	3	3	3	2	2	3	3	1	2
MCA-20-15.4	3	2	3	3	3	2	3	3	3	1	3
Average	**3**	**2**	**3**	**3**	**3**	**2**	**2.25**	**2.5**	**3**	**1**	**2.25**

CO-PSO Mapping Matrix for Course Code: MCA-20-15

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-15.1	3	2	1	3	2
MCA-20-15.2	3	2	1	3	2
MCA-20-15.3	3	3	2	3	2
MCA-20-15.4	3	3	2	3	2
Average	**3**	**2.5**	**1.5**	**3**	**2**

Unit – I

ModelingasaDesignTechnique: Principles of modeling, abstraction,encapsulation,modularity,hierarchy,typing,concurrency, persistence ofobjects. Purposeofmodelling. UML:Principlesofmodeling,UMLthings–structural,behavioral,grouping, annotational.Relationshipsin UML–dependency,association,generalization,realization.OverviewofUML diagrams, mechanisms in the UML–

specifications, adornments, common divisions, extensibility mechanisms - stereotypes, tagged values, constraints, UML profiles, UML views.

Unit – II

Class Modeling:Object &Class, Links &Associations, Generalization &Inheritance,Association Ends - scope, visibility, Multiplicity,Rolenames,Ordering,bags & sequences, Qualified association,Aggregation,association attributes &associationclasses,propagation of operations,Abstractclass, Metadata, reification, Constraints, derived data, packages, elements of class diagrams, constructingclassdiagrams.

StateModeling:Events,States,Transitions & Conditions, Activity Effects, Do-Activities, Entry & Exit Activities, CompletionTransitions, Sending Signal,Elements of Statediagrams,Nestedstatediagrams, signalgeneralization, concurrency, constructing state diagrams.

Unit – III

Use Case modeling: Actors, Use Cases, relationships - between actors, between use cases and between actor and use case, elements of use case diagram, constructing use case diagrams.

Interaction Modeling: Elements of sequence diagram and communication diagram, constructing sequence diagram and communication diagram

Activity Modeling: Elements of activity diagram, constructing activity diagram

Unit – IV

SystemAnalysis&design:Systemdevelopmentstages,systemconception,analysis, domainclassmodel, domain state model,iteratingthe analysis.

Applicationinteraction model, application class model, application state model, addingoperations

SystemDesign:estimatingperformance,makeareuseplan,organizethesystemintosubsystem,identifying concurrency, allocating subsystems to processors and tasks, management of data stores, handling global resources, choosing software control strategies, handling boundary conditions, setting trade-off priorities, selectingan architectstyle.

Class Design: bridging gap, realize use cases with operations, designing algorithms, design optimization, adjustmentofinheritance, organize classes&associations.

Text Books:

1. GradyBooch,JamesRumbaugh,IvarJacobson,TheUnifiedModelingLanguageUserGuide, Pearson education.
2. M. Blaha,J. Rumbaugh, Object-OrientedModelingand Design with UML, Pearson Education.

Reference Books:

1. J.Rumbaugh,M.Blaha,W.Premerlani,F.Eddy,W.Lorensen,Object-OrientedModelingandDesign, Prentice HallofIndia.
2. Satzinger,Jackson, Burd,Object-OrientedAnalysis& Design withthe UnifiedProcess,Thomson.
3. GradyBooch, “ObjectOrientedAnalysis& Design”, Pearson Education.

MCA-20-21: Web Technologies	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide fundamentals concepts of Web Services, JavaScript and lays foundations for the advanced studies in the area of web services.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-21.1	design web pages using HTML5 and CSS;
MCA-20-21.2	understand objects and data validation in JavaScript;
MCA-20-21.3	build Dynamic web site using server side PHP Programming and Database connectivity;
MCA-20-21.4	create web applications with Ajax.

CO-PO Mapping Matrix for Course Code: MCA-20-21

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-21.1	3	1	2	3	2	3	3	1	2	2	2
MCA-20-21.2	3	1	2	3	2	3	3	1	2	2	2
MCA-20-21.3	3	1	2	3	2	3	3	1	2	2	2
MCA-20-21.4	3	1	2	3	2	3	3	1	2	2	2
Average	**3**	**1**	**2**	**3**	**2**	**3**	**3**	**1**	**2**	**2**	**2**

CO-PSO Mapping Matrix for Course Code: MCA-20-21

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-21.1	3	3	2	3	3
MCA-20-21.2	3	3	2	3	3
MCA-20-21.3	3	3	2	3	3
MCA-20-21.4	3	3	2	3	3
Average	**3**	**3**	**2**	**3**	**3**

Unit – I

Introduction: Web browsers and its functions, web optimizations; Static page design; designing static web pages with HTML5.0-HTML basic, multimedia, Graphics, Form tags, CSS 2.0 concept and its properties & CSS 3.0 properties i.e. borders, backgrounds, fonts, text effects, Buffering, Weblog, Web Cache Poisoning.

Unit – II

JavaScript: Document Object Model (DOM), Obtaining user inputs, memory concepts, Operators, Control Structures, Looping constructs, break, continue statements, Programmer defined functions, Scoping rules, Recursion and iteration, Array declaration and allocation, passing arrays to function, Objects: String, Date,

Boolean, Window, document; using cookies, form validation in Java Script, Handling Events Using JavaScript.
Unit – III PHP: Installing and Configuring MySQL and PHP, Basic Security Guidelines, Variables, Data Types, Operators and Expressions, Constants, Flow Control Functions; Switching Flow, Loops, Code Blocks and Browser Output, Objects, Strings Processing, Form processing, Connecting to database, cookies, Session, dynamic contents.
Unit – IV Introduction to AJAX: Exploring different web technologies, Creating a simple AJAX application, Interacting with the Web Server Using the XMLHttpRequest Object, Create an XMLHttpRequest Object, Interact with the Web Server. Differentiating AJAX and Non-AJAX application. Working with PHP and AJAX: Introduction, Process Client Requests, Accessing Files Using PHP, Implementing Security and Accessibility in AJAX applications: Introduction, Secure AJAX Applications, and Accessible Rich Internet Applications.
Text Books: 1. Deitel H.M., Deitel P.J., Internet & World wide Web: How to program, Pearson Education. 2. Kogent Learning, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.
Reference Books: 1. Boronczyk, Naramore, Beginning PHP, Apache, MySQL Web Development, Wiley India Pvt.Ltd. 2. Thomas Powell, Ajax: The Complete Reference, McGraw Hill.

MCA-20-22: Linux and Shell Programming	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objectives of this course are to provide the in-depth coverage of various concepts of Linux. Linux administration is an essential course for the students.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-22.1	understand the concepts and commands of Linux;
MCA-20-22.2	understand the file management and process manipulation in Linux;
MCA-20-22.3	understand the C environment under Linux and do the system administration andcommunication in Linux;
MCA-20-22.4	developshell programs in Linux.

CO-PO Mapping Matrix for Course Code: MCA-20-21

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-22.1	3	2	3	3	3	2	1	1	3	1	2
MCA-20-22.2	3	2	3	3	3	2	1	1	3	1	2
MCA-20-22.3	3	2	3	3	3	2	2	1	3	1	2
MCA-20-22.4	3	2	3	3	3	3	2	1	3	1	2
Average	**3**	**2**	**3**	**3**	**3**	**2.25**	**1.5**	**1**	**3**	**1**	**2**

CO-PSO Mapping Matrix for Course Code: MCA-20-21

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-22.1	3	3	2	3	2
MCA-20-22.2	3	3	2	3	2
MCA-20-22.3	3	3	2	3	2
MCA-20-22.4	3	3	2	3	2
Average	**3**	**3**	**2**	**3**	**2**

Unit – I

Introduction: History, Basic features, architecture, distributions. Installing Linux, Logging in / Logging out.

File System: Introduction to files, Organization, Assessing File systems, Structure - boot block, super block, inode block, data block.

Basic and Advanced Commands: Directory oriented commands, File oriented commands, File access permissions: chmod, umask, chgrp, groups. General purpose commands.

Unit – II

File management and Compression: Computer devices, Disk related commands: dd, du, df, dfspace, fdisk,

compressing and uncompressing files. Manipulating Processes and Signals:Basics, process states and transitions, zombie and orphan processes, process oriented commands. Handling foreground and background jobs. Process scheduling using cron, crontab, at, batch. Changing priority. Signal generation and Handling. System calls: Files related system calls for opening, creating, reading, writing, relocating file descriptors, closing, duplicating file descriptors, linking, unlinking, accessing file status information, checking permissions, changing ownership, groups and permissions of files. Process related system calls: exec, fork, wait, exit.
Unit – III System Administration: Booting and shutting down process. Creating, mounting and unmounting file systems. Managing User accounts**:** creating, modifying & deleting user accounts and groups. Networking Tools: Communication oriented commands. ping, nslookup, telnet, arp, netstat, route, ftp, trivial file transfer protocol, finger, rlogin. C language compiler, the make command and makefiles, general debugging techniques, debugging with gdb.
Unit – IV Pipes and filters: Connecting processes with pipes, redirecting input and output. Filters: sort, grep, egrep, fgrep, uniq, more, pr, cut, paste, tr. Shell Programming: Shell meaning & types; Introduction to shell scripting, shell variables, exporting shell variables, Escape mechanisms, Shell meta characters, read command, conditional statements, looping and case statements, expr statement, command line arguments, sleep and basename commands, Bourne Shell Commands, string handling, arrays, shell functions, shell programs to automate system tasks.
Text Books: 1. Harwani B.M., Unix and Shell Programming, Oxford University Press. 2. Goerzen John, Linux Programming Bible, IDG Books, New Delhi.
Reference Books: 1. Matthew Neil, Stones Richard, Beginning Linux Programming, Wiley India Pvt. Ltd. 2. Christopher Negus, Linux Bible, Wiley India Pvt. Ltd. 3. Das Sumitabha, You UNIX – The Ultimate Guide, Tata McGraw Hill 4. Richard Peterson, Linux – The Complete Reference, Tata McGraw Hill

MCA-20-23: Advanced Data Base Systems	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The aim of this course is to provide an in-depth exposure of SQL and PL/SQL to implement database management system in an organization. The course covers the variety of databases to meet real life problem scenario.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-23.1	understand database architecture, designing of databases using ER and EER model;
MCA-20-23.2	to write complex queries in SQL and can design PL/SQL blocks for database implementation;
MCA-20-23.3	learn query optimization and concurrency control techniques;
MCA-20-23.4	gain knowledge of variety of databases to meet real life problem scenario.

CO-PO Mapping Matrix for the Course Code : MCA-20-23

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-23.1	3	2	3	3	2	2	2	3	1	2	1
MCA-20-23.2	3	3	3	2	3	1	3	3	2	3	1
MCA-20-23.3	3	2	2	3	2	2	2	2	3	2	2
MCA-20-23.4	3	3	3	2	3	3	1	3	3	3	3
Average	**3**	**2.5**	**2.75**	**2.5**	**2.5**	**2**	**2**	**2.75**	**2.25**	**2.5**	**1.75**

CO-PSO Mapping Matrix for the Course Code : MCA-20-23

COs	PO1	PO2	PO3	PO4	PO5
MCA-20-23.1	3	3	1	3	3
MCA-20-23.2	1	2	2	2	3
MCA-20-23.3	3	3	2	3	1
MCA-20-23.4	2	3	1	2	3
Average	**2.25**	**2.75**	**1.5**	**2.5**	**2.5**

UNIT – I

Database Systems Concepts and Architecture: Schema and Instances, DBMS architecture and Data Independence, Database languages and Interfaces, DBMS Functions and Component Modules. Entity Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships Types & Instances, Roles and Structural Constraints, E-R Diagrams, Design of an E-R Database Schema.

The Enhanced Entity-Relationship (EER) Model: Subclasses, Super classes, Inheritance, Specialization and Generalization.

UNIT – II

SQL: Data Definition and Data Types, DDL, DML, and DCL, Views & Queries in SQL, Specifying Constraints & Indexes in SQL. PL/SQL: Architecture of PL/SQL, Basic Elements of PL/SQL, PL/SQL Transactions, Cursors and Triggers.

Relational Database Design: Functional Dependencies, Decomposition, Normal Forms Based on Primary Keys-(1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF, Domain Key Normal Form.

UNIT – III

Query Processing and Optimization, Transaction Processing: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Concurrency Control Techniques: Two-Phase Locking Techniques, Timestamp Ordering, Serializability. Database Backup and Recovery: Recovery facilities, Recovery Techniques.

UNIT – IV

Databases for Advance Applications: Architecture for Parallel Database and Distributed Database, Active Database Concept and Triggers, Temporal Databases Concepts, Spatial and Multimedia Databases, Deductive Databases, Geographical Information System, Mobile Databases, Web Databases, XML Schema, Object- Based Databases, OLTP Vs. OLAP.

Text Books:

1. Elmasri&Navathe, Fundamentals of Database systems, Pearson Education.
2. Ivan Bayross, SQL, PL/SQL- The Program Language of ORACLE, BPB Publication.
3. Alexis Leon & Mathews Leon: Database Management System, Leon Vikas Publication.

Reference Books:

1. Korth&Silberschatz, Database System Concept, McGraw Hill International Edition.
2. Raghu Ramakrishnan& Johannes Gehrke, Database Management Systems, Mcgraw Hill.
3. Peter Rob, Carlos Colonel, Database system Design, Implementation, and Measurement, Cengage Learning.
4. Abbey, Abramson & Corey: Oracle 8i-A Beginner’s Guide, Tata McGraw Hill.

MCA-20-24(i): Principles of Programming Languages	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this paper is to make the students familiar with different elements of programming languages such as data types/operators/statements/control constructs and their implementation with the understanding that it will help them in becoming a better programmer.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-24(i).1	understand the programming language hierarchy and basics of compilation;
MCA-20-24(i).2	understand the different types of grammar;
MCA-20-24(i).3	understand the features of object oriented language and different methods of sequence control;
MCA-20-24(i).4	understand the implementation of different type of functions.

CO-PO Mapping Matrix for the Course Code : MCA-20-24(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-24(i).1	3	3	1	3	1	3	2	3	3	1	3
MCA-20-24(i).2	3	3	1	3	1	3	2	3	3	1	3
MCA-20-24(i).3	3	3	1	3	1	3	3	3	3	1	3
MCA-20-24(i).4	3	3	1	3	1	3	3	3	3	1	3
Average	**3**	**3**	**1**	**3**	**1**	**3**	**2.5**	**3**	**3**	**1**	**3**

CO-PSO Mapping Matrix for the Course Code : MCA-20-24(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-24(i).1	3	3	3	2	3
MCA-20-24(i).2	3	3	3	2	3
MCA-20-24(i).3	3	3	3	2	3
MCA-20-24(i).4	3	3	3	2	3
Average	**3**	**3**	**3**	**2**	**3**

Unit – I

Preliminaries: History, Impact of Programming Paradigms, Role of Programming Languages, Good Language, Effects of Programming Environment, Translators and virtual architectures, Binding and Binding time, Language Syntax, Analysis of Program, Synthesis of Object program, Formal translation models: BNF Grammars, General parsing, Language translation, Recursive descent parsing.

Unit – II

Formal languages and automata: The Chomsky hierarchy of formal languages, regular grammars, Regular expressions, Finite State Automata, Context-free grammars, Pushdown automata, Ambiguous grammars.
Language Semantics: Attribute grammars, Denotational semantics, Program verification and validation, Data objects, variables, constants, data types, declaration, type checking, type casting, type promotion, Enumerators, Composite data types.

Unit – III

Object Orientated concepts: Structured data types, Abstract data types, Information hiding, Subprogram concepts, Good program design, Type definitions, Type equivalence, Inheritance, Derived classes, Abstract classes, Polymorphism, Inheritance and software reuse.
Sequence control: Implicit and explicit sequence control, Sequence control within arithmetic expressions, sequence control between statements, sequencing with non-arithmetic expressions, Subprogram Sequence control.

Unit – IV

Miscellaneous topics: Parameter passing techniques, Static & Dynamic Scoping, Storage of variables, Static storage, Heap Storage management, Distributed Processing, Exceptions and Exception handlers, Co-routines, Scheduled subprograms, Parallel programming, Processor design, Hardware and Software architectures, Network Programming, Evolution of scripting languages, Applets, XML.

Text Books:

1. Pratt T.W., Zelkowitz M.V., Gopal T.V., Programming Languages Design and Implementation, Pearson Education.
2. Sebesta W. Robert, Concepts of Programming Languages, Pearson Education.

Reference Books:

1. Appleby Doris &VandeKopple J. Julius, Programming Languages-Paradigm and practice, Tata McGraw Hill.
2. Sethi Ravi, Programming Languages: Concepts & Constructs, Pearson Education
3. Scott M., Programming Language Pragmatics, Elsevier India.

MCA-20-24 (ii) :High Performance Networks	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Highlight and Characterize the constituent features of the Internet and other communication technologies for high speed networking and demanding applications. Apprise the students with the prevalent developments in High Performance Network technologies.

Course Outcomes: At the end of this course, the student will be able to:	
MCA-20-24(ii).1	have an insight into the modern wired and wireless technologies and architectures for high speed networks from a design and performance perspective;
MCA-20-24(ii).2	understand addressing and analyze performance issues related to the Internet;
MCA-20-24(ii).3	figure out the techniques involved to support real-time traffic and congestion control in the Internet along with an exposure to the Internet and Adhoc Network routing protocols;
MCA-20-24(ii).4	analyze the architectural issues of the application level services of the Internet and will be able to do Client-server programming for applications.

CO-PO Mapping Matrix for Course Code: MCA-20-24(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-24(ii).1	3	3	3	2	2	2	1	1	3	-	1
MCA-20-24(ii).2	3	3	3	2	1	2	1	1	3	-	2
MCA-20-24(ii).3	3	3	3	2	1	2	1	1	3	-	2
MCA-20-24(ii).4	3	3	3	2	2	2	2	1	3	-	2
Average	**3**	**3**	**3**	**2**	**1.5**	**2**	**1.25**	**1**	**3**	**-**	**1.75**

CO-PSO Mapping Matrix for Course Code: MCA-20-24(ii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-24(ii).1	3	2	1	3	2
MCA-20-24(ii).2	3	2	2	3	2
MCA-20-24(ii).3	3	2	2	3	2
MCA-20-24(ii).4	3	3	2	3	2
Average	**3**	**2.25**	**1.5**	**3**	**2**

Unit – I

TCP/IP Networks: Standards and Administration; Internet Structure; ISPs and Backbone Networks; Internet Architecture; Key Requirements for Efficiency of Networks: Scalable Connectivity, Cost-Effective Resource Sharing, Support for Services, Manageability; Performance Parameters for High-Speed Networks; Application Performance Needs.

Network Technologies for High-Speed Networks: Ethernet and its High speed versions, FDDI, Frame Relay Networks; SONET; DWDM; ATM: Design goals, Architecture and Logical Connection, ATM Cells, connection establishment and release, Switching, ATM Layers.
Wireless Networks: 802.11 Wireless LANs/Wi-Fi: **A**rchitecture, MAC Protocol, Frame, Mobility in the same IP subnet; LAN Interoperability; 802.16 Wireless MAN/Wi-Max: Services, Layers.
Cellular Internet Access: Architecture, Cellular Standards and Technologies, Managing Mobility in Cellular Networks.

Unit – II

Link Layer addressing & protocols: Types of Addresses and Address Resolution Protocol (ARP) ; HDLC; PPP.
Network Layer Performance and Protocols in TCP/IP : Delay, Throughput, Packet Loss, Congestion Control; Internet Protocol (IPv4); Fragmentation; Type of Service; Classful and Classless addressing; Subnetting&Supernetting; DHCP; CIDR.
Private Network Interconnection: Virtual Private Network; Network Address Translation (NAT).
Next Generation IP: IPv6; ICMP; Mobile IP; Address Mapping: Multicasting & IGMP.

Unit – III

TCP/IP Transport Layer and Congestion Control: Client/Server paradigm; Peer-to-Peer Paradigm; Port numbers; TCP connection; TCP flow and congestion control; Congestion –Avoidance Mechanisms: DECbit, Random Early Detection(RED), Source-Based Congestion Avoidance; UDP services and applications; SCTP Services & Features.
Quality of Service in IP Networks: Application Requirements; Data flow characteristics; Integrated Services (RSVP); Differentiated Services ; Multiprotocol Label Switching; Real-Time Transport Protocol.
Internet Routing Protocols: Unicast Routing Protocols (RIP; OSPF; BGP); Multicast Routing and Protocols (DVMRP, MOSPF, PIM, MBGP).
Mobile Adhoc Networks: Introduction; Table-Driven and On-Demand Routing Protocols.

Unit – IV

Standard Client-Server Protocols and Applications: WWW and HTTP; Web Services; FTP connections; Electronic-Mail architecture & Security; Remote logging using TELNET.
Domain Name System: Name Space, DNS in the Internet, Caching, Resource records, messages.
Client-server programming: Application Programming Interface; Introduction to Sockets; Socket Descriptors; Ports and Connection.
Network Management: Introduction, Management Information Base (MIB); SNMP.

Text Books:

1. William Stallings, High-Speed Networks and Internets, Performance and Quality of Service,Pearson Education.
2. Peterson, L.L. & Davie, B.S., Computer networks: a systems approach, Morgan Kaufmann.
3. Jean Walrand and Pravinvariya , High performance Communication networks, Harcourt and Morgan Kauffman

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill.
2. B Muthukumaran, Introduction to High Performance Networks, McGraw-Hill
3. Adrian Farrel, The Internet and Its Protocols: A Comparative Approach,Elsevier Science.
4. Douglas E. Comer, Internetworking with TCP/IP Volume – I, Principles, Protocols, and Architectures, Pearson Education.
5. Mahbub Hassan, Raj Jain, High Performance TCP/IP Networking, Concepts, Issues, and Solutions, Pearson Education.
6. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Pearson Education.
7. Andrew S. Tanenbaum, Computer Networks, PHI.

MCA-20-24(iii): Compiler Design	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of the course is to provide in-depth coverage of underlying concepts & techniques used in compiler design and to cover major topics in compilation Theory. This course will make students ready for job assignments involving compilers and prepare students to undertake projects on compilers Construction.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-24(iii).1	understand overall process of compilation;
MCA-20-24(iii).2	understand the process of parsing in compilers;
MCA-20-24(iii).3	analyze semantic analysis, building a symbol table, handling storage management and error-detection in the process of compiler designing;
MCA-20-24(iii).4	design a compiler and understand the concept of code generation and optimization.

CO-PO Mapping Matrix for the Course Code : MCA-20-24(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-24(iii).1	3	2	2	2	1	2	2	2	3	1	2
MCA-20-24(iii).2	3	2	2	2	2	2	2	2	3	1	2
MCA-20-24(iii).3	3	2	2	2	2	2	2	2	3	1	2
MCA-20-24(iii).4	3	2	2	2	2	3	2	2	3	1	2
Average	**3**	**2**	**2**	**2**	**1.75**	**2.25**	**2**	**2**	**3**	**1**	**2**

CO-PSO Mapping Matrix for the Course Code : MCA-20-24(iii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-24(iii).1	3	2	3	3	2
MCA-20-24(iii).2	3	2	3	3	3
MCA-20-24(iii).3	3	2	3	3	3
MCA-20-24(iii).4	3	2	3	3	3
Average	**3**	**2**	**3**	**3**	**2.75**

Unit – I

Compilers and Translators, Need of Translators, Tools used for compilation, Structure of Compiler, Single-Pass and Multi-Pass Compilers, Bootstrapping, Compiler Construction Tools, Phases of Compilation process, Classification of grammars.

Lexical Analysis: Design, Finite Automata and Regular Expressions, Process of Lexical Analysis, Lexical

Analyzer generators, Derivations and parse trees.

Unit – II

Parsing Techniques: Top down Parsing- Predictive Parsers, Left Recursion and its removal, Recursive Descent Parsers, LL Grammars.

Bottom-up parsing: Shift Reduce Parsing, Operator Precedence Parsing, LR Parsers, LR grammars, Comparison of parsing methods, Parser Generators.

Unit – III

Semantic Analysis: Syntax-Directed Translation Schemes.

Building Symbol Table, Data Structures for symbol table, representing scope information.

An overview of Run-time Storage Administration.

Error Detection and Recovery: Errors, Lexical-Phase Errors, Syntactic Phase Errors, Semantic Errors.

Unit – IV

Intermediate Source Forms: Postfix Notation, Syntax Trees, Triples & Quadruples.

Code Optimization: Potential cases of Code Optimization, Optimization of basic blocks, Local and Global optimizations, Code Improving Transformation.

Code Generator: Issues in the design of a code generator.

Text Books:

1. Alfred V Aho, Principles of Compiler Design, Narosa Publishing House.
2. Jean Paul Tremblay and Sorenson, The Theory and Practice of Compiler Writing, McGraw Hill.

Reference Books:

1. Dhamdhere D.M, System programming and operating system, McGraw Hill.
2. Beck L. Leland, System Software, Pearson Education.
3. Aho, Sethi, & Ullman, Compilers Principles, Techniques and Tools, Pearson Education.
4. Fischer, Crafting a compiler in C, Pearson Education.

MCA-20-25(i): Theory of Computation	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of theoretical computer science. It provides an insight about design of all types machines and their applications.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-25(i).1	design various finite state machines for real life problems;
MCA-20-25(i).2	differentiate between the applications of different kind of machines;
MCA-20-25(i).3	solve the tractable and intractable problems using various approaches;
MCA-20-25(i).4	understand the need and importance of Turing machines and their suitability.

CO-PO Mapping Matrix for the Course Code : MCA-20-25(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-25(i).1	3	2	1	3	1	3	2	2	3	1	3
MCA-20-25(i).2	3	2	1	3	1	3	2	2	3	1	3
MCA-20-25(i).3	3	2	1	3	1	3	2	3	3	1	3
MCA-20-25(i).4	3	2	1	3	1	3	2	3	3	1	3
Average	**3**	**2**	**1**	**3**	**1**	**3**	**2**	**2.5**	**3**	**1**	**3**

CO-PSO Mapping Matrix for the Course Code : MCA-20-25(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-25(i).1	3	3	3	2	3
MCA-20-25(i).2	3	3	3	2	3
MCA-20-25(i).3	3	3	3	2	3
MCA-20-25(i).4	3	3	3	2	3
Average	**3**	**3**	**3**	**2**	**3**

Unit – I

Finite State Machines: Finite Automata, Designing of DFA and NDFA, NFA with E-Transitions, Equivalence of DFA and NFA with proof, Regular Expressions and Regular languages, Laws of Regular Expressions, Kleene's Theorem 1 and 2, Properties and Limitations of FSM

FSM with Output: Moore and Mealy Machines, Arden's Theorem with proof, Closure Properties of Regular Sets, Pumping Lemma for Regular Grammars, Minimization of FA.

Unit – II

Formal Grammars: Definition, Construction of Regular & Context Free Grammar, Derivation, Parse Trees,

Ambiguity, Removal of Ambiguity, Simplification of Context Free Grammar, CNF and GNF, Closure properties of CFL, Pumping Lemma for CFL.
Pushdown Automaton: Introduction, Types of PDA, Designing of PDA's, Conversion from PDA to CFG and vice-versa.

Unit – III

Linear Bounded Automata (LBA), Turing Machines (TM), General Model of Computation, TM as Language Acceptors, TM as Computing Partial Functions, Combining TM, Multi-Tape TM, Restricted and Universal TM; TM and Computers.
Recursive and recursively-enumerable languages and Properties, More General Grammars

Unit – IV

Reductions and the Halting Problem, Post's correspondence problem, Rice's theorem, Cook's Theorem, decidability of membership, emptiness and equivalence problems of languages, Decidable languages and problems, Diagonalization method.
Computable Functions: Primitive recursive functions, Godel Numbering, Tractable and Intractable problems, Computable Complexity.

Text Books:

1. John C. Martin, Introduction to Languages and the Theory of Computation, McGraw Hill.
2. Peter Linz, An introduction to formal language & automata, Jones & Bartlett publications.

Reference Books:

1. Hopcroft J. E. & Ullman J. D, Formal languages and their relation to Automata, Pearson Education.
2. Lewis, H.R. &Papadimitrious, C. H., Elements of the theory of computation, PHI Learning.
3. Michael Sipser, Introduction to the Theory of Computation, Cengage Learning.

MCA-20-25 (ii): Design and Analysis of Algorithms	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various algorithm design techniques. It focuses on various problems and their solutions using different algorithm design techniques.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-25(ii).1	understand the complexity of problems and apply the solutions accordingly;
MCA-20-25(ii).2	categorize problems based on their characteristics and practical importance;
MCA-20-25(ii).3	design solutions to problems using various algorithmic techniques;
MCA-20-25(ii).4	classifying and solving problems as P, NP or NP Complete.

CO-PO Mapping Matrix for the Course Code : MCA-20-25 (ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-25(ii).1	3	2	1	3	2	3	2	1	3	2	2
MCA-20-25(ii).2	3	3	1	3	1	3	2	1	3	1	3
MCA-20-25(ii).3	3	2	1	3	1	3	2	1	3	1	3
MCA-20-25(ii).4	3	3	1	3	1	3	1	1	3	1	1
Average	**3**	**2.5**	**1**	**3**	**1.25**	**3**	**1.75**	**1**	**3**	**1.25**	**2.25**

CO-PSO Mapping Matrix for the Course Code : MCA-20-25 (ii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-25(ii).1	3	3	3	3	3
MCA-20-25(ii).2	3	3	3	3	3
MCA-20-25(ii).3	3	3	3	3	3
MCA-20-25(ii).4	3	3	3	3	3
Average	**3**	**3**	**3**	**3**	**3**

Unit – I

Introduction: Algorithms, Role of algorithms in computing, Analysing algorithms, Designing algorithms, Asymptotic notations.

Divide and Conquer: Solving recurrence equations: Back substitution method, Recursion tree method, Masters theorem.

Probabilistic Analysis and Randomized Algorithms: The hiring problem, Indicator random variables, Randomized algorithms, Probabilistic analysis and further uses of indicator random variables

Unit – II

Trees: Red-black trees and Splay trees.
Dynamic Programming (DP): Elements of DP, Matrix chain multiplication, Longest common subsequence, optimal binary search trees.
Greedy Techniques (GT): Elements of GT, Activity selection problem, Huffman codes, Knapsack Problem.

Unit – III

Graph Algorithms: Topological sort, Strongly connected components, Single source shortest path: Analysis of Dijkstra's Algorithm, Limitations of Dijkstra's Algorithm, Negative weight cycle, Bellman-Ford algorithm. All Pairs Shortest Path: Relation of Shortest path and matrix multiplication, Analysis of Floyd Warshall algorithm. Maximum Flow: Flow network, Ford-Fulkerson method.
Strings: Storage of strings, Naive string-matching algorithm, Rabin-Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm

Unit – IV

Computational Geometry: Line-segment properties, Convex hull, Closest pair of points.
Computational complexity: Notion of Polynomial time algorithms, Complexity classes: P, NP, NP-Hard and NP-Complete, Polynomial time verification, Reducibility, NP-Completeness, Examples of NP-Complete and NP-Hard problems: Traveling Salesman Problem, Knapsack, Bin Packing, Satisfiability, Vertex Cover, Clique, Independent Set.

Text Books:

1. Cormen, Leiserson, Rivest, Introduction to Algorithms, PHI India.
2. Neapolitan R., Foundations of Algorithms, Jones and Bartlett Learning.

Reference Books:

1. Cooper A., Computability Theory, Chapman and Hall/ CRC Press.
2. A.V.Aho, J.E.Hopcroft, and J.D.Ullman, The Design and Analysis of Computer Algorithms, Pearson Education India
3. AnanyLevitin, Introduction to the Design and Analysis of Algorithms, Pearson Education.
4. R.C.T Lee, S.S.Tseng, R.C.Chang, Y.T.Tsai, Introduction to Design and Analysis of Algorithms: A Strategic Approach, Tata McGraw Hill
5. Steven Skiena, The Algorithm Design Manual, Springer India.

MCA-20-25 (iii): Security in Computing

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30(i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40(i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the coverage of various security parameters and vulnerabilities. This course enables the students to handle various security issues in real-world.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-25 (iii).1	learn the concepts of computer security and various cryptographic techniques for securing a system;
MCA-20-25 (iii).2	understand the concepts of database security and various network security controls;
MCA-20-25 (iii).3	get familiar with various Internet security protocols;
MCA-20-25 (iii).4	understand various physical security breaches and Intellectual property rights.

CO-PO Mapping Matrix for Course Code: MCA-20-25(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-25 (iii).1	3	3	1	3	2	2	3	2	3	3	1
MCA-20-25 (iii).2	3	3	1	3	1	3	2	2	2	2	1
MCA-20-25 (iii).3	3	3	3	3	2	3	3	2	3	1	3
MCA-20-25 (iii).4	3	3	2	2	1	2	2	3	2	3	3
Average	**3**	**3**	**1.75**	**2.75**	**1.5**	**2.5**	**2.5**	**2.25**	**2.5**	**2.25**	**2**

CO-PSO Mapping Matrix for Course Code: MCA-20-25(iii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-25 (iii).1	3	3	3	1	1
MCA-20-25 (iii).2	2	2	2	1	1
MCA-20-25 (iii).3	3	2	1	2	1
MCA-20-25 (iii).4	2	2	2	2	1
Average	**2.5**	**2.25**	**2**	**1.5**	**1**

Unit – I

Computer Security Concepts, Threats, Attacks and Assets, Security Functional Requirements, Security Architecture and Scope of Computer Security, Computer Security Trends and Strategies. Cryptography: Terminology and Background, Substitution Ciphers, Transpositions, Cryptanalysis,
Program Security: Secure Program, Non-malicious Program Error, Viruses and other Malicious Code, Targeted Malicious Code, Control against Program Threats.

Unit – II

Database Security: Database Management System, Relational Databases, Database Access Control, Inference, Security Requirements, Reliability and Integrity, Sensitive Data, Database Encryption. Network Security: Threats in Network, Network Security Controls, and Firewall- Need for firewall, Characteristics, Types of firewall, Firewall Basing, Intrusion Detection System- Types, Goals of IDS, IDS strengths and Limitations.
Unit – III Internet Security Protocols and Standards: Secure Socket Layer (SSL) and Transport Layer Security (TLS), IPv4 and IPv6 Security, Kerberos 672, X.509, Public Key Infrastructure. Linux Security Model, File System Security, Linux Vulnerability, Linux System Hardening, Application Security. Window Security Architecture, Windows Vulnerability, Windows Security Defense, Browser Defenses.
Unit – IV Physical Security Threats, Physical Security Prevention and Mitigation Measures, Recovery form Physical Security Breaches, Security Auditing Architecture, Security Audit Trail, Security Risk assessment, Security Controls or Safeguard, IT Security Plan, Implementation of Controls, Cybercrime and Computer Crime, Intellectual Property, Privacy, Ethical Issues.
Text Books: **1.** Charles. P. Pfleeger& Shari Lawrence Pfleeger, Security in Computing, Pearson Education. **Reference Books:** 1. William Stalling, Lawrie Brown, Computer Security Principles and Practice, Pearson Education. 2. AtulKahate, Cryptography and Network Security, Tata McGraw-Hill Education

MCA-20-31: Computer Architecture and Parallel Processing	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To know parallel processing and new trends and developments in computer architectures. Understand design and development of ILP based processors and evaluate their performance. Understand MIMD architectures and different topologies used in these architectures. Study the cache coherence problems and their solutions.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-31.1	learn the concepts of parallel architectures and exploitation of parallelism at instruction level;
MCA-20-31.2	understand architectural features of multi-issue ILP processors;
MCA-20-31.3	learn MIMD architectures and interconnection networks used in them and evaluate their comparative performances;
MCA-20-31.4	analyze causes of cache coherence problem and learn algorithm for its solution.

CO-PO Mapping Matrix for Course Code: MCA-20-31

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-31.1	3	1	3	3	3	1	1	2	3	1	1
MCA-20-31.2	3	2	3	3	3	1	1	2	3	1	1
MCA-20-31.3	3	2	3	3	3	2	1	2	3	1	2
MCA-20-31.4	3	3	3	3	3	2	1	2	3	1	2
Average	**3**	**2**	**3**	**3**	**3**	**1.5**	**1**	**2**	**3**	**1**	**1.5**

CO-PSO Mapping Matrix for Course Code: MCA-20-31

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-31.1	3	2	1	3	2
MCA-20-31.2	3	2	1	3	2
MCA-20-31.3	3	3	2	3	2
MCA-20-31.4	3	3	2	3	2
Average	**3**	**2.5**	**1.5**	**3**	**2**

Unit – I

Computational Model: Basic computational models, evolution and interpretation of computer architecture, concept of computer architecture as a multilevel hierarchical framework. Classification of parallel architectures, Relationships between programming languages and parallel architectures.

Parallel Processing: Types and levels of parallelism, Instruction Level Parallel (ILP) processors, dependencies between instructions, principle and general structure of pipelines, performance measures of pipeline, pipelined processing of integer, Boolean, load and store instructions, VLIW architecture, Code Scheduling for ILP-Processors - Basic block scheduling, loop scheduling, global scheduling.

Unit – II

Superscalar Processors: Emergence of superscalar processors, Tasks of superscalar processing – parallel decoding, superscalar instruction issue, shelving, register renaming, parallel execution, preserving sequential consistency of instruction execution and exception processing, comparison of VLIW & superscalar processors
Branch Handling: Branch problem, Approaches to branch handling – delayed branching, branch detection and prediction schemes, branch penalties and schemes to reduce them, multiway branches, guarded execution.

Unit – III

MIMD Architectures: Concepts of distributed and shared memory MIMD architectures, UMA, NUMA, CC-NUMA & COMA models, problems of scalable computers.
Direct Interconnection Networks: Linear array, ring, chordal rings, star, tree, 2D mesh, barrel shifter, hypercubes.

Unit – IV

Dynamic interconnection networks: single shared buses, comparison of bandwidths of locked, pended & split transaction buses, arbiter logics, crossbar, multistage networks – omega, butterfly
Cache coherence problem, hardware based protocols – snoopy cache protocol, directory schemes, and hierarchical cache coherence protocols.

Text Books:

1. Sima, Fountain, Kacsuk, Advanced Computer Architecture, Pearson Education.
2. D. A. Patterson and J. L. Hennessey, Computer Architecture,A Quantitative Approach, Elsevier India.

Reference Books:

1. Kai Hwang, Advanced Computer Architecture, McGraw Hill.
2. Nicholas Carter, Computer Architecture, McGraw Hill.
3. Harry F. Jordan, Gita Alaghband, Fundamentals of Parallel Processing, Pearson Education.

MCA-20-32: Data Mining and Integration using R

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30(i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40(i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in- depth coverage of data mining and integration aspects along with its implementation in R programming language.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-32.1	understand the fundamental concepts of data warehousing and data mining;
MCA-20-32.2	acquire skills to implement data mining techniques;
MCA-20-32.3	learn schema matching, mapping and integration strategies;
MCA-20-32.4	implement data mining techniques in R to meet the market job requirements.

CO-PO Mapping Matrix for the Course Code : MCA-20-32

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
MCA-20-32.1	3	3	3	3	2	1	3	3	2	2	1
MCA-20-32.2	3	3	3	2	3	2	2	3	3	3	2
MCA-20-32.3	2	1	2	3	3	2	2	3	2	1	2
MCA-20-32.4	3	3	3	2	3	1	3	2	3	2	1
Average	**2.75**	**2.5**	**2.75**	**2.5**	**2.75**	**1.5**	**2.5**	**2.75**	**2.5**	**2**	**1.5**

CO-PSO Mapping Matrix for the Course Code : MCA-20-32

COs	PO1	PO2	PO3	PO4	PO5
MCA-20-32.1	3	2	3	3	3
MCA-20-32.2	3	3	2	2	3
MCA-20-32.3	2	2	1	3	1
MCA-20-32.4	3	3	1	2	3
Average	**2.75**	**2.5**	**1.75**	**2.5**	**2.5**

UNIT – I

Data Warehouse: A Brief History, Characteristics, Architecture for a Data Warehouse. Data Mining: Introduction: Motivation, Importance, Knowledge Discovery Process, Data Mining Functionalities, Interesting Patterns, Classification of Data Mining Systems, Major issues, Data Preprocessing: Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization, Outliers.

UNIT – II

Data Mining Techniques: Clustering- Requirement for Cluster Analysis, Clustering Methods- Partitioning Methods, Hierarchical Methods, Decision Tree- Decision Tree Induction, Attribute Selection Measures, Tree Pruning. Association Rule Mining- Market Basket Analysis, Frequent Itemset Mining using Apriori Algorithm, Improving the Efficiency of Apriori. Concept of Nearest Neighborhood and Neural Networks.

UNIT – III

Data Integration: Architecture of Data Integration, Describing Data Sources: Overview and Desiderate, Schema

Mapping Language, Access Pattern Limitations, String Matching: Similarity Measures, Scaling Up String Matching, Schema Matching and Mapping: Problem Definition, Challenges, Matching and Mapping Systems, Data Matching: Rule- Based Matching, Learning- Based Matching, Matching by Clustering.

UNIT – IV

R Programming: Advantages of R over other Programming Languages, Working with Directories and Data Types in R, Control Statements, Loops, Data Manipulation and integration in R, Exploring Data in R: Data Frames, R Functions for Data in Data Frame, Loading Data Frames, Decision Tree packages in R, Issues in Decision Tree Learning, Hierarchical and K-means Clustering functions in R, Mining Algorithm interfaces in R.

Text Books:

1. J Hanes, M. Kamber, Data Mining Concepts and Techniques, Elsevier India.
2. A.Doan, A. Halevy, Z. Ives, Principles of Data Integration, Morgan Kaufmann Publishers.
3. S. Acharya, Data Analytics Using R, McGraw Hill Education (India) Private Limited.

Reference Books:

1. G.S. Linoff, M.J.A. Berry, Data Mining Techniques, Wiley India Pvt. Ltd.
2. Berson, S.J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw-Hill.
3. J.Horbulyk, Data Integration Best Practices.
4. Jared P. Lander, R For Everyone, Pearson India Education Services Pvt. Ltd.

MCA-20-33: Artificial Intelligence	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of Artificial Intelligence techniques and their applications. It focuses on various search techniques and expert systems along with other parts of artificial intelligence in computer science.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-33.1	understand the different knowledge representation schemes specially FOPL;
MCA-20-33.2	apply various search methods to solve AI problems efficiently;
MCA-20-33.3	understand the Expert System and techniques to manage the uncertainty in Expert Systems;
MCA-20-33.4	understand the learning techniques and Genetic Algorithm.

CO-PO Mapping Matrix for the Course Code : MCA-20-33

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-33.1	3	2	1	3	1	3	2	2	3	1	3
MCA-20-33.2	3	2	1	3	1	3	2	2	3	1	3
MCA-20-33.3	3	2	1	3	1	3	2	3	3	1	3
MCA-20-33.4	3	3	1	3	1	3	2	3	3	1	3
Average	**3**	**2.25**	**1**	**3**	**1**	**3**	**2**	**2.5**	**3**	**1**	**3**

CO-PSO Mapping Matrix for the Course Code : MCA-20-33

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-33.1	3	3	3	2	3
MCA-20-33.2	3	3	3	2	3
MCA-20-33.3	3	3	3	2	3
MCA-20-33.4	3	3	3	2	3
Average	**3**	**3**	**3**	**2**	**3**

Unit – I

Introduction: Background and history, Overview of AI applications areas.

The predicate calculus: Syntax and semantic for propositional logic and FOPL, Clausal form, inference rules, resolution and unification.

Knowledge representation: Network representation-Associative network & conceptual graphs, Structured representation- Frames & Scripts.

Unit – II Search strategies: Strategies for state space search-data driven and goal driven search; Search algorithms- uninformed search (depth first, breadth first, depth first with iterative deepening) and informed search (Hill climbing, best first, A* algorithm, mini-max etc.), computational complexity, Properties of search algorithms - Admissibility, Monotonicity, Optimality, Dominance.
Unit – III Production system: Types of production system-commutative and non-commutative production systems, Decomposable and non-decomposable production systems, Control of search in production systems. Rule based expert systems: Architecture, development, managing uncertainty in expert systems - Bayesian probability theory, Stanford certainty factor algebra, Nonmonotonic logic and reasoning with beliefs, Fuzzy logic, Dempster/Shaffer and other approaches to uncertainty.
Unit – IV Knowledge acquisition: Types of learning, learning by automata, intelligent editors, learning by induction. Genetic algorithms: Problem representation, Encoding Schemes, Operators: Selection, Crossover, Mutation, Replacement etc.
Text Books: 1. George F. Luger, Artificial Intelligence, Pearson Education. 2. Dan W. Patterson Introduction to Artificial Intelligence and Expert system, PHI.
Reference Books: 1. Ben Coppin, Artificial Intelligence Illuminated, Narosa Publishing House. 2. Eugene Charniak, Drew McDermott Introduction to Artificial Intelligence, Pearson Education. 3. Nils J. Nilsson Principles of Artificial Intelligence, Narosa Publishing House. 4. Jackson Peter, Introduction to Expert systems, Pearson-Education.

MCA-20-34 (i): Cloud Computing and IoT	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To study the fundamental concepts of cloud computing, enabling technologies, cloud service models and security concerns. To learn core issues of Internet of Things, IOT communication protocols and security concerns.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-34(i).1	understand core issues of cloud computing and enabling technologies;
MCA-20-34(i).2	design services based on cloud computing platforms;
MCA-20-34(i).3	understand concepts, architecture, applications and design principles for connected devices in IoT;
MCA-20-34(i).4	explain, analyze and design IoT-oriented communication protocols and security concerns.

CO-PO Mapping Matrix for Course Code: MCA-20-34(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-34(i).1	3	2	3	3	3	2	2	2	3	2	1
MCA-20-34(i).2	3	3	3	3	3	2	3	3	3	2	3
MCA-20-34(i).3	3	2	3	3	3	2	2	2	3	2	1
MCA-20-34(i).4	3	3	3	3	3	2	3	3	3	2	3
Average	**3**	**2.5**	**3**	**3**	**3**	**2**	**2.5**	**2.5**	**3**	**2**	**2**

CO-PSO Mapping Matrix for Course Code: MCA-20-34(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-34(i).1	3	3	2	3	2
MCA-20-34(i).2	3	3	3	3	3
MCA-20-34(i).3	3	3	2	3	2
MCA-20-34(i).4	3	3	3	3	3
Average	**3**	**3**	**2.5**	**3**	**2.5**

Unit – I

Cloud Computing: Definition, roots of cloud computing, characteristics, cloud architecture, deployment models, service models.
Virtualization:benefits & drawbacks of virtualization, server virtualization,virtualization of - operating system, platform, CPU, network, application, memory and I/O devicesetc.

Unit – II

Cloud Computing Service Platforms – Compute services, storage services,database services,

applicationservices, queuing services, e-mail services, notification services, media services, content delivery services, analytics services, deployment& management services, identity& access management services and their case studies.
Security in cloud computing: issues, threats, data security and information security

Unit – III

Internet of Thing (IoT): overview, conceptual framework, architecture, major components, common applications
Design principles for connected devices: Modified OSI Model for IoT/M2M systems, ETSI M2M Domains and High-level capabilities, wireless communication technologies - NFC, RFID, Bluetooth BR/EDR and Bluetooth low energy, ZigBee, WiFi, RF transceiver and RF modules. Data enrichment, data consolidation & device management at gateway.

Unit – IV

Design principles for web connectivity: web communication protocols for connected devices: constrained application protocol, CoAP Client web connectivity, client authentication, lightweight M2M communication protocol. Message communication protocols for connected devices - CoAP-SMS, CoAP-MQ, MQTT, XMPP.
IoT privacy, security and vulnerabilities and their solutions.

Text Books:

1. ArshdeepBahga, Vijay Madisetti, Cloud Computing – A Hands-on Approach, University Press.
2. RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing – Principles and Paradigms, Wiley India Pvt. Ltd.
3. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hills

Reference Books:

1. Kai Hwang, Geoffrey C.Fox, and Jack J. Dongarra, Distributed and Cloud Computing, Elsevier India Private Limited
2. Saurabh Kumar, Cloud Computing, Wiley India Pvt. Ltd.
3. Shailendra Singh, Cloud Computing, Oxford
4. Coulouris, Dollimore and Kindber, Distributed System: Concept and Design, Fifth Edition,Addison Wesley
5. Michael Miller, Cloud Computing, Dorling Kindersley India
6. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud computing: A practical Approach, McGraw Hill
7. DimitriosSerpnos, Marilyn Wolf, Internet of Things (IoT) Systems, Architecture, Algorithms, Methodologies, Springer
8. Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-onApproach), VPT
9. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications

MCA-20-34(ii): Cyber Security	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory

Internal Maximum Marks: 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	question. All questions will carry equal marks.

Course Objectives: The course has been designed to give students an extensive overview of cyber security issues, tools and techniques that are critical in solving problems in cyber security domains.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-34 (ii).1	learn various challenges and constraints in cyber security;
MCA-20-34(ii).2	learn IT ACT (Cyber law) to the given case/problem and analyse it;
MCA-20-34(ii).3	understand the need for Computer Cyber forensics;
MCA-20-34(ii).4	demonstrate the network defence tools to provide security of information.

CO-PO Mapping Matrix for Course Code: MCA-20-34(ii)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
MCA-20-34(ii).1	3	3	3	2	2	3	2	3	3	2	2
MCA-20-34(ii).2	3	3	3	3	3	2	1	2	3	3	1
MCA-20-34(ii).3	3	3	3	3	3	3	2	2	3	2	2
MCA-20-34(ii).4	3	3	3	3	3	2	1	2	3	1	2
Average	**3**	**3**	**3**	**2.75**	**2.75**	**2.5**	**1.5**	**2.25**	**3**	**2**	**1.75**

CO-PSO Mapping Matrix for Course Code: MCA-20-34(ii)

COs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
MCA-20-34 (ii).1	3	2	2	2	1
MCA-20-34(ii).2	3	2	1	3	2
MCA-20-34(ii).3	3	3	3	3	2
MCA-20-34(ii).4	3	3	3	3	2
Average	**3**	**2.5**	**2.25**	**2.75**	**1.75**

Unit- I

Introduction to Cyber Security: Overview of Cyber Security, Internet Governance: Challenges and Constraints, Cyber Threats, Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, International convention on Cyberspace.

Unit – II

Introduction to Cybercrime and Laws: Origins of Cybercrime, Classifications of Cybercrimes, information Security, Cybercriminals, Criminals Plan for Attacks, Cybercafe, Botnets, Attack Vector, The Indian IT ACT 2000 and amendments.

Tools and Methods used in Cybercrime: Introduction, Proxy Server and Anonymizers, Password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, DOS and DDOS attack, SQLinjection.

Unit – III

Phishing and Identity Theft: Introduction to Phishing, Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft: PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle.

Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law –types of intellectual property rights.

Unit – IV

Network Defence tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs. Firewall, Packet Characteristic to Filter, Stateless Vs. Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, Virtual Private Networks, Linux Firewall, Windows Firewall, Snort Detection System, Introduction to block chain technology and its applications.
Text Books: 1. Mike Shema, Anti-Hacker Tool Kit (Indian Edition), McGraw Hill. 2. Nina Godbole and SunitBelpure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
Reference Books: 1. Marjie T. Britz, Computer Forensics and Cyber Crime: An Introduction, Pearson Education 2. Chwan-Hwa (John) Wu,J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press 3. Bill Nelson, Amelia Phillips, Christopher Steuart, Guide to Computer Forensics and Investigations, Cengage Learning 4. DebiragE.Bouchoux, Intellectual Property,CengageLearning.

MCA-20-34 (iii): Digital Marketing

Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The purpose of this syllabus is to make students aware about the basics of marketing. The course discusses about the important role of Digital Marketing in present age of Information Technology.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-34 (iii).1	understand basics of marketing and digital marketing;
MCA-20-34 (iii).2	analyse the role of search engine in improving digital marketing and understand about the basics and importance of email marketing;
MCA-20-34 (iii).3	analyse role of social media marketing for the given problem;
MCA-20-34 (iii).4	understand about the basics and importance of web marketing and mobile marketing;

CO-PO Mapping Matrix for the Course Code : MCA-20-34 (iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-34 (iii).1	3	1	2	1	2	1	2	1	2	1	2
MCA-20-34 (iii).2	3	3	1	2	1	2	3	2	3	2	3
MCA-20-34 (iii).3	3	2	2	1	2	2	3	2	3	2	3
MCA-20-34 (iii).4	3	1	2	1	1	1	3	1	2	1	2
Average	**3**	**1.75**	**1.75**	**1.25**	**1.5**	**1.5**	**2.75**	**1.5**	**2.5**	**1.5**	**2.5**

CO-PSO Mapping Matrix for the Course Code : MCA-20-34 (iii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-34 (iii).1	3	2	2	2	2
MCA-20-34 (iii).2	3	3	3	3	3
MCA-20-34 (iii).3	3	3	3	3	2
MCA-20-34 (iii).4	3	3	2	2	2
Average	**3**	**2.75**	**2.5**	**2.5**	**2.25**

Unit – I

Introduction to Marketing, Importance and Scope of Marketing, Elements of Marketing - Needs, Wants, Demands, Consumer, Markets and Marketers; Marketing vs Sales. Introduction to Digital Marketing, Benefits & Opportunity of Digital Marketing, Inbound and Outbound Marketing, Content Marketing, Understanding Traffic, Understanding Leads, Digital Marketing use in 'Business to Business' (B2B), 'Business to Consumer' (B2C) and 'Not-for Profit' marketing

Unit – II
Search Marketing (SEO): Introduction to Search Engine, Search Engine Optimization (SEO), importance of SEO for business websites, Search Results & Positioning, Benefits of Search Positioning, Role of Keywords in SEO, Meta Tags and Meta Description, On-page & Off-page optimization, Back Link, Internal & External Links, Ranking, SEO Site Map, Steps for B2B SEO and B2C SEO, Advantages & Disadvantages of SEO. Email Marketing: Introduction to Email Marketing, Elements of Email, Email List Generation, Email Structure, Email Delivery, Online Data Capture, Off Line data Capture, Creating an Email campaign, Campaign Measurement, Concept of A/B testing &its use in email marketing.
Unit – III
Digital Display Advertising: Concepts, Benefits, Challenges, Ad Formats, Ad Features, Ad Display Frequency. Overview of Google AdWords. Social Media Marketing: Key Concepts, Different Social Media Channels – Facebook, YouTube, Twitter, Instagram, Business Page- Setup and Profile, Social Media Content, Impact of Social Media on SEO, Basic concepts – CPC, PPC, CPM, CTR, CR. Importance of Landing Page. How to create & test landing Pages. User Generated Content (Wikipedia etc.), Multi-media - Video (Video Streaming, YouTube etc), Multi-media - Audio & Podcasting (iTunes etc), Multimedia - Photos/Images (Flickr etc).
Unit – IV
Introduction to Mobile Marketing, Overview of the B2B and B2C Mobile Marketing, Use of Mobile Sites, Apps (Applications) and Widgets, Overview of Blogging Web Analytics: Introduction to Web Analytics, Web Analytics – Types & Levels, Introduction of Analytics Tools and it's use case (Google Analytics and others), Analytics Reporting, Traffic and Behaviour Report, Evaluate Conversion.s
Text Books: 1. Stanton William J., Fundamentals of Marketing, McGraw Hill. 2. VandanaAhuja, Digital Marketing, Oxford Higher Education. 3. Seema Gupta, Digital Marketing, McGrawHill
Reference Books: 1. Kotler Philip & Armstrong Graw, Principles of Marketing, Pearson Education. 2. Neelamegham S., Indian Cases in Marketing, Vikas Publication. 3. Ian Dodson,The Art of Digital Marketing, Wiley. 4.Puneet Singh Bhatia, Fundamentals of Digital Marketing, Pearson Education.

MCA-20-35(i) Advances in JAVA	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The course develops programming ability of students to create dynamic web applications using server side technology with Java Database Connectivity. Students can learn networking and remote method invocation using Java API. Advanced Java features will increase ability of students in web application development.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-35(i).1	develop programming using AWT, Layout, Menu and Frames;
MCA-20-35(i).2	gain the knowledge of Server Side programming by implementing Servlet and write the deployment descriptor and enterprise application deployment;
MCA-20-35(i).3	design and Develop various application using JSPs;
MCA-20-35(i).4	learn to access database through Java programs, using Java Data Base Connectivity (JDBC).

CO-PO Mapping Matrix for Course Code: MCA-20-35 (i)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-35(i).1	3	2	2	3	2	2	3	2	3	1	3
MCA-20-35(ii).2	3	3	2	3	3	2	3	2	3	1	3
MCA-20-35(iii).3	3	3	2	2	2	2	3	2	3	1	3
MCA-20-35(iv).4	3	3	2	2	3	2	3	2	3	2	3
Average	**3**	**2.75**	**2**	**2.5**	**2.5**	**2**	**3**	**2**	**3**	**1.25**	**3**

CO-PSO Mapping Matrix for Course Code: MCA-20-35(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-35(i).1	3	3	2	3	2
MCA-20-35(ii).2	3	3	3	3	3
MCA-20-35(iii).3	3	3	3	3	2
MCA-20-35(iv).4	3	3	3	3	3
Average	**3**	**3**	**2.75**	**3**	**2.5**

UNIT-I

GUI Programming: AWT Classes, AWT Controls, AWT Button, AWT Label, AWT TextField, AWT TextArea, AWT Checkbox, AWTCheckboxGroup, AWT Choice, AWT List, AWT Scrollbar, AWT MenuItem& Menu, AWT PopupMenu, AWT Panel, MouseListener, MouseMotionListener, Java ItemListener, Java KeyListener, Java WindowListener. Adapter Classes, Layout managers; Grid Layout, Flow Layout, Card Layout, Border Layout, Menus, Java Frames.

UNIT-II

Servlet API and Overview: Servlet Introduction, Servlet Life Cycle, Types of Servlet, Servlet Configuration with Deployment Descriptor, Working with ServletContext and ServletConfig Object, Attributes in Servelt, Response and Redirection using Request Dispacher and using sendRedirect Method, Filter API, Manipulating Responses using Filter API, Session Tracking: using Cookies, HTTPSession, Hidden Form Fields and URL Rewriting,Types of Servlet Event: ContextLevelandSessionLevel.

UNIT-III

Java Server Pages: Introduction to JSP , Comparison with Servlet, JSP Architecture, JSP Life Cycle, JSP Scripting Elements, JSP Directives, JSP Action, JSP Implicit Objects, JSP Expression Language, JSP Standard Tag Libraries, JSP Custom Tag, JSP Session Management, JSP Exception Handling, MVC in JSP, Custom tags; Attributes, Iteration, Custom URI.

UNIT-IV

JDBC Programming: JDBC Architecture, Types of JDBC Drivers, Introduction to major JDBC Classes and Interface, Creating simple JDBC Application, Types of Statement (Statement Interface, Prepared Statement, Callable Statement), Exploring ResultSet Operations, Batch Updates in JDBC, Managing Database Transaction.

Text Books:-

1. Patrick Naughton, Herbert, Schild, The Complete reference Java 2, Tata Mc-Graw Hill.
2. Kathy Walrath,Java server programming, J2EE, Black Book, Dream Tech Publishers.
3. SubrahmanyamAllamaraju, Cedric Buest, Professional Java Server Programming, Wiley Publication.

Reference Books:

1. Michael Morgan, Java 2 for Professionals Developers, SAMS Techmedia.
2. Kito D. Mann,Java Server Faces in Action, Manning Publication
3. Maydene Fisher, Jon Ellis, Jonathan Bruce,JDBC™ API Tutorial and Reference, Addison Wesley.
4. GiulioZambon, Beginning JSP, JSF andTomcat, Apress.

MCA-20-35 (ii):Advanced Web Technologies	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the coverage of advanced technologies used in the design and development of web based applications such as Ajax/Node JS/Angular JS etc.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-35 (ii).1	apply various jQuerymethods in building UI projects;
MCA-20-35 (ii).2	design single-page applications using Angular JS;
MCA-20-35 (ii).3	handle the HTTP request by using Node JS;
MCA-20-35 (ii).4	manage and optimize the web applications.

CO-PO Mapping Matrix for Course Code: MCA-20-35 (ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-35 (ii).1	3	1	3	2	3	1	3	2	3	1	1
MCA-20-35 (ii).2	3	2	3	2	3	2	3	2	3	1	2
MCA-20-35 (ii).3	3	2	3	2	3	2	3	2	3	1	2
MCA-20-35 (ii).4	3	3	2	3	3	2	1	2	3	1	2
Average	**3**	**2**	**2.75**	**2.25**	**3**	**1.75**	**2.5**	**2**	**3**	**1**	**1.75**

CO-PSO Mapping Matrix for Course Code: MCA-20-35 (ii)

COs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
MCA-20-35 (ii).1	3	3	3	2	3
MCA-20-35 (ii).2	3	3	3	3	3
MCA-20-35 (ii).3	3	3	3	3	3
MCA-20-35 (ii).4	3	3	3	2	3
Average	**3**	**3**	**3**	**2.5**	**3**

Unit – I

Advanced Client side programming: Fundamentals of jQuery, Element Selector, Document ready function, Events, jQuery UI, Unobtrusive client validation, working with AJAX and jQuery.
Feature detection: Browser detection, Feature detection, Modernizer.

Unit – II

Introduction to AngularJS: Controllers, Models, Directives and Services, Single Page Applications, Angular User Interfaces: Angular Forms, Using Angular with Angular UI and Angular Bootstrap, Angular Services, Developing Custom Directives, Enhanced End-to End Testing.

Unit – III

Introduction to Node JS: Node JS process model, Advantages, Traditional web server model. Setup Install Node.js on windows, REPL, Node JS console, Node JS modules, Events: Event Emitter class, inheriting events, Node Package Manager, Creating web server: handling http requests, sending requests, File System, Debugging Node JS application, Database Connectivity.

Unit – IV

Search engines: Searching techniques used by search engines, keywords, advertisements, Search engine optimization for individual web pages: header entries, tags, selection of URL, alt tags, Search engine optimization for entire website: Hyperlinks and link structure, page rank of Google, click rate, residence time of website, frames, scripts, content management system, cookies, robots, Pitfalls in Optimization: optimization and testing, keyword density, doorway pages, duplicate contents, quick change of topics, broken links, poor readability, rigid layouts, navigation styles.
Text Books: **1.** ShyamSeshadri& Brad Green, AngularJS: Up and Running, O'Relly. **2.** Peter Smith, Professional Website performance, Wiley India Pvt. Ltd.
Reference Books: 1. Brad Dayley, Node.js, MongoDB, and AngularJS Web Development (Developer's Library), Addison Wesley. 2. Simon Holmes, Getting MEAN with Mongo, Express, Angular, and Node, Manning Publications. 3. Black Book, HTML5, Dreamtech Press. 4. Maro Fischer, Website Boosting: Search Engine, Optimization, Usability, Website Marketing, Firewall Media, New Delhi.

MCA-20-35(iii): Programming in Kotlin	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this paper is to make the students familiar with the Programming Language Kotlin so that they shall be able to design the Mobile Applications.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-35(iii).1	understand the different collection implementation using Kotlin;
MCA-20-35(iii).2	implement different types of functions;
MCA-20-35(iii).3	understand the concepts of classes and interfaces and implement them;
MCA-20-35(iii).4	design and develop Android using Kotlin.

CO-PO Mapping Matrix for the Course Code : MCA-20-35(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-35(iii).1	3	2	1	3	1	3	3	1	3	1	3
MCA-20-35(iii).2	3	2	1	3	1	3	3	1	3	1	3
MCA-20-35(iii).3	3	3	1	3	1	3	3	2	3	1	3
MCA-20-35(iii).4	3	3	1	3	1	3	3	2	3	1	3
Average	**3**	**2.5**	**1**	**3**	**1**	**3**	**3**	**1.5**	**3**	**1**	**3**

CO-PSO Mapping Matrix for the Course Code : MCA-20-35(iii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-35(iii).1	3	3	3	2	3
MCA-20-35(iii).2	3	3	3	2	3
MCA-20-35(iii).3	3	3	3	2	3
MCA-20-35(iii).4	3	3	3	2	3
Average	**3**	**3**	**3**	**2**	**3**

Unit – I

Variables and Data types, Handling of Strings, Arrays: Generic arrays, arrays of primitives, List, Map and Set. Ranges, Null safety: Nullable and Non-nullable types, Elvis operator (?:).

Unit – II

Conditional Statements: if, when; Loops in Kotlin: for, repeat, while; break and continue.
Functions: Inline Function, Lambda Functions, Function Reference, Vararg parameters in Functions.

Unit – III

Class: Final class, open class, Inheritance: inheriting methods and fields from a class, Overriding properties and methods, Visibility modifiers, Abstract class, Data Class, Enum class, Sealed class, Nested class, Inner class, Interfaces, Programming asynchronous applications with Coroutines, Annotations.
Unit – IV Exception Handling: Try, Catch, Finally block, Throw. Android development using Kotlin. Views: TextView, EditView, ScrollView, ImageView, ListView, Recycler view etc. Android UI Layouts: Linear, Relative and Constraint, Creating Activities, Intents and Fragments.
Text Books: 1. Sommerhoff Peter, Kotlin for Android App Development, Pearson Education. 2. VenkatSubramaniam, Programming Kotlin, Pragmatic Bookshelf.
Reference Books: 1. Stephen Samuel & Stefan Bocutiu, Programming Kotlin, Packt Publishing Ltd. 2. Antonio Leiva, Kotlin for Android Developers, Leanpub. 3. MarcinMoskala& Igor Wojda, Android Development with Kotlin, Packt Publishing Ltd.

MCA-20-41: Big Data and Pattern Recognition

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The aim of this course is to develop knowledge of big data tools including MapReduce, NoSQL and Hadoop. The course provides an idea about data analysis; pattern recognition approaches and gives the practical exposure of NoSQL.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-41.1	understand Big Data strategies in Big Data Environment;
MCA-20-41.2	learn Basics of HDFS and Learn map-reduce analytics using Hadoop;
MCA-20-41.3	acquire knowledge of pattern recognition approaches and methods;
MCA-20-41.4	todevelop solutions in NoSQL to meet the current job requirements.

CO-PO Mapping Matrix for the Course Code : MCA-20-41

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
MCA-20-41.1	3	3	3	3	2	2	3	2	2	2	1
MCA-20-41.2	3	2	3	2	3	1	2	3	3	2	3
MCA-20-41.3	2	2	1	3	1	2	3	2	1	3	1
MCA-20-41.4	3	3	3	2	3	3	1	1	3	2	3
Average	**2.75**	**2.5**	**2.5**	**2.5**	**2.25**	**2**	**2.25**	**2**	**2.25**	**2.25**	**2**

CO-PSO Mapping Matrix for the Course Code : MCA-20-41

COs	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
MCA-20-41.1	3	3	3	3	1
MCA-20-41.2	3	1	1	2	1
MCA-20-41.3	2	2	2	3	3
MCA-20-41.4	3	3	3	2	2
Average	**2.75**	**2.25**	**2.25**	**2.5**	**1.75**

UNIT – I

Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data, Identifying Data Characteristics, Business Motivations and Drivers for Big Data Adoption: Business Architecture, Business Process Management, Information and Communication Technology, Big Data Analytics Lifecycle, Enterprise Technologies and Big Data Business Intelligence, Industry examples of big data.

UNIT – II

Data Governance for Big Data Analytics: Evolution of Data Governance, Big Data and Data Governance, Big Datasets, Big Data Oversight, Big Data Tools and Techniques: HDFS, Map Reduce, YARN, Zookeeper, HBase, HIVE, Pig, Mahout, Developing Big Data Applications, Stepwise Approach to Big Data Analysis, Big Data Failure: Failure is common, Failed Standards, Legalities.

UNIT – III

Data Analysis and Pattern Recognition: Quantitative and Qualitative Analysis, Pattern Recognition Systems, Fundamental Problems in Pattern Recognition, Feature Extraction and Reduction, Paradigms, Pattern Recognition Approaches, Importance and Applications. Data Domain for Pattern Recognition. Pattern Recognition using Nearest Neighbour Classifier and Modeling an AND Gate Neural Nets.

UNIT – IV

An Overview of NoSQL, Characteristics of NoSQL, NoSQL Storage Types, Introduction of NoSQL Products, NoSQL Data Management for Big Data: Schema Less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph databases, NoSQL Misconceptions, NoSQL over RDBMS.

Text Books:

1. Thomas Erl, WajidKhattak and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques Prentice Hall.
2. David Loshin, Big Data Analytics from Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph Morgan Kaufmann.
3. Jules J. Berman, Principles of Big Data Preparing, Sharing and Analyzing Complex Information, Morgan Kaufmann.
4. GauravVaish, Getting Started with NoSQL, Packt Publishing.
5. RajjanShinghal, Pattern Recognition Techniques and Applications, Oxford Higher Education.

Reference Books:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer.
2. Jay Liebowitz, Big Data and Business Analytics, Auerbach Publications, CRC press.
3. Pete Warden, Big Data Glossary, O'Reily.
4. Michael Mineli, Michele Chambers, AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications.

MCA-20-42:Computer Graphics and Animation

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an introduction to the theory and practice of Computer Graphics and Animation. Provide an insight to applications of Graphics and the graphics hardware devices and software used. Introduce the principles needed to design a graphics system and the algorithms related with them.

Course Outcomes: At the end of this course, the student will be able to:

MCA-20-42.1	have a knowledge of graphics applications and components and devices required to support the applications;
MCA-20-42.2	develop algorithms for scan converting geometrical primitives such as lines, circles, ellipses, and curves along with algorithms for filling polygons, required for designing real-world applications;
MCA-20-42.3	design algorithms for carrying out manipulations in pictures using geometric transformations, viewing transformations , and clipping operations;
MCA-20-42.4	model 3-dimensional objects and apply viewing, visible –surface determination, and shading techniques to the models for achieving realism. The student will also learn to design and develop animation sequences.

CO-PO Mapping Matrix for Course Code: MCA-20-42

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-42.1	3	1	3	2	1	1	1	1	3	-	1
MCA-20-42.2	3	2	3	3	1	1	2	1	3	-	1
MCA-20-42.3	3	2	3	3	1	1	2	1	3	-	1
MCA-20-42.4	3	2	3	3	1	1	2	1	3	-	2
Average	**3**	**1.75**	**3**	**2.75**	**1**	**1**	**1.75**	**1**	**3**	**-**	**1.25**

CO-PSO Mapping Matrix for Course Code: MCA-20-42

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-42.1	3	2	1	3	2
MCA-20-42.2	3	3	1	3	3
MCA-20-42.3	3	3	1	3	3
MCA-20-42.4	3	3	2	3	3
Average	**3**	**2.75**	**1.25**	**3**	**2.75**

Unit – I

Introduction to Computer Graphics and its Components: Overview of Computer Graphics, its functions & elements; Introduction to GUI, Computer Vision, Augmented Reality and other Applications of Graphics; Popular Graphics Software; Components and Working of Interactive Graphics; Raster Scan and Random Scan systems and Display Processors; Look-up table; Loading the Frame Buffer; Coordinate Systems.

Graphics Devices: Display Technologies: Resolution, Aspect Ratio, Refresh CRT, ColorCRT, Flat Panel Displays; Interactive Input Devices for Graphics, Image and Video Input Devices.

Unit – II

Scan Conversion: Drawing Geometry;Output Primitives; Lines and Pixel Graphics; AntiAliasing; Scan Converting Lines: DDA line drawing algorithms, Bresenham's line Algorithm; Scan Converting Circles: Polynomial method for circle drawing, circle drawing using polar coordinates, Bresenham's circle drawing; Algorithms for Generation of ellipse; Line Styles; Generation of Bar Charts, Pie-Charts.

Curve Representation: Parametric Curves, Parametric Representation of a Circle, Parametric representation of cubic curves, drawing Bezier curves.

Filled-Area Primitives: Basic Stack based fill algorithms: Flood fill algorithm, Boundary fill algorithm; Scan-line polygon fill algorithm and its computational structures.

Unit – III

Two-Dimensional Transformations: Coordinate and Geometric Transformations; Translation, Rotation, Scaling; Matrix representations and Homogeneous coordinates, Composite transformations, General Pivot Point rotation, General Fixed Point Scaling, Shearing; Reflection ; Reflection about an arbitrary line.

2-D Viewing: Viewing pipeline; Window, Viewport, Window-to-Viewport transformation; Zooming, Panning; Pointing and Positioning techniques; Rubber band technique; Dragging.

Clipping operations: Point and Line clipping, Cohen-Sutherland line clipping, Mid-Point Subdivision line clipping, Liang-Barsky line clipping, Sutherland-Hodgman polygon clipping; Weiler-Atherton polygon clipping.

Unit – IV

3-D Graphics & Modeling: Visualization techniques for Realism; 3D Object Representation; Solid Model Representation Schemes; Euclidean Geometry methods: Regularized Boolean Set Operations, Primitive Instancing, Boundary Representations, Curved lines and surfaces, Sweep Representations, Spatial-Partitioning Representations - Octree representation, Constructive Solid Geometry; Procedural Methods: Fractals, Shape Grammars, Particle systems, Physically Based modeling, Visualization techniques; 3D transformations.

Three-Dimensional Viewing: Viewing Pipeline**; P**arallel Projection: Orthographic and Oblique Projection; Perspective Projection.

Visible-Surface Determination: Z-buffer, Depth-Sorting, Area Subdivision, BSP-Tree method; Ray casting.

Illumination and Shading: Modeling Light Intensities; Basic Illumination Models; Gouraud Shading; Phong Shading.

Introduction to Animation: Designing of Animation Sequences; Key-Frame Systems; Animation Techniques: Tweening, Morphing.

Text Books:

1. Donald Hearn, M. Pauline Baker, Computer Graphics, Pearson Education.
2. J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics - Principles and Practice, Pearson Education.

Reference Books:

1. Newmann&Sproull, Principles of Interactive Computer Graphics, McGraw Hill.
2. Rogers, David F., Procedural Elements of Computer Graphics, McGraw Hill.
3. Zhigang Xiang, Roy Plastock, Computer Graphics, Tata McGraw Hill.
4. Malay K. Pakhira, Computer Graphics, Multimedia and Animation, PHI
5. Steven Harrington, Computer Graphics, A Programming Approach, McGraw Hill.

MCA-20-43: Mobile Application Development

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various concepts of mobile application development especially android based applications. This course will help the students in learning to develop and publish their own mobile applications.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-43.1	know the components and structure of mobile application development frameworks for Android based mobiles;
MCA-20-43.2	design and implement the user interfaces of mobile applications;
MCA-20-43.3	implement fragments and location based services in Android application;
MCA-20-43.4	understand the basics of SQLite and develop interactive graphics in mobile applications.

CO-PO Mapping Matrix for Course Code: MCA-20-43

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-43.1	3	1	2	3	2	2	1	1	1	1	1
MCA-20-43.2	3	1	2	2	2	3	2	2	1	1	1
MCA-20-43.3	3	1	2	3	2	3	2	2	1	1	1
MCA-20-43.4	3	1	2	3	2	3	2	2	1	1	1
Average	**3**	**1**	**2**	**2.75**	**2**	**2.75**	**1.75**	**1.75**	**1**	**1**	**1**

CO-PSO Mapping Matrix for Course Code: MCA-20-43

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-43.1	3	2	1	3	2
MCA-20-43.2	3	3	1	3	3
MCA-20-43.3	3	3	1	3	3
MCA-20-43.4	3	3	1	3	3
Average	**3**	**2.75**	**1**	**3**	**2.75**

Unit – I

Introduction: Mobile Applications, Characteristics and Benefits, Application Models, Mobile devices Profiles. Basics of Android, Importance and scope, Android Versions, Features of Android, Android Architecture, Android Stack, Android Applications Structure, Android Emulator, Android SDK, Overview of Android Studio, Android and File Structure, Android Virtual Device Manager, DDMS, LogCat, Understanding Activities.
Android User Interface: Measurements – Device and pixel density independent measuring units. Layouts – Linear, Relative, Grid and Table Layouts.

Unit – II

User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers, List View, Spinner View.
Event Handling – Handling clicks or changes of various UI components.
Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS
Services- Callbacks and Override in application, Application Signing, API keys for Google Maps, Publishing application to the Android Market.

Unit – III

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities
Location and Mapping: location based services, Mapping, Google Maps activity, Working with MapView and MapActivity; Playing and Recording of Audio and Video in application; Sensors and Near Field Communication; Native libraries and headers, Building client server applications.

Unit – IV

Using Graphics: Canvas Drawing, Shadows, and Gradients.
Persisting Data to files: Saving to Internal Storage, Saving to External Storage
Introduction to SQLite database: creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (Insert, delete, retrieve and update).

Text Books:

1. ZigurdMednieks, Laird Dornin, G,BlakeMeike and Masumi Nakamura, Programming Android, O'Reilly Publications.
2. Wei-Meng Lee, Beginning Android Application Development, Wiley India Ltd.

Reference Books:

1. James C.S., Android Application development for Java Programmer, CENGAGE Learning.
2. Pradeep Kothari, Android Application Development: Black Book, Wiley India Ltd.
3. Gargenta M., Nakamura M., Learning Android, O'Reilly Publications.

MCA-20-44(i): Soft Computing

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Introduce fundamental soft computing concepts with an exposure to non-traditional techniques for problem solving and optimization. Provide Soft Computing based research oriented direction for solving imprecisely defined problems. Provide a comprehensive introduction to nature-inspired metaheuristic methods for search and optimization, including the latest trends in evolutionary algorithms and other forms of natural computing.

Course Outcomes: At the end of this course, the student will be able to:

MCA-20-44(i).1	have a knowledge of soft computing techniques along with their applications and non-traditional metaheuristic optimization and data clustering techniques & algorithms for obtaining optimized solutions to optimization, computational intelligence, and design/scheduling applications;
MCA-20-44(i).2	apply fuzzy logic theory to imprecisely defined problems;
MCA-20-44(i).3	use Neural Networks concepts to find solutions to problems where normally algorithmic methods do not exist or are costly;
MCA-20-44(i).4	design high-quality solutions using Genetic Algorithms for optimization and search problems and have exposure to MATLAB environment for implementing solutions to problems using soft computing techniques.

CO-PO Mapping Matrix for Course Code: MCA-20-44(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-44(i).1	3	3	3	3	2	3	3	2	3	-	3
MCA-20-44(i).2	3	3	3	3	2	3	3	2	3	-	3
MCA-20-44(i).3	3	3	3	3	2	3	3	2	3	-	3
MCA-20-44(i).4	3	3	3	3	2	3	3	2	3	-	3
Average	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**-**	**3**

CO-PSO Mapping Matrix for Course Code: MCA-20-44(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-44(i).1	3	3	3	3	3
MCA-20-44(i).2	3	3	3	3	3
MCA-20-44(i).3	3	3	3	3	3
MCA-20-44(i).4	3	2	3	3	3
Average	**3**	**2.75**	**3**	**3**	**3**

Unit – I

Soft Computing: Conventional AI to Computational Intelligence; Soft Computing Constituents and Applications.
Introduction toNon-traditional Metaheuristic Optimization Techniques: Random Optimization, Simulated Annealing, Tabu Search, Ant Colony Optimization, Particle Swarm Optimization, Harmony Search, Memetic

Algorithms, Other Evolutionary Algorithms such as Firefly Algorithm, Bee Algorithm, Shuffled Frog Leap algorithm, Bat algorithm etc.
Data Clustering Algorithms: K-Means, Fuzzy C-Means, Mountain Clustering, Subtractive Clustering.

Unit – II

Fuzzy Set theory: Fuzzy Sets & Classical Sets; Operations on Fuzzy Sets, Fuzzy Relations, Linguistic Variables.
Membership Functions: Introduction, Features &Fuzzification, Methods of Membership Value Assignment; Defuzzification.
Fuzzy Systems: Crisp Logic, Predicate Logic, Fuzzy Logic; Fuzzy Rule Base and Approximate Reasoning, Fuzzy Quantifiers; Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy Logic Control System; Fuzzy Expert Systems.

Unit – III

Neural Networks: Fundamental Concepts, Basic Models and Architecture; Machine Learning Using Neural Networks; Associative Memory Networks and their Applications.
Supervised Learning Neural Networks: Perceptron Networks, Radial Basis Function Networks: Back Propagation Neural Network: Architecture, Learning, Applications, & Research Directions; The Boltzman Machine.
Unsupervised Learning Networks: Competitive Learning networks; Kohonen Self-Organizing Networks; Hebbian learning; The Hopfield Network; Counterpropagation Networks; Adaptive Resonance Theory: Introduction, Architecture, & Applications; Feed forward Networks; Reinforcement Learning.

Unit – IV

Genetic Algorithms: Introduction to Genetic Algorithms (GA) and their Terminology; Traditional Optimization and Search Techniques vs GeneticAlgorithm; Operators in Genetic Algorithms; Problem Solving using Genetic Algorithm; Classification of Genetic Algorithms; Holland's Classifier Systems; Genetic Programming; Advantages and Limitations of Genetic Algorithm; Applications of Genetic Algorithm; Applications of GA in Machine Learning.
Introduction to Hybrid Systems; MATLAB Environment for Soft Computing Techniques.

Text Books:

1. S. N. Sivanandam& S. N. Deepa, Principles of Soft Computing, Wiley - India.
2. JyhShing Roger Jang, Chuen Tsai Sun, EijiMizutani, NeuroFuzzy and Soft Computing, Prentice Hall

Reference Books:

1. S.Rajasekaran and G.A.VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, Prentice-Hall of India Pvt. Ltd.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall.
3. George J. Klir, Ute St. Clair, Bo Yuan, Fuzzy Set Theory: Foundations and Applications Prentice Hall.
4. Simon O. Haykin, Neural networks: a comprehensive foundation, Pearson Education.
5. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall
6. Goldberg D. E., Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education.
7. Ahmad Lotfi, Jonathan Garibaldi, Applications and Science in Soft Computing, Springer.
8. Rajkumar Roy, Mario Koppen, Soft Computing and Industry: Recent Applications, Springer.
9. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India.
10. Du, Ke-Lin, Swamy, M. N. S., Search and Optimization by Metaheuristics: Techniques and Algorithms, Springer
11. OmidBozorg-Haddad, Mohammad Solgi, Hugo A. Loaiciga, Meta-heuristic and Evolutionary Algorithms for Engineering Optimization, Wiley

MCA-20-44(ii): Machine Learning

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week.
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester exam:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to enable student to perform experiments in Machine Learning using real-world data.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-44(ii).1	understand the basics of machine learning and supervised learning;
MCA-20-44(ii).2	analyse and implement the concepts of Naïve-Bayes and Regression;
MCA-20-44(ii).3	understand the unsupervised learning using clustering algorithms;
MCA-20-44(ii).4	perform dimensionality reduction and understand the basics of reinforcement learning.

CO-PO Mapping Matrix for the Course Code : MCA-20-44(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-44(ii).1	3	3	2	3	2	3	3	1	3	1	3
MCA-20-44(ii).2	3	3	2	3	2	3	3	1	3	1	3
MCA-20-44(ii).3	3	3	2	2	1	2	2	3	3	1	2
MCA-20-44(ii).4	3	3	2	2	1	2	2	3	3	1	2
Average	**3**	**3**	**2**	**2.5**	**1.5**	**2.5**	**2.5**	**2**	**3**	**1**	**2.5**

CO-PSO Mapping Matrix for the Course Code : MCA-20-44(ii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-44(ii).1	3	3	3	3	3
MCA-20-44(ii).2	3	3	3	3	3
MCA-20-44(ii).3	2	3	3	3	3
MCA-20-44(ii).4	2	3	3	3	3
Average	**2.5**	**3**	**3**	**3**	**3**

Unit – I

Machine Learning: Introduction to Machine Learning, Overview of Machine Learning, Key Terminology and task of ML, Applications of ML.
Supervised Learning: Classification, Decision Tree Representation- Appropriate problem for Decision Learning, Decision Tree Algorithm, and Hyperspace Search in Decision Tree.

Unit – II
Naive Bayes- Bayes Theorem, Classifying with Bayes Decision Theory, Conditional Probability, Bayesian Belief Network. Regression: Linear Regression- Predicting numerical value, Finding best fit line with linear regression, Regression Tree- Using CART for regression.
Unit – III
Logistic Regression - Classification with Logistic Regression and the Sigmoid Function. Clustering: Learning from unclassified data –Introduction to clustering, K-Mean Clustering, Expectation-Maximization Algorithm(EM algorithm), Hierarchical Clustering, Supervised Learning after clustering.
Unit – IV
Dimensionality reduction- Dimensionality reduction techniques, Principal component analysis, Anomaly Detection, Recommender Systems. SVM, Reinforcement Learning.
Text Books: 1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited. 2. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press.
Reference Books: 1.Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press. 2.Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press. 3.Peter Harrington, Machine Learning in Action, Manning 4.ShaiShalevShwartz and Shai Ben David, Understanding Machine Learning From Theory to Algorithms, Cambridge University Press

MCA-20-44 (iii): Digital Image Processing

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester examination: Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an introduction to the basic concepts and methodologies for digital image processing. To develop a foundation that can be used as a basis for further studies and research. Introduce the students to the fundamental techniques and algorithms used for acquiring, processing and extracting useful information from digital images.

Course Outcomes: At the end of this course, the student will be able to:

MCA-20-44(iii).1	get acquainted with digital image fundamentals and its applications and get acquainted with the image representation and description methods;
MCA-20-44(iii).2	Learn and perform image pre-processing and enhancement to improve the image for further processing;
MCA-20-44(iii).3	reconstruct photometric properties degraded by the imaging process and partition a digital image into multiple segments;
MCA-20-44(iii).4	represent and analyse images at different resolutions , process images according to their shapes, and apply compression techniques to reduce the storage space of images.

CO-PO Mapping Matrix for Course Code: MCA-20-44(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-44(iii).1	3	2	3	2	1	1	2	1	3	-	2
MCA-20-44(iii).2	3	3	3	2	1	2	2	1	3	-	2
MCA-20-44(iii).3	3	3	3	3	1	2	2	1	3	-	2
MCA-20-44(iii).4	3	3	3	3	1	2	2	1	3	-	2
Average	3	2.75	3	2.5	1	1.75	2	1	3	-	2

CO-PSO Mapping Matrix for Course Code: MCA-20-44(iii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-44(iii).1	3	3	1	3	2
MCA-20-44(iii).2	3	3	2	3	2
MCA-20-44(iii).3	3	3	2	3	2
MCA-20-44(iii).4	3	3	2	3	2
Average	3	3	1.75	3	2

Unit – I

Digital Image Fundamentals: Introduction to Digital Image Processing and its applications; Components of an Image Processing System.

Image Representation and Description: Image Representation; Digital Image Properties; Boundary descriptors; Regional descriptors; Steps in Digital Image Processing; Elements of Visual perception; Image

Sensing and Acquisition; Image Sampling and Quantization; Relationship between Pixels; Color Representation.
Data Structures for Image Analysis: Levels of Image Data Representation; Traditional Image Data Structures: Matrices, Chains, Topological Data Structures, Relational Structures; Hierarchical Data Structures: Pyramids, Quadtrees, Other Pyramidal Structures.

Unit – II

Image Pre-Processing: Pixel Brightness Transformations: Position-Dependent Brightness Correction, Gray-Scale Transformation; Geometric Transformations: Pixel Co-ordinate Transformations, Brightness Interpolation; Local Pre-Processing.
Image Enhancement: Spatial Domain: Gray level transformations; Histogram processing; enhancement using arithmetic and logic operators; Basics of Spatial Filtering; Smoothing and Sharpening Spatial Filtering.
Frequency Domain: Introduction to Fourier Transform; Filtering in the Frequency Domain; Smoothing and Sharpening frequency domain filters; Homomorphic Filtering.

Unit – III

Image Restoration and Segmentation: Noise models; Mean Filters; Order Statistics; Adaptivefilters; Noise Reduction by Frequency Domain Filtering; Inverse and Wiener filtering; Constrained Least Squares Filtering.
Segmentation: Point, line, and Edge Detection; Edge Linking and Boundary detection; Thresholding; Region based segmentation; Edge based Segmentation; Segmentation by Morphological Watersheds; Matching.
Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing.

Unit – IV

Wavelets and MultiresolutionProcessing: Background: Image Pyramids; Subband coding; Multiresolution expansions.
Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.
Compression – Fundamentals ; Image Compression models; Error-Free Compression; Variable Length Coding, LZW coding, Bit-Plane Coding, Lossless Predictive Coding; Lossy Compression: Lossy Predictive Coding, Transform Coding, wavelet Coding; Image Compression Standards.

Text Books:

1. Rafael C. Gonzales, Richard E. Woods, Digital Image Processing, Pearson Education.

Reference Books:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, Tata McGraw Hill.
2. Anil Jain K., Fundamentals of Digital Image Processing, PHI Learning.
3. Willliam K Pratt, Digital Image Processing, John Willey.
4. Malay K. Pakhira, Digital Image Processing and Pattern Recognition, PHI Learning.
5. S. Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing,McGraw Hill
6. B. Chanda ,D.DuttaMajumder, Digital Image Processing and Analysis, Prentice Hall of India.

MCA-20-45 (i): Optimization Techniques

Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various linear programming problems and their solution techniques. It focuses on various optimization techniques and their applications in problem solving.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-45 (i).1	understand the role and principles of optimization techniques in business world;
MCA-20-45 (i).2	understand the techniques to solve and use LPP and IPP;
MCA-20-45 (i).3	analyse the optimization techniques in strategic planning for optimal gain;
MCA-20-45 (i).4	understand the techniques to solve networking and inventory issues.

CO-PO Mapping Matrix for the Course Code : MCA-20-45 (i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-45 (i).1	3	2	1	2	1	2	1	1	2	1	1
MCA-20-45 (i).2	3	2	1	3	1	3	1	1	2	1	1
MCA-20-45 (i).3	3	2	1	3	1	3	1	2	3	1	3
MCA-20-45 (i).4	3	2	1	3	2	3	1	2	3	1	3
Average	**3**	**2**	**1**	**2.75**	**1.25**	**2.75**	**1**	**1.5**	**2.5**	**1**	**2**

CO-PSO Mapping Matrix for the Course Code : MCA-20-45 (i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-45 (i).1	3	2	2	3	2
MCA-20-45 (i).2	3	2	3	3	3
MCA-20-45 (i).3	3	2	3	3	3
MCA-20-45 (i).4	3	2	3	3	3
Average	**3**	**2**	**2.75**	**3**	**2.75**

Unit – I

Introduction: The Historical development, Nature, Meaning and Management Application of Operations research. Modelling, Its Principal and Approximation of O.R. Models, Main characteristic and phases, General Methods of solving models, Scientific Methods, Scope, Role on Decision Making and Development of Operation Research in India.

Linear Programming: Formulation, Graphical solution, standard and matrix form of linear programming problems, Simplex method and its flow chart, Two-phase Simplex method, Degeneracy.

Unit – II

Duality in LPP: Definition of Dual Problem, General Rules for converting any Primal into its Dual, Dual Simplex method and its flow chart.

Integer Programming: Importance, Applications and Classification, Gomory's all integer programming problem technique and its flow chart, Branch and Bound Method.

Unit – III

Transportation Models: Formulation of problem, Obtaining Initial Basic feasible solution, Optimality tests, Progressing towards optimal solution, Unbalanced Transportation Problems.

Assignment Models: Formulation of problem, Hungarian Method for Assignment Problems, Unbalanced Assignment Problems.

Unit – IV

Inventory theory Costs involved in inventory problems - single item deterministic models-economic lot size models without shortages and with shortages having production rate infinite and finite.

PERT and CPM: Basic steps in PERT/CPM, Techniques, Network Diagram Representation, Forward and Backward Pass-computation, Representation in Tabular form, Determination of Critical path, Critical activity, Floats and Slack Times, Implementation in any programming language.

Text Books:

1. Sharma, S.D., Operations Research, KedarNath and Ram Nath, Meerut.
2. Gupta P.K., Hira and D.S., Operation Research, Sultan Chand & Sons, New Delhi.

Reference Books:

1. KantiSwarup, Gupta P.K. & Man Mohan, Operation Research, Sultan Chand & sons, New Delhi.
2. Rao S.S., Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi.
3. Taha, H.A., Operation Research – An Introduction, McMillan Publishing Co, New York.
4. Gillet, B.E., Introduction to Operations Research: A Computer Oriented Algorithmic Approach, Tata McGraw Hill, New York.

MCA-20-45(ii): Information Systems

Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide an in-depth exploration of how businesses successfully manage information and provide insight into how today's businesses leverage information technologies and systems to achieve corporate objectives.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-45(ii).1	gain skills sought after in today's workplace;
MCA-20-45(ii).2	gain knowledge about IT Infrastructure & Emerging Technologies and their impact on business models and managerial decision-making;
MCA-20-45(ii).3	learn the security issues in information systems and various EnterpriseApplications;
MCA-20-45(ii).4	understand, participate in, and eventually lead management discussions and drivedecisions about the firm's information systems.

CO-PO Mapping Matrix for Course Code: MCA-20-45(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-45(ii).1	3	1	3	3	3	1	1	2	3	1	1
MCA-20-45(ii).2	3	2	3	3	3	1	2	2	3	1	2
MCA-20-45(ii).3	3	2	3	3	3	2	2	2	3	1	2
MCA-20-45(ii).4	3	2	3	3	3	2	1	2	3	1	2
Average	**3**	**1.75**	**3**	**3**	**3**	**1.5**	**1.5**	**2**	**3**	**1**	**1.75**

CO-PSO Mapping Matrix for Course Code: MCA-20-45(ii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-45(ii).1	3	2	2	3	2
MCA-20-45(ii).2	3	2	2	3	2
MCA-20-45(ii).3	3	2	2	3	2
MCA-20-45(ii).4	3	2	2	3	2
Average	**3**	**2**	**2**	**3**	**2**

Unit – I

Fundamental of Management Information systems: The Fundamental Roles of Information System in business, Trends in Information Systems, Types of Information Systems, Managerial Challenges of Information Technology.

The Components of Information Systems: System Concept, Components of an Information System, Information

System Resources, Information System Activities, Recognizing Information Systems.
Unit – II IT Infrastructure and Emerging Technologies: IT Infrastructure, Infrastructure Components, Software/Hardware Platform Trends and Emerging Technologies, Management Issues. Foundation of Business Intelligence: Databases and Information Management: Organizing Data in a Traditional File Environment, The Database Approach to Data Management, Using Database to Improve Business Performance and Decision Making, Managing Data Resources.
Unit – III Securing Information Systems: System Vulnerability and Abuse, Business Value of Security and Control, Establishing a Framework for Security and Control, Technologies and Tools for Security. Key System Applications for the Digital Age. EnterpriseApplications: Enterprise Systems, Supply Chain Management Systems, Customer Relationship Management Systems, Enterprise Applications: New Opportunities and Challenges.
Unit – IV Managing Knowledge: The Knowledge Management Landscape, Enterprises-Wide Knowledge Management Systems, Knowledge Work Systems, Intelligent Techniques. Enhancing Decision Making: Decision Making and Information Systems, Systems for Decision Support, Executive Support Systems (ESS), Group Decision-Support Systems (GDSS).
Text Books: 1. Kenneth C.Laudon, Jane P.Laudon, Management Information Systems: Managing the Digital Firm, Pearson Education. 2. James A O'Brien, George M Marakas, Management Information Systems, Tata McGraw-Hill.
Reference Books: 1. Laudon&Laudon, Essentials of Management Information Systems, Pearson Education. 2. McLeod & Schell, Management Information Systems, Pearson Education. 3. Jawadekar, W.S., Management Information Systems, Tata McGraw-Hill. 4. Robert G.Mudrick, CoelE.Ross, James R.Claggett,Information Systems for Modern Management.

MCA-20-45 (iii): Blockchain Technology

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester exam:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to introduce the concept of Blockchain. This course introduces the concept of Bitcoin and makes students familiar with Bitcoin network, payments, clients and APIs.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-45 (iii).1	understand the concept of Blockchain and Decentralization;
MCA-20-45 (iii).2	understand the usage of Block chain and Bitcoin implementation;
MCA-20-45 (iii).3	understand and analyse the Bitcoin network and payments;
MCA-20-45 (iii).4	analyze the various platforms used for Blockchain.

CO-PO Mapping Matrix for the Course Code : MCA-20-45 (iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MCA-20-45 (iii).1	3	3	2	1	1	1	2	1	1	1	2
MCA-20-45 (iii).2	3	2	2	2	1	2	3	2	2	1	1
MCA-20-45 (iii).3	3	3	2	2	1	2	3	2	3	1	3
MCA-20-45 (iii).4	3	3	2	3	1	3	3	3	3	1	3
Average	**3**	**2.75**	**2**	**2**	**1**	**2**	**2.75**	**2**	**2.25**	**1**	**2.25**

CO-PSO Mapping Matrix for the Course Code : MCA-20-45 (iii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
MCA-20-45 (i).1	3	3	2	2	2
MCA-20-45 (i).2	3	3	2	2	2
MCA-20-45 (i).3	3	3	3	3	2
MCA-20-45 (i).4	3	3	3	3	3
Average	**3**	**3**	**2.5**	**2.5**	**2.25**

Unit – I

Discover Blockchain Technology: Blockchain, Growth of blockchain technology, Distributed systems, History of blockchain and Bitcoin, Types of blockchain.
Decentralization: Methods of decentralization, Routes of decentralization, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized organizations and platforms for decentralization.

Unit – II

Blockchain: Architecture, Versions, Variants, Use cases, Life use cases of blockchain, Blockchainvs shared

Database, Introduction to cryptocurrencies, Types, Applications. Bitcoins: Introducing Bitcoin, Bitcoin digital keys and addresses, Transactions, Blockchain mining. Alternative Coins. Limitations of Bitcoin.
Unit – III Concept of Double Spending, Hashing, Proof of work. Bitcoin Network and payments, Bitcoin network, Wallets, Bitcoin payments, Innovation in Bitcoin, Bitcoin Clients and APIs.
Unit – IV Introduction to Blockchain Platforms: Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, etc. Advantages and Disadvantages, EthereumvsBitcoin, Design a new blockchain, Potential for disruption, Design a distributed application, Blockchain applications.
Text Books: 1. Imran Bashir, Mastering Blockchain, PACKT Publication. 2. ArshdeepBikramadityaSingal, GautamDhameja, PriyansuSekhar Panda., Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions, APress. 3. Bahga, Vijay Madisetti, Blockchain Applications: A Hands-On Approach. 4. Melanie Swan, Blockchain, OReilly
Reference Books: 1. Aravind Narayan. Joseph Bonneau, Bitcoin and Cryptocurrency Technologies, princton 2. Arthu.T Books, Bitcoin and Blockchain Basics: A non-technical introduction for beginners.

CO-PO-PSO MAPPING MATRIX FOR ALL THE COURSES OFMCA

SEMESTER	COURSE CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
I	MCA-20-11	3	2	3	3	3	2	2	2	2.75	1.75	1.75	3	2.75	2	3	2
	MCA-20-12	3	2	1	3	1	3	2	2.25	3	1	3	3	3	3	2	3
	MCA-20-13	3	2	3	3	3	1.75	1	1.75	3	1	2	3	2.5	2	3	2
	MCA-20-14	3	1.75	3	3	2	1.75	1.5	2	3	-	1.75	3	2.75	1.25	3	2
	MCA-20-15	3	2	3	3	3	2	2.25	2.5	3	1	2.25	3	2.5	1.5	3	2
II	MCA-20-21	3	1	2	3	2	3	3	1	2	2	2	3	3	2	3	3
	MCA-20-22	3	2	3	3	3	2.25	1.5	1	3	1	2	3	3	2	3	2
	MCA-20-23	3	2.5	2.75	2.5	2.5	2	2	2.75	2.25	2.5	1.75	2.25	2.75	1.5	2.5	2.5
	MCA-20-24(i)	3	3	1	3	1	3	2.5	3	3	1	3	3	3	3	2	3
	MCA-20-24(ii)	3	3	3	2	1.5	2	1.25	1	3	-	1.75	3	2.25	1.5	3	2
	MCA-20-24(iii)	3	2	2	2	1.75	2.25	2	2	3	1	2	3	2	3	3	2.75
	MCA-20-25(i)	3	2	1	3	1	3	2	2.5	3	1	3	3	3	3	2	3
	MCA-20-25(ii)	3	2.5	1	3	1.25	3	1.75	1	3	1.25	2.25	3	3	3	3	3
	MCA-20-25(iii)	3	3	1.75	2.75	1.5	2.5	2.5	2.25	2.5	2.25	2	2.5	2.25	2	1.5	1
III	MCA-20-31	3	2	3	3	3	1.5	1	2	3	1	1.5	3	2.5	1.5	3	2
	MCA-20-32	2.75	2.5	2.75	2.5	2.75	1.5	2.5	2.75	2.5	2	1.5	2.75	2.5	1.75	2.5	2.5
	MCA-20-33	3	2.25	1	3	1	3	2	2.5	3	1	3	3	3	3	2	3
	MCA-20-34(i)	3	2.5	3	3	3	2	2.5	2.5	3	2	2	3	3	2.5	3	2.5
	MCA-20-34(ii)	3	3	3	2.75	2.75	2.5	1.5	2.25	3	2	1.75	3	2.5	2.25	2.75	1.75
	MCA-20-34(iii)	3	1.75	1.75	1.25	1.5	1.5	2.75	1.5	2.5	1.5	2.5	3	2.75	2.5	2.5	2.25
	MCA-20-35(i)	3	2.75	2	2.5	2.5	2	3	2	3	1.25	3	3	3	2.75	3	2.5
	MCA-20-35(ii)	3	2	2.75	2.25	3	1.75	2.5	2	3	1	1.75	3	3	3	2.5	3
	MCA-20-35(iii)	3	2.5	1	3	1	3	3	1.5	3	1	3	3	3	3	2	3
IV	MCA-20-41	2.75	2.5	2.5	2.5	2.25	2	2.25	2	2.25	2.25	2	2.75	2.25	2.25	2.5	1.75
	MCA-20-42	3	1.75	3	2.75	1	1	1.75	1	3	-	1.25	3	2.75	1.25	3	2.75

SEMESTER	COURSE CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
	MCA-20-43	3	1	2	2.75	2	2.75	1.75	1.75	1	1	1	3	2.75	1	3	2.75
	MCA-20-44(i)	3	3	3	3	2	3	3	2	3	-	3	3	2.75	3	3	3
	MCA-20-44(ii)	3	3	2	2.5	1.5	2.5	2.5	2	3	1	3	2.5	3	3	3	3
	MCA-20-44(iii)	3	2	3	2.5	1	1.75	1.5	2	3	-	1.75	3	2.5	1.5	3	2.25
	MCA-20-45(i)	3	2	1	2.75	1.25	2.75	1	1.5	2.5	1	2	3	2	2.75	3	2.75
	MCA-20-45(ii)	3	1.75	3	3	3	1.5	1.5	2	3	1	1.75	3	2	2	3	2
	MCA-20-45(iii)	3	2.75	2	2	1	2	2.75	2	2.25	1	2.25	3	3	2.5	2.5	2.25
I to IV	**Average**	**2.98**	**2.24**	**2.26**	**2.70**	**1.97**	**2.23**	**2.06**	**1.95**	**2.77**	**1.36**	**2.14**	**2.93**	**2.69**	**2.26**	**2.70**	**2.45**

Kurukshetra University, Kurukshetra
(Established by the State Legislature Act XII of 1956)
(‘A+’ Grade, NAAC Accredited)

|| योगस्थ: कुरु कर्माणि ||
समबुद्धि व योगयुक्त होकर कर्म करो
(Perform Actions while Stead fasting in the State of Yoga)

Scheme of Examination and Syllabus of

Master of Science (M.Sc.) Computer Science(Software)(CBCS) in Phased Manner

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS

CBCS CURRICULUM (2020-21)

Program Name: Master of Science (M.Sc.)Computer Science (Software)(CBCS)

(For the Batches Admitted From 2020-2021)

10(3516)

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS
KURUKSHETRA UNIVERSITY, KURUKSHETRA

VISION

Pursue conducive advancement towards nurturing globally competent and ethically conscientious professionals and entrepreneurs in agile computing technologies and allied spheres for unceasing evolution of Nations IT affiliated commercial and research endeavours.

MISSION

Thrive to establish a strong foundation for technical competency in spheres concordant to software oriented design and development. Nurture skills and competency for administering expertise gained in computing discipline to a wide horizon of interdisciplinary application domains, thus supporting sustainable development of the society. Habituate the students to strive for technological innovations and successful endeavours ethically, supported by sustained learning continuance and problem solving proficiency that may promote nations welfare in terms of economic acceleration leading to the growth of society.

NAME OF THE PROGRAMME: MASTER OF SCIENCE
(COMPUTER SCIENCE (SOFTWARE))
DURATION :TWO YEARS

PROGRAMME OUTCOMES (POs)	
PO1	Knowledge Capable of demonstrating comprehensive disciplinary knowledge gained during course of study.
PO2	Research Aptitude Capability to ask relevant/appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis.
PO3	Communication Ability to communicate effectively on general and scientific topics with the scientific community and with society at large.
PO4	Problem Solving Capability of applying knowledge to solve scientific and other problems.
PO5	Individual and Team Work Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings.
PO6	Investigation of Problems Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions.
PO7	Modern Tool usage Ability to use and learn techniques, skills and modern tools for scientific practices.
PO8	Science and Society Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices.
PO9	Life-Long Learning Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life.
PO10	Ethics Capability to identify and apply ethical issues related to one's work, avoid unethical behaviour such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work.
PO11	Project Management Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects.

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
PSO1	Provide exposure to the hardware and software environment of computer systems along with a comprehensive strengthening of computational expertise in programming languages and open source platforms.
PSO2	Enhance competency in designing and modeling software based applications with enrichment of proficiency in software design skills.
PSO3	Strengthen technical skills and professional expertise in adopting contemporary trends and technological developments for the application of innovative approaches and propositions to real-world problem scenario.
PSO4	Inspire pursuance of skillful expertise for careers in Commercial/ Government Sectors, Academics/ Consultancy/ Research and Development for technological innovations, and collateral fields related to Computer Science and Information Technology.

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SCHEME OF EXAMINATION FOR MASTER OF SCIENCE
(COMPUTER SCIENCE (SOFTWARE))
CHOICE BASED CREDIT SYSTEM (CBCS)
W. E. F. ACADEMIC SESSION 2020-21 IN PHASED MANNER

Paper Code	Nomenclature of Paper	Credits	Workload Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks	Total Marks	Pass Marks
					Max.	Pass			
First Semester									
MS-20-11	Web Engineering	4	4	3	75	30	25	100	40
MS-20-12	Advanced Database Systems	4	4	3	75	30	25	100	40
MS-20-13	Linux and Shell Programming	4	4	3	75	30	25	100	40
MS-20-14	Discrete Mathematical Structures	4	4	3	75	30	25	100	40
MS-20-15	S/W Lab – I Based on MS-20-11 and MS-20-12	2.5	5	3	100	40	-	100	40
MS-20-16	S/W Lab – II Based on MS-20-13	2.5	5	3	100	40	-	100	40
	Total	**21**	**26**		**500**	**200**	**100**	**600**	**240**
Second Semester									
MS-20-21	Data Structures and Algorithms	4	4	3	75	30	25	100	40
MS-20-22	Programming in Java	4	4	3	75	30	25	100	40
MS-20-23	Object Oriented Analysis and Design using UML	4	4	3	75	30	25	100	40
MS-20-24	Data Communication and Computer Networks	4	4	3	75	30	25	100	40
MS-20-25	S/W Lab – III Based on MS-20-21	2.5	5	3	100	40	-	100	40
MS-20-26	S/W Lab – IV Based on MS-20-22	2.5	5	3	100	40	-	100	40
*OE-20-27	Open Elective Based on MOOCs (The selected course should not be directly related with Computer Science) Or As Per University Guidelines	2	2	3	35	14	15	50	20
	Total	**23**	**28**		**535**	**214**	**115**	**650**	**260**
Third Semester									
MS-20-31	Data Mining and Analytics using R	4	4	3	75	30	25	100	40
MS-20-32	Computer Graphics and Animation	4	4	3	75	30	25	100	40
MS-20-33	Elective-I	4	4	3	75	30	25	100	40
MS-20-34	Elective-II	4	4	3	75	30	25	100	40
MS-20-35	S/W Lab – V Based on MS-20-31	2.5	5	3	100	40	-	100	40
MS-20-36	S/W Lab – VI Based on MS-20-32	2.5	5	3	100	40	-	100	40
**MS-20-37	Summer Training / Internship	8	-	Viva Voce	150	60	50	200	80
*OE-20-38	Open Elective Based on MOOCs (The selected course should not be directly related with Computer Science) Or As Per University Guidelines	2	2	3	35	14	15	50	20
	Total	**31**	**28**		**685**	**274**	**165**	**850**	**340**

Paper Code	Nomenclature of Paper	Credits	Workload Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks	Total Marks	Pass Marks
					Max.	Pass			
			Elective – I						
MS-20-33(i)	Compiler Design	4	4	3	75	30	25	100	40
MS-20-33(ii)	Advanced Computer Architecture	4	4	3	75	30	25	100	40
MS-20-33(iii)	Principles of Programming Languages	4	4	3	75	30	25	100	40
			Elective – II						
MS-20-34 (i)	Mobile Computing	4	4	3	75	30	25	100	40
MS-20-34 (ii)	Theory of Computation	4	4	3	75	30	25	100	40
MS-20-34(iii)	Artificial Intelligence	4	4	3	75	30	25	100	40
			Fourth Semester						
MS-20-41	Mobile Application Development	4	4	3	75	30	25	100	40
MS-20-42	Machine Learning using Python	4	4	3	75	30	25	100	40
MS-20-43	Elective-III	4	4	3	75	30	25	100	40
MS-20-44	Elective-IV	4	4	3	75	30	25	100	40
MS-20-45	S/W Lab–VII Based on MS-20-41	2.5	5	3	100	40	-	100	40
MS-20-46	S/W Lab-VIII Based on MS-20-42	2.5	5	3	100	40	-	100	40
	Total	**21**	**26**		**500**	**200**	**100**	**600**	**240**
	Grand Total	**96**	**108**		**2220**	**888**	**480**	**2700**	**1080**
			Elective – III						
MS-20-43 (i)	Cryptography and Network Security	4	4	3	75	30	25	100	40
MS-20-43 (ii)	Big Data and Pattern Recognition	4	4	3	75	30	25	100	40
MS-20-43(iii)	Cyber Security and Blockchain Technology	4	4	3	75	30	25	100	40
			Elective – IV						
MS-20-44 (i)	Optimization Techniques	4	4	3	75	30	25	100	40
MS-20-44 (ii)	Soft Computing	4	4	3	75	30	25	100	40
MS-20-44(iii)	Cloud Computing and IoT	4	4	3	75	30	25	100	40

***Note 1:** In addition to the credits earned by compulsory and elective courses, every student has to earn 2 more credits by selecting an open elective/MOOC course during second and third semester.

****Note 2:** Summer Training / Internship will be held immediately after 2nd Semester Examination and will be having a minimum duration of 45 days and maximum duration of 60 days. Students have to submit the Summer Training / Internship Report latest by 30th August. Evaluation of the Report and Viva-Voce shall be held during 3rd Semester. The Evaluation and Viva-Voce shall be held by one External and one Internal examiner.

Note 3: The credits for the first year are44(21+23) and for the second year are 52(31+21). Total credits of the courseshall be 44+52 = 96.

Note 4: For the purpose of computation of work-load the following mechanism shall be adopted:

- 1 Credit = 1 Theory period of one hour duration.
- 1 Credit = 1 Practical period of two hour duration.

Note 5: Evaluation procedure for internal assessment marks:

Two Mid Term Examinations should be conducted by the concerned teacher each of 10 marks. Five marks may be given by the concerned teacher on the basis of performance during the course (puzzles/ assignments/ interactions/ attendance etc).

Note 6: Size of groups in all practical courses should not be more than thirty students.

MS-20-11: Web Engineering	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide fundamentals concepts of Web Services, JavaScript and lays foundations for the advanced studies in the area of web services.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-11.1	design web pages using HTML5 and CSS;
MS-20-11.2	understand objects and data validation in JavaScript;
MS-20-11.3	build Dynamic website using server sidePHP Programmingand Databaseconnectivity;
MS-20-11.4	create web applications with Ajax.

CO-PO Mapping Matrix for Course Code: MS-20-11

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-11.1	3	1	2	3	2	3	3	1	2	2	2
MS-20-11.2	3	1	2	3	2	3	3	1	2	2	2
MS-20-11.3	3	1	2	3	2	3	3	1	2	2	2
MS-20-11.4	3	1	2	3	2	3	3	1	2	2	2
Average	**3**	**1**	**2**	**3**	**2**	**3**	**3**	**1**	**2**	**2**	**2**

CO-PSO Mapping Matrix for Course Code: MS-20-11

COs	PSO1	PSO2	PSO3	PSO4
MS-20-11.1	3	3	2	3
MS-20-11.2	3	3	2	3
MS-20-11.3	3	3	2	3
MS-20-11.4	3	3	2	3
Average	**3**	**3**	**2**	**3**

Unit – I

Introduction: Web browsers and its functions, web optimizations; Static page design; designing static web pages with HTML5.0-HTML basic, multimedia, Graphics, Form tags, CSS 2.0 concept and its properties & CSS 3.0 properties i.e. borders, backgrounds, fonts, text effects, Buffering, Weblog, Web Cache Poisoning.

Unit – II

JavaScript: Document Object Model (DOM), Obtaining user inputs, memory concepts, Operators, Control Structures, Looping constructs, break, continue statements, Programmer defined functions, Scoping rules, Recursion and iteration, Array declaration and allocation, passing arrays to function, Objects: String, Date, Boolean, Window, document; using cookies, form validation in Java Script, Handling Events Using JavaScript.

Unit – III

PHP: Installing and Configuring MySQL and PHP, Basic Security Guidelines, Variables, Data Types, Operators and Expressions, Constants, Flow Control Functions; Switching Flow, Loops, Code Blocks and Browser Output, Objects, Strings Processing, Form processing, Connecting to database, cookies, Session, dynamic contents.

Unit – IV

Introduction to AJAX: Exploring different web technologies, Creating a simple AJAX application, Interacting with the Web Server Using the XMLHttpRequest Object, Create an XMLHttpRequest Object, Interact with the Web Server. Differentiating AJAX and Non-AJAX application.

Search engine optimization for individual web pages: header entries, tags, selection of URL, alt tags, Search engine optimization for entire website: Hyperlinks and link structure, page rank of Google, click rate, residence time of website

Text Books:

1. Deitel H.M., Deitel P.J., Internet & World Wide Web: How to program, Pearson Education.
2. Kogent Learning, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.

Reference Books:

1. Boronczyk, Naramore, Beginning PHP, Apache, MySQL Web Development, Wiley India Pvt. Ltd.
2. Thomas Powell, Ajax: The Complete Reference.
3. Maro Fischer, Website Boosting: Search Engine, Optimization, Usability, Website Marketing, Firewall Media, New Delhi.

MS-20-12: Advanced Database Systems

Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide an in- depth knowledge of SQL and PL/SQL to design database for an organization. This course focuses on advance topics of the database including EER model, object oriented database, and emerging concepts of database.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-12.1	review the fundamental aspects of database along with EER model;
MS-20-12.2	get the practical exposure to SQL and PL/SQL to implement database management system in an organization;
MS-20-12.3	learn normalization and concurrency control techniques;
MS-20-12.4	acquire knowledge of different kind of emerging databases in real life scenario.

CO-PO Mapping Matrix for the Course Code : MS-20-12

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-12.1	3	3	3	3	2	2	1	3	2	2	3
MS-20-12.2	3	2	3	1	3	2	3	3	2	2	1
MS-20-12.3	3	2	2	3	2	2	2	1	3	2	2
MS-20-12.4	2	3	3	2	3	1	3	3	3	2	3
Average	**2.75**	**2.5**	**2.75**	**2.25**	**2.5**	**1.75**	**2.25**	**2.5**	**2.5**	**2**	**2.25**

CO-PSO Mapping Matrix for the Course Code : MS-20-12

COs	PSO1	PSO2	PSO3	PSO4
MS-20-12.1	3	3	3	3
MS-20-12.2	2	2	2	2
MS-20-12.3	3	3	2	3
MS-20-12.4	2	3	1	2
Average	**2.5**	**2.75**	**2**	**2.5**

Unit – I

Database System Concepts and Architecture: Three - Schema Architecture and Data Independence, Entity Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships Types & instances ER Diagrams, Naming conventions and Design Issues. Relational Model Constraints, Enhanced Entity Relationship Model: Subclasses, Super classes, Inheritance, Specialization and Generalization.

Unit – II

SQL: Data Definition and Data Types, DDL, DML, and DCL, Join Operations, Views & Queries in SQL, Specifying Constraints & Indexes in SQL. PL/SQL: Architecture of PL/SQL, Basic Elements of PL/SQL, PL/SQL Transactions, Cursors and Triggers. Relational Algebra: Unary and Binary Relational Operations.

Unit – III

Functional Dependencies, Normal Forms Based on Primary Keys- (1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF, Domain Key Normal Form. Query Processing and Optimization, Introduction to Transaction Processing, and Desirable Properties of Transactions, Concurrency Control Techniques, Database Backup and Recovery.

Unit – IV

Overview Object Oriented Database Model, Databases for Advance Applications: Architecture for Parallel Database and Distributed Database, Active Database Concept and Triggers, Temporal Databases Concepts, Spatial and Multimedia Databases, Geographical Information System, Mobile Databases, Web Databases, XML Schema, XML Query.

Text Books:

1. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education.
2. Jules J. Berman, Principles of Big Data, Elsevier India.

Reference Books:

1. Date C.J., An Introduction to Database Systems, Pearson Education.
2. Hector G.M., Ullman J.D., Widom J., Database Systems: The Complete Book, Pearson Education.
3. Silberschatz A., Korth H., Sudarshan S., Database System Concepts, McGraw Hill.

MS-20-13: Linux and Shell Programming	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objectives of this course are to provide the in-depth coverage of various concepts of Linux. Linux administration is an essential course for the students.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-13.1	understand the basic concepts and commands of Linux;
MS-20-13.2	understand the file management and process manipulation in Linux;
MS-20-13.3	understand the C environment under Linux and do the system administration andcommunication in Linux;
MS-20-13.4	developshell programs in Linux.

CO-PO Mapping Matrix for Course Code: MS-20-13

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-13.1	3	2	3	3	3	2	1	1	3	1	2
MS-20-13.2	3	2	3	3	3	2	1	1	3	1	2
MS-20-13.3	3	2	3	3	3	2	2	1	3	1	2
MS-20-13.4	3	2	3	3	3	3	2	1	3	1	2
Average	**3**	**2**	**3**	**3**	**3**	**2.25**	**1.5**	**1**	**3**	**1**	**2**

CO-PSO Mapping Matrix for Course Code: MS-20-13

COs	PSO1	PSO2	PSO3	PSO4
MS-20-13.1	3	2	3	2
MS-20-13.2	3	2	3	2
MS-20-13.3	3	2	3	3
MS-20-13.4	3	2	3	3
Average	**3**	**2**	**3**	**2.5**

Unit – I

Introduction: History, Basic features, architecture, distributions. Installing Linux, Logging in / Logging out.
File System: Introduction to files, Organization, Assessing File systems, Structure - boot block, super block, inodeblock, data block.
Basic and Advanced Commands: Directory oriented commands, File oriented commands, File access permissions: chmod, umask, chgrp, groups. General purpose commands.

Unit – II

File management and Compression: Computer devices, Disk related commands: dd, du, df, dfspace, fdisk, compressing and uncompressing files.
Manipulating Processes and Signals:Basics, process states and transitions, zombie and orphan processes, process oriented commands. Handling foreground and background jobs. Process scheduling using cron, crontab, at, batch. Changing priority. Signal generation and Handling.
System calls: Files related system calls for opening, creating, reading, writing, relocating file descriptors, closing, duplicating file descriptors, linking, unlinking, accessing file status information, checking permissions, changing ownership, groups and permissions of files. Process related system calls: exec, fork, wait, exit.

Unit – III

System Administration: Booting and shutting down process. Creating, mounting and unmounting file systems. Managing User accounts**:** creating, modifying & deleting user accounts and groups.
Networking Tools: Communication oriented commands. ping, nslookup, telnet, arp, netstat, route, ftp, trivial file transfer protocol, finger, rlogin.
C language compiler, the make command and makefiles, general debugging techniques, debugging with gdb.

Unit – IV

Pipes and filters: Connecting processes with pipes, redirecting input and output. Filters: sort, grep, egrep, fgrep, uniq, more, pr, cut, paste, tr.
Shell Programming: Shell meaning & types; Introduction to shell scripting, shell variables, exporting shell variables, Escape mechanisms, Shell meta characters, read command, conditional statements, looping and case statements, expr statement, command line arguments, sleep and basename commands, Bourne Shell Commands, string handling, arrays, shell functions, shell programs to automate system tasks.

Text Books:

1. Harwani B.M., Unix and Shell Programming, Oxford University Press.
2. Goerzen John, Linux Programming Bible, IDG Books, New Delhi.

Reference Books:

1. Matthew Neil, Stones Richard, Beginning Linux Programming, Wiley India Pvt. Ltd.
2. Christopher Negus, Linux Bible, Wiley India Pvt. Ltd.
3. Das Sumitabha, You UNIX – The Ultimate Guide, Tata McGraw Hill
4. Richard Peterson, Linux – The Complete Reference, Tata McGraw Hill

MS-20-14: Discrete Mathematical Structures

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester exam:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide in-depth coverage of discrete mathematical structures. It focuses on learning about sets, logics, analysis techniques, and graphs and their use in the field of computer science.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-14.1	understand the basic concepts of sets, function and relations;
MS-20-14.2	understand logics and counting principles;
MS-20-14.3	understand the lattices, Boolean algebra and their use in computer science;
MS-20-14.4	design and understand the working with graphs and trees.

CO-PO Mapping Matrix for the Course Code : MS-20-14

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-14.1	3	2	1	1	2	2	1	2	2	1	2
MS-20-14.2	3	3	1	3	1	3	1	2	3	1	2
MS-20-14.3	3	1	1	2	1	2	1	1	2	1	2
MS-20-14.4	3	2	1	2	1	2	1	1	2	1	2
Average	**3**	**2**	**1**	**2**	**1.25**	**2.25**	**1**	**1.5**	**2.25**	**1**	**2**

CO-PSO Mapping Matrix for the Course Code : MS-20-14

COs	PSO1	PSO2	PSO3	PSO4
MS-20-14.1	2	2	2	3
MS-20-14.2	2	3	3	3
MS-20-14.3	3	3	3	3
MS-20-14.4	3	2	2	3
Average	**2.5**	**2.5**	**2.5**	**3**

Unit – I

Set Theory: Basic Set Theory, Operations on Sets, Algebra of sets, Venn Diagrams.
Relations: Binary Relations, Complement of relations, Inverse of relations, Composite relations, Properties, Equivalence, Partial Order and Total order relations.
Functions: Functions on Set, Domain, Co-domain, Representation of Functions, Types, Identity and Inverse Functions, Composition of Functions.

Unit – II

Propositional Calculus: Propositional logic, Equivalences, Predicates, Quantifiers, Nested Quantifiers, Rules of Inference, Normal Forms, Proofs: Methods, Strategy. Counting: Pigeonhole Principle, Inclusion-Exclusion Principle, Permutations and Combinations, Binomial Coefficients, Counting Principles.
Unit – III Advanced Counting Techniques: Recurrence Relations, Solving Recurrence Relations Lattices and Boolean algebra: Lattices, Hasse Diagram, Principle of Duality, Types of Lattices, Special Lattices, Boolean Expression, Equivalent circuits, Dual, Normal Forms.
Unit – IV Graphs: Introduction, Terminology, Types of Graphs, Representation of Graphs, Paths and Circuits, Cut-set and Cut - Vertices, Graph Isomorphism, Homomorphism, Connectivity, Bipartite Graphs, Subgraphs, Operations on Graphs, Euler and Hamiltonian Graphs, Shortest Path Problem, Planar & Dual Graphs, Coloring. Tree: Tree Notations, Properties of tree, Types of Tree, Operations, Minimum Spanning Tree (MST).
Text Books: 1. Kenneth G. Rosen, Discrete Mathematics and Its Applications, Tata McGraw Hill. 2. Koshy T., Discrete Mathematics with Applications, Elsevier India.
Reference Books: 1. Eric Gosett, Discrete Mathematics with proof, Wiley India Pvt. Ltd. 2. Seymour Lipshutz, Schaum Outlines of Discrete Mathematics, Tata McGraw-Hill. 3. Kenneth Ross, Discrete Mathematics, Pearson Educations India.

MS-20-21: Data Structures and Algorithms	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide in-depth coverage of advanced data structures and algorithm design techniques. It focuses on learning about analysing and designing algorithms to solve a problem and learn to find the asymptotic efficiency of an algorithm.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-21.1	analyse worst-case running times of algorithms using asymptotic analysis;
MS-20-21.2	understand the basic and advanced data structures and to implement them;
MS-20-21.3	understand and implement various techniques for problem solving;
MS-20-21.4	identify the type of problem and solving using appropriate technique.

CO-PO Mapping Matrix for the Course Code : MS-20-21

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-21.1	3	3	1	3	1	3	2	3	3	1	2
MS-20-21.2	3	2	1	3	1	3	2	3	3	1	2
MS-20-21.3	3	3	1	3	3	3	2	3	3	1	3
MS-20-21.4	3	2	1	3	3	3	2	3	3	1	3
Average	**3**	**2.5**	**1**	**3**	**2**	**3**	**2**	**3**	**3**	**1**	**2.5**

CO-PSO Mapping Matrix for the Course Code : MS-20-21

COs	PSO1	PSO2	PSO3	PSO4
MS-20-21.1	2	3	2	3
MS-20-21.2	2	3	2	3
MS-20-21.3	2	3	3	3
MS-20-21.4	2	3	3	3
Average	**2**	**3**	**2.5**	**3**

Unit – I

Introduction to Data Structures: Classification of Data Structures, Arrays.

Stacks & Queues: Representation of Stacks, Stack Operations, Applications, Queues, Operations on Queues, Circular Queues, Dequeue, Priority Queues, Applications.

Introduction to Algorithms: Role of algorithms in computing, Complexity of algorithms, analysing algorithms, designing algorithms, asymptotic notations.

Unit – II

Linked Lists: Introduction, Types, and Operations (Insertion, Deletion, Traversal, Searching), Applications, Dynamic Memory Management, and Implementation of Linked Representations.

Trees: Binary Tree Traversals, Threaded Binary Trees, Binary Search Trees and Operations, AVL Trees, Heap, M-way Search Trees, B-Trees, B+ Trees, Applications.

Unit – III

Divide and Conquer: Solving recurrence equations: back substitution method, recursion tree method, master's theorem.

Analysis of heap sort and quick sort; Counting sort, Radix sort, Bucket sort, Lower bounds for sorting.

Dynamic Programming (DP): Elements of DP, Matrix chain multiplication, Longest common subsequence, optimal binary search trees.

Unit – IV

Greedy Techniques (GT): Elements of GT, Activity selection problem, Huffman codes, Knapsack Problem.

Graph Algorithms: Negative weight cycle, Bellman-Ford algorithm. All Pairs Shortest Path.

Maximum Flow: Flow network, Ford-Fulkerson method.

Strings: Storage of strings, Naive string-matching algorithm, Rabin-Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm

Text Books:

1. G.A.V Pai, Data Structures and Algorithms, McGraw-Hill.
2. Cormen, Leiserson, Rivest, Introduction to Algorithms, PHI India.

Reference Books:

1. Neapolitan R., Foundations of Algorithms, Jones and Bartlett Learning.
2. Seymour Lipschutz, Data Structures, McGraw-Hill, Schaum's Outlines, New Delhi.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education.

MS-20-22: Programming in JAVA	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The course aims is to equip the students with JAVA programming language concepts with object-oriented programming principles.In this course student will be able tolearn the basic syntax and semantics of the Java language and programming environment, build robust applications using Java's object-oriented features, implement the interface, Packages and inheritance, understand exceptional handling and multi-threading concepts and implementation using Applets, AWT and Event Handling and concepts of JAVA beans, Swing.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-22.1	learn the basic features of Java;
MS-20-22.2	develop program using different concepts of OOPs;
MS-20-22.3	develop programming using Java I/O stream classes;
MS-20-22.4	design and Implement Graphics programming using Applet, AWT and Layouts.

CO-PO Mapping Matrix for Course Code: MS-20-22

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-22.1	3	1	3	3	3	2	1	2	3	1	2
MS-20-22.2	3	2	3	3	3	2	2	2	3	2	2
MS-20-22.3	2	2	3	3	3	2	2	2	3	2	2
MS-20-22.4	3	3	3	3	3	2	1	2	3	1	2
Average	**2.75**	**2**	**3**	**3**	**3**	**2**	**1.5**	**2**	**3**	**1.5**	**2**

CO-PSO Mapping Matrix for Course Code: MS-20-22

Cos	PSO1	PSO2	PSO3	PSO4
MS-20-22.1	3	2	2	3
MS-20-22.2	3	3	2	3
MS-20-22.3	3	3	2	3
MS-20-22.4	3	3	2	3
Average	**3**	**2.75**	**2**	**3**

UNIT – I

Introduction to Java: Importance and features of Java, Java virtual machine, Byte code, JDK, Keywords, constants, variables and Data Types, Operators and Expressions, Decision Making, Branching and Looping, jump statements: break, continue, and return. Introducing classes, objects and methods: defining a class, adding variables and methods, creating objects, constructors, class inheritance. Arrays and String: Creating an array, one and two dimensional arrays, string array and methods.

UNIT – II

Packages and interfaces, Exception Handling: Fundamentals exception types, uncaught exceptions, throw exception, built in exception, creating your own exceptions, Multithreaded Programming: Fundamentals, Java thread model: synchronization, messaging, thread classes, Runnable interface, inter thread Communication, suspending, resuming and stopping threads.

UNIT – III

I/O Streams: String and String Buffer classes, Wrapper classes: Basics types, using super, Multilevel hierarchy abstract and final classes. Input/Output Programming: Basics, Streams, Byte and Character Stream, predefined streams, Reading and writing from console and files.

UNIT –IV

Event Handling: Different Mechanism, the Delegation Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes, Working with windows, Graphics and Text, using AWT controls, Layout managers, handling Image, animation, sound and video, Beans: Introduction to Java Beans.

Text Books:

1. E. Balaguruswamy, Programming with JAVA- A Primer, Tata Mc-Graw Hill.
2. Patrick Naughton, Herbert, Schild, The Complete reference Java 2, Tata Mc-Graw Hill.

Reference Books:

1. Patrick Nieaneyer and Joshna Peck, Exploring Java, O, Reilley.
2. Hareliy Hahn, Teacher the Internets, P.H.I.
3. Barry Boone, William Stanck, Java 2 exam Guide, Tata Mc-Graw Hill.

MS-20-23: Object Oriented Analysis and Design Using UML	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To understand the concepts of UML and its applications for class modeling, state modeling, use case modeling, interactionmodeling, activity modeling etc. and to analyse & design software systems using object-oriented approach.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-23.1	understand basics of modeling and fundamentals of UML such as things, relationships, diagrams, extensibility mechanisms and views;
MS-20-23.2	to practically apply knowledge of class modeling and state modeling using object-oriented analysis and design methods with a clear emphasis on UML;
MS-20-23.3	to practically apply knowledge of use case modeling, interaction modeling and activity modelingusing UML;
MS-20-23.4	have a working ability and grasping attitude to analyse and design software systems based on object-oriented thinking using UML.

CO-PO Mapping Matrix for Course Code: MS-20-23

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-23.1	3	2	3	3	3	2	2	2	3	1	2
MS-20-23.2	3	2	3	3	3	2	2	2	3	1	2
MS-20-23.3	3	2	3	3	3	2	2	3	3	1	2
MS-20-23.4	3	2	3	3	3	2	3	3	3	1	3
Average	**3**	**2**	**3**	**3**	**3**	**2**	**2.25**	**2.5**	**3**	**1**	**2.25**

CO-PSO Mapping Matrix for Course Code: MS-20-23

COs	PSO1	PSO2	PSO3	PSO4
MS-20-23.1	2	3	3	3
MS-20-23.2	2	3	3	3
MS-20-23.3	2	3	3	3
MS-20-23.4	2	3	3	3
Average	**2**	**3**	**3**	**3**

Unit – I

ModelingasaDesignTechnique: Principles of modeling, abstraction,encapsulation,modularity,hierarchy,typing,concurrency, persistence ofobjects,purposeofmodeling
UML:Principlesofmodeling,UMLthings–structural,behavioral,grouping, annotational.Relationshipsin UML–dependency,association,generalization,realization.OverviewofUML diagrams, Mechanisms in the UML–

specifications, adornments, common divisions, Extensibility mechanisms - stereotypes, tagged values, constraints, UML profiles, UML views.
Unit – II Class Modeling:Object &Class, Links &Associations, Generalization &Inheritance,Association Ends - scope, visibility, Multiplicity,Rolenames,Ordering,bags & sequences, Qualified association,Aggregation,association attributes &association classes, propagation of operations,Abstractclass, Metadata, reification, Constraints, derived data, packages, elements of class diagrams, constructingclassdiagrams. StateModeling:Events,States,Transitions & Conditions, Activity Effects, Do-Activities, Entry & Exit Activities, CompletionTransitions, Sending Signal,Elements of Statediagrams,Nestedstatediagrams, signalgeneralization, concurrency, constructing state diagrams.
Unit – III Use Case modeling: Actors, Use Cases, relationships - between actors, between use cases and between actor and use case, elements of use case diagram, constructing use case diagrams. Interaction Modeling: Elements of sequence diagram and communication diagram, constructing sequence diagram and communication diagram Activity Modeling: Elements of activity diagram, constructing activity diagram
Unit – IV SystemAnalysis&design:Systemdevelopmentstages,systemconception,analysis, domainclassmodel, domain state model,iteratingthe analysis. Applicationinteraction model, application class model, application state model, addingoperations SystemDesign:estimatingperformance,makeareuseplan,organizethesystemintosubsystem,identifying concurrency, allocating subsystems to processors and tasks, management of data stores, handling global resources, choosing software control strategies, handling boundary conditions, setting trade-off priorities, selectingan architectstyle. Class Design: bridging gap, realize use cases with operations, designing algorithms, design optimization, adjustmentofinheritance.
Text Books: 1. GradyBooch,JamesRumbaugh,IvarJacobson,TheUnifiedModelingLanguageUserGuide, Pearson education. 2. M. Blaha,J. Rumbaugh, Object-OrientedModelingand Design with UML, Pearson Education.
Reference Books: 1. J.Rumbaugh,M.Blaha,W.Premerlani,F.Eddy,W.Lorensen,Object-OrientedModelingandDesign, Prentice HallofIndia. 2. Satzinger,Jackson, Burd,Object-OrientedAnalysis& Design withthe UnifiedProcess,Thomson. 3. GradyBooch, ObjectOrientedAnalysis & Design, Pearson Education.

MS-20-24 Data Communication and Computer Networks	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives:
Provide an in-depth coverage of various concepts, components, and technologies of Computer Networks and Data Communication. Provide the architectural overview of the Internet. Enable the exposure of students to the current trends in wired and wireless communication technologies and real-world networking scenario

Course Outcomes: At the end of this course, the student will be able to:

MS-20-24.1	characterize various types of computer networks and standards along with an insight into the principles of networking by using protocol layering of the Internet and the TCP/IP protocol suite;
MS-20-24.2	comprehend the notion of data communication and its related functional components and aspects;
MS-20-24.3	understand design issues related to Local area Networks and get acquainted with the prevailing wired and wireless LAN technology standards;
MS-20-24.4	get versed with the routing, addressing, congestion control, and security issues in Networks and the Internet architecture.

CO-PO Mapping Matrix for Course Code: MS-20-24

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-24.1	3	1	3	3	2	1	1	2	3	-	1
MS-20-24.2	3	1	3	3	2	2	1	2	3	-	2
MS-20-24.3	3	2	3	3	2	2	2	2	3	-	2
MS-20-24.4	3	3	3	3	2	2	2	2	3	-	2
Average	**3**	**1.75**	**3**	**3**	**2**	**1.75**	**1.5**	**2**	**3**	**-**	**1.75**

CO-PSO Mapping Matrix for Course Code: MS-20-24

COs	PSO1	PSO2	PSO3	PSO4
MS-20-24.1	1	1	1	3
MS-20-24.2	1	1	3	3
MS-20-24.3	1	2	3	3
MS-20-24.4	1	2	3	3
Average	**1**	**1.5**	**2.5**	**3**

Unit – I

Network Characterization: Goals and Applications; Categorization according to Size, Purpose, Design issues & Transmission Technologies; Network Architecture and Service Models; Design issues for the Layers; Reference Models: OSI and TCP/IP; Functions of layers and protocols of TCP/IP; Comparison of OSI & TCP/IP ; Data

Transmission using TCP/IP.

Networking Models & Applications: Centralized, Decentralized, and Distributed; Client-Server and Peer-to-Peer; File sharing & Web- based; Content Distribution Networks.

Introduction to Example Networks: The Internet and its Conceptual View ; Applications of Internet; Accessing The Internet; Connection-Oriented Networks: X.25, Frame Relay and ATM.

Unit – II

Data Communication Concepts & Components: Digital and Analog Data and Signals, Asynchronous and Synchronous transmission; bit rate & baud, bandwidth& Channel Capacity; Nyquist Bit Rate, Shannon Capacity; Network Performance Parameters; Transmission Impairment.

Connecting Devices & Transmission Media: Network Interface Cards, Connectors, Hubs, Transceivers & Media Connectors; Link-Layer Switches, Bridge, Routers, Gateways, Virtual LANs; Guided Transmission Media; Wireless transmission; Satellite communication.

Data Encoding & Modulation Techniques: NRZ, NRZ-I, Manchester and Differential Manchester encoding; 4B/5B ; Pulse Code Modulation & Delta Modulation; Digital to Analog encoding.

Switching and Bandwidth Utilization: Methods of Switching; Virtual Circuit & Datagram Networks; Multiplexing; Spread Spectrum.

Wired Networks and the Local Loop: Telephone Networks; Modems; Broadband and ADSL; ADSL Versus Cable; Hybrid Fiber-Coaxial Network ; Fiber-to-the-Home Broadband.

Unit – III

Data Link Layer: Communication at the Data Link Layer; Nodes and Links; Link Layer Addressing; Examples of Data Link layer protocols.

Design Issues: Framing techniques: Byte Oriented and Bit Oriented Protocols; Error Detection and Correction; Sliding Window Flow Control Protocols.

Media Access Control: Random Access: Aloha, CSMA , CSMA/CD; Collision free protocols with Controlled Access; Limited Contention Protocols; Wavelength Division Multiple access for Fiber-Optic Data Communication.

IEEE LAN standards: Ethernet (Physical specifications, Encoding, Frame Format & MAC protocol); Binary Exponential Backoff algorithm; Token Ring and FDDI.

Introduction to Wireless Networks: IEEE 802.11 Wireless LAN; Wi-Max; Wireless LAN Protocol: MACA; Bluetooth and other wireless PAN technologies; Cellular Networks: Generations.

Unit – IV

Transport layer: Addressing, Services and Protocols; TCP and UDP services & header formats.

Network Layer: Services, Routing Algorithms: Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Multi Cast Routing, Routing for Mobile hosts.

Network Layer in TCP/IP: Basic characteristics of IP protocol; addressing and header format of IPv4; IPv6.

Congestion Control & Quality of Service: General Principals; Congestion control in Virtual – Circuit Subnets; Congestion Control in Datagram Subnets: Choke packets, Load Shedding; Random Early Detection, Jitter Control; Over provisioning, Buffering, Traffic Shaping, Leaky Bucket, Token Bucket, Resource Reservation, Admission Control, Packet Scheduling.

Network Security: Security Goals; Attacks; Cryptography; Confidentiality: Symmetric-Key and Asymmetric –Key Ciphers; Message Integrity & Authentication; Digital Signature; Certificates; IPSec; Firewalls; SSL.

Text Books:

1. Andrew S. Tanenbaum, Computer Networks, PHI.
2. Behrouz A Forouzan, Data Communications and Networking, Mc-Graw Hill Education.

Reference Books:

1. Michael A. Gallo, William M. Hancock, Computer Communications and Networking Technologies – CENGAGE learning.
2. William Stallings, Data and Computer Communications, PHI.

MS-20-31: Data Mining and Analytics using R

Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in- depth coverage of data mining and analytics aspects along with its implementation in R programming language.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-31.1	understand the fundamental concepts of data warehousing and data mining;
MS-20-31.2	learn data mining techniques for prediction/ forecasting;
MS-20-31.3	acquire knowledge of variety of data and analytical strategies;
MS-20-31.4	to implement data mining techniques in R to perform analytical operations.

CO-PO Mapping Matrix for Course Code: MS-20-31

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
MS-20-31.1	3	3	3	3	2	2	1	3	2	2	3
MS-20-31.2	3	2	3	2	3	2	2	3	3	2	1
MS-20-31.3	2	2	2	3	1	2	1	2	3	3	2
MS-20-31.4	2	3	3	2	3	3	1	1	3	2	3
Average	**2.5**	**2.5**	**2.75**	**2.5**	**2.25**	**2.25**	**1.25**	**2.25**	**2.75**	**2.25**	**2.25**

CO-PSO Mapping Matrix for Course Code: MS-20-31

COs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
MS-20-31.1	3	3	1	3
MS-20-31.2	2	2	3	1
MS-20-31.3	3	2	1	3
MS-20-31.4	3	3	1	2
Average	**2.75**	**2.5**	**1.5**	**2.25**

Unit – I

Data Warehouse: A Brief History, Characteristics, Architecture for a Data Warehouse. Fact and Dimension Tables, Data Mining: Introduction, Motivation, Importance, Knowledge Discovery Process, Data Mining Functionalities, Interesting Patterns, Classification of Data Mining Systems, Major issues, Data Preprocessing: Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization, Data Visualization, Outliers.

Unit – II

Data Mining Techniques: Statistical Perspective on Data Mining, Similarity Measures, Clustering- Requirement for Cluster Analysis, Clustering Methods, Decision Tree- Decision Tree Induction, Attribute Selection Measures, Tree Pruning. Association Rule Mining: Frequent Item-set Mining using Apriori Algorithm, Nearest Neighbour Classification: Performance of Nearest Neighbour Classifiers.

Unit – III

Data Analytics: Ways of Thinking About Data, Qualitative and Quantitative Data, And Data Strategies, Conceptualizing Data Analysis as a Process, Managing Data Analysis Process, Exploratory Data Analysis: Exploring a New Dataset, Summarizing Numeric Data, Anomalies in Numeric Data, Visualizing Relations between Variables. Working with External Data: Manual Data Entry, CSV Files, Other Files, Merging Data from Different Sources.

Unit – IV

R Programming: Advantages of R over other Programming Languages, Working with Directories and Data Types in R, Control Statements, Loops, Data Manipulation and integration in R, Exploring Data in R: Data Frames, R Functions for Data in Data Frame, Loading Data Frames, Decision Tree packages in R, Issues in Decision Tree Learning, Hierarchical and K-means Clustering functions in R, Mining Algorithm interfaces in R.

Text Books:

1. J Hanes, M. Kamber, Data Mining Concepts and Techniques, Elsevier India.
2. Ronald K. Pearson, Exploratory Data Analysis Using R, CRC Press.
3. S. Acharya, Data Analytics Using R, McGraw Hill Education (India) Private Limited.

Reference Books:

1. G.S. Linoff, M.J.A. Berry, Data Mining Techniques, Wiley India Pvt. Ltd.
2. Berson, S.J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw-Hill.
3. J.Horbulyk, Data Integration Best Practices, elastic.io
4. Jared P. Lander, R For Everyone, Perason India Education Services Pvt. Ltd.

MS-20-32:Computer Graphics and Animation

Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an introduction to the theory and practice of computer graphics. Provide an insight to applications of Graphics and the graphics hardware devices and software used. Introduce the use of the components and principles needed to design a graphics system and the algorithms related with them. To comprehend and analyse the fundamentals of animation and underlying techniques and principles

Course Outcomes: At the end of this course, the student will be able to:

MS-20-32.1	have a knowledge of graphics applications and components and devices required to support the applications;
MS-20-32.2	develop algorithms for scan converting geometrical primitives such as lines, circles, ellipses, and curves along with algorithms for filling polygons, required for designing real-world applications;
MS-20-32.3	design algorithms for carrying out manipulations in pictures using geometric transformations, viewing transformations, and clipping operations;
MS-20-32.4	model 3-dimensional objects and apply viewing, visible –surface determination, and shading techniques to the models for achieving realism. The student will also learn to design and develop animation sequences.

CO-PO Mapping Matrix for Course Code: MS-20-32

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
MS-20-32.1	3	1	3	2	1	1	1	1	3	-	1
MS-20-32.2	3	2	3	3	1	1	2	1	3	-	1
MS-20-32.3	3	2	3	3	1	1	2	1	3	-	1
MS-20-32.4	3	2	3	3	1	1	2	1	3	-	2
Average	**3**	**1.75**	**3**	**2.75**	**1**	**1**	**1.75**	**1**	**3**	**-**	**1.25**

CO-PSO Mapping Matrix for Course Code: MS-20-32

COs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
MS-20-32.1	2	1	1	3
MS-20-32.2	1	3	3	3
MS-20-32.3	1	3	3	3
MS-20-32.4	1	3	3	3
Average	**1.25**	**2.5**	**2.5**	**3**

Unit – I

Introduction to Computer Graphics and its Components: Overview of Computer Graphics, its functions & elements; Introduction to GUI, Computer Vision, Augmented Reality and other Applications of Graphics; Popular Graphics Software; Components and Working of Interactive Graphics; Raster Scan and Random Scan Systems and Display Processors; Look-up table; Loading the Frame Buffer; Coordinate Systems.

Graphics Devices: Display Technologies: Resolution, Aspect Ratio, Refresh CRT,ColorCRT, Flat Panel Displays; Interactive Input Devices for Graphics, Image and Video Input Devices.

Unit – II

Scan Conversion: Drawing Geometry;Output Primitives; Lines and Pixel Graphics; AntiAliasing; Scan Converting Lines: DDA line drawing algorithms, Bresenham's line Algorithm; Scan Converting Circles: DDA algorithm for circle drawing, Polynomial method for circle drawing, circle drawing using polar coordinates, Bresenham's circle drawing; Algorithms for Generation of ellipse; Line Styles; Generation of Bar Charts, Pie-Charts.

Curve Representation: Parametric Curves, Parametric Representation of a Circle, Parametric representation of cubic curves, drawing Bezier curves.

Filled-Area Primitives: Basic Stack based fill algorithms: Flood fill algorithm, Boundary fill algorithm; Scan-line polygon fill algorithm and its computational structures.

Unit – III

Two-Dimensional Transformations: Coordinate and Geometric Transformations; Translation, Rotation, Scaling; Matrix representations and Homogeneous coordinates, Composite transformations, General Pivot Point rotation, General Fixed Point Scaling, Shearing; Reflection ; Reflection about an arbitrary line.

2-D Viewing: Viewing pipeline; Window, Viewport, Window-to-Viewport transformation; Zooming, Panning; Pointing and Positioning techniques; Rubber band technique; Dragging.

Clipping operations: Point and Line clipping, Cohen-Sutherland line clipping, Mid-Point Subdivision line clipping, Liang-Barsky line clipping, Sutherland-Hodgman polygon clipping; Weiler-Atherton polygon clipping.

Unit – IV

3-D Graphics & Modeling: 3-D modeling of objects; Solid Model Representation Schemes: Euclidean Geometry methods and Procedural Methods: Fractals, Shape Grammars, Visualization techniques; 3D transformation matrices for Translation, Scaling and Rotation.

Three-Dimensional Viewing: Viewing Pipeline**; P**arallel Projection: Orthographic and Oblique projection; Perspective Projection.

Visible-Surface Determination: Z-buffer, depth-sorting, Area Subdivision, BSP-Tree method; Ray casting.

Illumination and Shading: Modeling Light Intensities, Basic Illumination Models; Gouraud Shading, Phong Shading;

Introduction to Animation: Designing of Animation Sequences; Key-Frame Systems; Animation Techniques: Tweening, Morphing.

Text Books:

1. Donald Hearn, M. Pauline Baker, Computer Graphics, Pearson Education.
2. J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics - Principles and Practice, Pearson Education.

Reference Books:

1. Newmann&Sproull, Principles of Interactive Computer Graphics, McGraw Hill.
2. Rogers, David F., Procedural Elements of Computer Graphics, McGraw Hill.
3. Zhigang Xiang, Roy Plastock, Computer Graphics, Tata McGraw Hill.
4. Malay K. Pakhira, Computer Graphics, Multimedia and Animation, PHI
5. Steven Harrington, Computer Graphics, A Programming Approach, McGraw Hill

MS-20-33(i): Compiler Design	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of the course is to provide in-depth coverage of underlying concepts & techniques used in compiler design and to cover major topics in compilation Theory. This course will make students ready for job assignments involving compilers and prepare students to undertake projects on compilers Construction.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-33(i).1	understand overall process of compilation;
MS-20-33(i).2	understand the process of parsing in compilers;
MS-20-33(i).3	analyze semantic analysis, building a symbol table, handling storage management and error-detection in the process of compiler designing;
MS-20-33(i).4	design a compiler and understand the concept of code generation and optimization.

CO-PO Mapping Matrix for the Course Code : MS-20-33(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-33(i).1	3	2	2	2	1	2	2	2	3	1	2
MS-20-33(i).2	3	2	2	2	2	2	2	2	3	1	2
MS-20-33(i).3	3	2	2	2	2	2	2	2	3	1	2
MS-20-33(i).4	3	2	2	2	2	3	2	2	3	1	2
Average	**3**	**2**	**2**	**2**	**1.75**	**2.25**	**2**	**2**	**3**	**1**	**2**

CO-PSO Mapping Matrix for the Course Code : MS-20-33(i)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-33(i).1	3	3	3	3
MS-20-33(i).2	3	3	3	3
MS-20-33(i).3	3	3	3	3
MS-20-33(i).4	3	3	3	3
Average	**3**	**3**	**3**	**3**

Unit – I
Compilers and Translators, Need of Translators, Tools used for compilation, Structure of Compiler, Single-Pass and Multi-Pass Compilers, Bootstrapping, Compiler Construction Tools, Phases of Compilation process, Classification of grammars. Lexical Analysis: Design, Finite Automata and Regular Expressions, Process of Lexical Analysis, Lexical Analyzer generators, Derivations and parse trees.
Unit – II
Parsing Techniques: Top down Parsing- Predictive Parsers, Left Recursion and its removal, Recursive Descent Parsers, LL Grammars. Bottom-up parsing: Shift Reduce Parsing, Operator Precedence Parsing, LR Parsers, LR grammars, Comparison of parsing methods, Parser Generators.
Unit – III
Semantic Analysis: Syntax-Directed Translation Schemes. Building Symbol Table, Data Structures for symbol table, representing scope information. An overview of Run-time Storage Administration. Error Detection and Recovery: Errors, Lexical-Phase Errors, Syntactic Phase Errors, Semantic Errors.
Unit – IV
Intermediate Source Forms: Postfix Notation, Syntax Trees, Triples & Quadruples. Code Optimization: Potential cases of Code Optimization, Optimization of basic blocks, Local and Global optimizations, Code Improving Transformation. Code Generator: Issues in the design of a code generator.
Text Books: 1. Alfred V Aho, Principles of Compiler Design, Narosa Publishing House. 2. Jean Paul Tremblay and Sorenson, The Theory and Practice of Compiler Writing, McGraw Hill.
Reference Books: 1. Dhamdhere D.M, System programming and operating system, McGraw Hill. 2. Beck L. Leland, System Software, Pearson Education. 3. Aho, Sethi, & Ullman, Compilers Principles, Techniques and Tools, Pearson Education. 4. Fischer, Crafting a compiler in C, Pearson Education.

MS-20-33 (ii): Advanced Computer Architecture	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To know parallel processing and new trends and developments in computer architectures. Understand design and development of ILP based processors and evaluate their performance. Understand MIMD architectures and different topologies used in these architectures. Study the cache coherence problems and their solutions

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-33 (ii).1	learn the concepts of parallel architectures and exploitation of parallelism at instruction level;
MS-20-33 (ii).2	understand architectural features of multi-issue ILP processors;
MS-20-33 (ii).3	learn MIMD architectures and interconnection networks used in them and evaluate their comparative performances;
MS-20-33 (ii).4	analyze causes of cache coherence problem and learn algorithm for its solution.

CO-PO Mapping Matrix for Course Code: MS-20-33 (ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-33 (ii).1	3	1	3	3	3	1	1	2	3	1	1
MS-20-33 (ii).2	3	2	3	3	3	1	1	2	3	1	1
MS-20-33 (ii).3	3	2	3	3	3	2	1	2	3	1	2
MS-20-33 (ii).4	3	3	3	3	3	2	1	2	3	1	2
Average	**3**	**2**	**3**	**3**	**3**	**1.5**	**1**	**2**	**3**	**1**	**1.5**

CO-PSO Mapping Matrix for Course Code: MS-20-33 (ii)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-33 (ii).1	2	1	3	3
MS-20-33 (ii).2	2	1	3	3
MS-20-33 (ii).3	2	1	3	3
MS-20-33 (ii).4	2	1	3	3
Average	**2**	**1**	**3**	**3**

Unit – I

Computational Model: Basic computational models, evolution and interpretation of computer architecture, concept of computer architecture as a multilevel hierarchical framework. Classification of parallel architectures, Relationships between programming languages and parallel architectures

Parallel Processing: Types and levels of parallelism, Instruction Level Parallel (ILP) processors, dependencies between instructions, principle and general structure of pipelines, performance measures of pipeline, pipelined processing of integer, Boolean, load and store instructions, VLIW architecture, Code Scheduling for ILP- Processors - Basic block scheduling, loop scheduling, global scheduling.

Unit – II

Superscalar Processors: Emergence of superscalar processors, Tasks of superscalar processing – parallel decoding, superscalar instruction issue, shelving, register renaming, parallel execution, preserving sequential consistency of instruction execution and exception processing, comparison of VLIW & superscalar processors Branch Handling: Branch problem, Approaches to branch handling – delayed branching, branch detection and prediction schemes, branch penalties and schemes to reduce them, multiway branches, guarded execution.

Unit – III

MIMD Architectures: Concepts of distributed and shared memory MIMD architectures, UMA, NUMA, CC-NUMA & COMA models, problems of scalable computers.

Direct Interconnection Networks: Linear array, ring, chordal rings, star, tree, 2D mesh, barrel shifter, hypercubes.

Unit – IV

Dynamic interconnection networks: single shared buses, comparison of bandwidths of locked, pended & split transaction buses, arbiter logics, crossbar, multistage networks – omega, butterfly

Cache coherence problem, hardware based protocols – snoopy cache protocol, directory schemes, and hierarchical cache coherence protocols.

Text Books:

1. Sima, Fountain, Kacsuk, Advanced Computer Architecture, Pearson Education.
2. D. A. Patterson and J. L. Hennessey, Computer Architecture – A Quantitative Approach, Elsevier India.

Reference Books:

1. Kai Hwang, Advanced Computer Architecture, McGraw Hill.
2. Nicholas Carter, Computer Architecture, McGraw Hill.
3. Harry F. Jordan, Gita Alaghband, Fundamentals of Parallel Processing, Pearson Education.

MS-20-33(iii): Principles of Programming Languages

Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this paper is to make the students familiar with different elements of programming languages such as data types/operators/statements/control constructs and their implementation with the understanding that it will help them in becoming a better programmer.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-33(iii).1	understand the programming language hierarchy and basics of compilation;
MS-20-33(iii).2	understand the different types of grammar;
MS-20-33(iii).3	understand the features of object oriented language and different methods of sequence control;
MS-20-33(iii).4	understand the implementation of different type of functions.

CO-PO Mapping Matrix for the Course Code : MS-20-33(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-33(iii).1	3	3	1	3	1	3	2	3	3	1	3
MS-20-33(iii).2	3	3	1	3	1	3	2	3	3	1	3
MS-20-33(iii).3	3	3	1	3	1	3	3	3	3	1	3
MS-20-33(iii).4	3	3	1	3	1	3	3	3	3	1	3
Average	**3**	**3**	**1**	**3**	**1**	**3**	**2.5**	**3**	**3**	**1**	**3**

CO-PSO Mapping Matrix for the Course Code : MS-20-33(iii)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-33(iii).1	3	3	3	2
MS-20-33(iii).2	3	3	3	2
MS-20-33(iii).3	3	3	3	2
MS-20-33(iii).4	3	3	3	2
Average	**3**	**3**	**3**	**2**

Unit – I

Preliminaries: History, Impact of Programming Paradigms, Role of Programming Languages, Good Language, Effects of Programming Environment, Translators and virtual architectures, Binding and Binding time, Language Syntax, Analysis of Program, Synthesis of Object program, Formal translation models: BNF Grammars, General parsing, Language translation, Recursive descent parsing.

Unit – II

Formal languages and automata: The Chomsky hierarchy of formal languages, regular grammars, Regular expressions, Finite State Automata, Context-free grammars, Pushdown automata, Ambiguous grammars.

Language Semantics: Attribute grammars, Denotational semantics, Program verification and validation, Data objects, variables, constants, data types, declaration, type checking, type casting, type promotion, Enumerators, Composite data types.

Unit – III

Object Orientated concepts: Structured data types, Abstract data types, Information hiding, Subprogram concepts, Good program design, Type definitions, Type equivalence, Inheritance, Derived classes, Abstract classes, Polymorphism, Inheritance and software reuse.

Sequence control: Implicit and explicit sequence control, Sequence control within arithmetic expressions, sequence control between statements, sequencing with non-arithmetic expressions, Subprogram Sequence control.

Unit – IV

Miscellaneous topics: Parameter passing techniques, Static & Dynamic Scoping, Storage of variables, Static storage, Heap Storage management, Distributed Processing, Exceptions and Exception handlers, Co-routines, Scheduled subprograms, Parallel programming, Processor design, Hardware and Software architectures, Network Programming, Evolution of scripting languages, Applets, XML.

Text Books:

1. Pratt T.W., Zelkowitz M.V., Gopal T.V., Programming Languages Design and Implementation, Pearson Education.
2. Sebesta W. Robert, Concepts of Programming Languages, Pearson Education.

Reference Books:

1. Appleby Doris &VandeKopple J. Julius, Programming Languages-Paradigm and practice”, Tata McGraw Hill.
2. Sethi Ravi, Programming Languages: Concepts & Constructs, Pearson Education
3. Scott M., Programming Language Pragmatics, Elsevier India.

MS-20-34 (i) Mobile Computing	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Introduce the notion and concepts of Mobile Computing and its Applications. Provide an exposure to the latest trends and technologies related to Mobile Computing.

Course Outcomes: At the end of this course, the student will be able to:	
MS-20-34(i).1	characterize and categorize Mobile Computing Environments along with the knowledge of their deployment and applications;
MS-20-34(i).2	learn the operational and architectural aspects of Mobile telephony and its generations;
MS-20-34(i).3	gain knowledge of the architectural issues of contemporary wireless LANs and the reformations accomplished in the Network and Transport layers of TCP/IP model for adaptation to Mobile Networks;
MS-20-34(i).4	get familiar with the application level support for mobility in Networks along with pertinent design issues related with Mobile Adhoc Networks and Wireless Sensor Networks.

CO-PO Mapping Matrix for Course Code: MS-20-34 (i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-34(i).1	3	2	3	2	1	1	1	1	3	-	2
MS-20-34(i).2	3	3	3	2	1	1	2	1	3	-	2
MS-20-34(i).3	3	3	3	3	1	2	2	1	3	-	2
MS-20-34(i).4	3	3	3	3	1	2	2	1	3	-	2
Average	**3**	**2.75**	**3**	**2.5**	**1**	**1.5**	**1.75**	**1**	**3**	**-**	**2**

CO-PSO Mapping Matrix for Course Code: MS-20-34 (i)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-34(i).1	2	1	2	3
MS-20-34(i).2	2	1	2	3
MS-20-34(i).3	2	2	2	3
MS-20-34(i).4	2	2	2	3
Average	**2**	**1.5**	**2**	**3**

Unit – I

Mobile Communications and Mobile Computing: Overview & Classification; Mobile Computing Applications; Characteristics of Mobile Computing; Data Dissemination; Wireless Transmission & Cellular Systems; Mobile Devices; Mobile Computing Architecture; Mobile Computing through Telephony; Multiple Access Procedures; Emerging Technologies; Generations of Mobile Communication Technologies.

Satellite Communication: Basics, Applications, Personal Satellite Communications; Routing, Localization, Handover, Future Wideband Access Systems.

The Cellular Concept: Components & Architecture; Call Setup, Frequency reuse, Cell Design; Interference in Cellular System; Channel Assignment & Handoff; Mobility Management; Application of Smart Antennas in Cellular Telephony.

Unit – II

Mobile Telecommunication System: GSM: Services & Architecture; Protocols; Localization & Calling; GSM Channels; GSM Addresses and Identifiers; Frequency Allocation, Call Routing; Mobility Management; Security; New Data Services; EDGE; General Packet radio Service (GPRS): Architecture, Operations, Data Services, Applications; IS-95; Universal Mobile Telecommunication System (UMTS): Architecture, Handover, Security; DECT; TETRA.

Wireless Media Access Control: Multiplexing & Modulation; Frequency Hopping Spread Spectrum (FHSS); Direct Sequence Spread Spectrum; Code Division Multiple Access (CDMA) in Mobile Communication Systems; 3G Wireless Communication Standards; WCDMA, OFDM, High Speed Packet Access (HSPA); Long Term Evolution (LTE); Broadband Wireless Access Standards.

Introduction to 4G & 5G Networks: Introduction, Applications & Architecture of 4G & 5G Networks.

Unit – III

Wireless LANs: Infrastructure & Ad hoc Networks; IEEE 802.11: Architecture & Services; Physical & MAC layer; HIPERLAN1/2; Bluetooth: User Scenario, Architecture & Security.

Mobile Network Layer: Mobile IP: Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP, VoIP.

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, TCP over 2.5/3G Wireless networks.

Unit – IV

Support for Mobility: File Systems; World Wide Web; Wireless Application Protocol (WAP).

Application Servers and Management: Mobile Agent; Application Framework; Application Server; gateways; Device Management; Overview of Mobile Application Development Platforms.

Mobile Ad-hoc and Wireless Sensor Networks: Introduction to MANETs and their Applications; Routing & Routing Algorithms; Security in Ad-hoc Networks; Wireless Sensor Networks: Overview and Data Dissemination; Applications; Vehicular Ad Hoc networks(VANET); MANET vs VANET.

Text Books:

1. Jochen Schiller, Mobile Communications, Addison-Wesley.
2. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, Mobile Computing, Technology Applications and Service Creation, McGraw Hill.

Reference Books:

1. Raj Kamal, Mobile Computing, Oxford University Press
2. Krzysztof Wesolowski, Mobile Communication Systems, Wiley
3. William Stallings ,Wireless Communications & Networking, Second Edition, Pearson
4. UweHansmann, LotherMerk, Martin S. Nicklaus, Thomas Stober, Principles of Mobile Computing, Springer.
5. William.C.Lee, Mobile Cellular Telecommunications-Analog and Digital Systems, Tata McGraw Hill Edition.

6. C.K.Toh, AdHoc Mobile Wireless Networks, Pearson Education
7. Prasant Kumar Pattnaik, Rajib Mall, Fundamentals of Mobile Computing, PHI Learning
8. Tomasz Imielinski ,Henry F. Korth, Mobile Computing, Kluwer Academic Publishers

MS-20-34(ii): Theory of Computation	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of theoretical computer science. It provides an insight about design of all types of machines and their applications.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-34(ii).1	design various finite state machines for real life problems;
MS-20-34(ii).2	differentiate between the applications of different kind of machines;
MS-20-34(ii).3	solve the tractable and intractable problems using various approaches;
MS-20-34(ii).4	understand the need and importance of Turing machines and their suitability.

CO-PO Mapping Matrix for the Course Code : MS-20-34(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-34(ii).1	3	2	1	3	1	3	2	2	3	1	3
MS-20-34(ii).2	3	2	1	3	1	3	2	2	3	1	3
MS-20-34(ii).3	3	2	1	3	1	3	2	3	3	1	3
MS-20-34(ii).4	3	2	1	3	1	3	2	3	3	1	3
Average	**3**	**2**	**1**	**3**	**1**	**3**	**2**	**2.5**	**3**	**1**	**3**

CO-PSO Mapping Matrix for the Course Code : MS-20-34(ii)

COs	PSO1	PSO2	PSO3	PSO5
MS-20-34(ii).1	3	3	3	3
MS-20-34(ii).2	3	3	3	3
MS-20-34(ii).3	3	3	3	3
MS-20-34(ii).4	3	3	3	3
Average	**3**	**3**	**3**	**3**

Unit – I
Finite State Machines: Finite Automata, Designing of DFA and NDFA, NFA with E-Transitions, Equivalence of DFA and NFA with proof, Regular Expressions and Regular languages, Laws of Regular Expressions, Kleene's Theorem 1 and 2, Properties and Limitations of FSM FSM with Output: Moore and Mealy Machines, Arden's Theorem with proof, Closure Properties of Regular Sets, Pumping Lemma for Regular Grammers, Minimization of FA.
Unit – II
Formal Grammars: Definition, Construction of Regular & Context Free Grammar, Derivation, Parse Trees, Ambiguity, Removal of Ambiguity, Simplification of Context Free Grammar, CNF and GNF, Closure properties of CFL, Pumping Lemma for CFL. Pushdown Automaton: Introduction, Types of PDA, Designing of PDA's, Conversion from PDA to CFG and vice-versa.
Unit – III
Linear Bounded Automata (LBA), Turing Machines (TM), General Model of Computation, TM as Language Acceptors, TM as Computing Partial Functions, Combining TM, Multi-Tape TM, Restricted and Universal TM; TM and Computers. Recursive and recursively-enumerable languages and Properties, More General Grammars
Unit – IV
Reductions and the Halting Problem, Post's correspondence problem, Rice's theorem, Cook's Theorem, decidability of membership, emptiness and equivalence problems of languages, Decidable languages and problems, Diagonalization method. Computable Functions: Primitive recursive functions, Godel Numbering, Tractable and Intractable problems, Computable Complexity.
Text Books: 1. John C. Martin, Introduction to Languages and the Theory of Computation, McGraw Hill. 2. Peter Linz, An introduction to formal language & automata, Jones & Bartlett publications.
Reference Books: 1. Hopcroft J. E. & Ullman J. D, Formal languages and their relation to Automata, Pearson Education. 2. Lewis, H.R. &Papadimitrious, C. H., Elements of the theory of computation, PHI Learning. 3. Michael Sipser, Introduction to the Theory of Computation, Cengage Learning.

MS-20-34(iii): Artificial Intelligence

Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of Artificial Intelligence techniques and their applications. It focuses on various search techniques and expert systems along with other parts of artificial intelligence in computer science.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-34(iii).1	understand the different knowledge representation schemes specially FOPL;
MS-20-34(iii).2	apply various search methods to solve AI problems efficiently;
MS-20-34(iii).3	understand the Expert System and techniques to manage the uncertainty in Expert Systems;
MS-20-34(iii).4	understand the learning techniques and Genetic Algorithm.

CO-PO Mapping Matrix for the Course Code : MS-20-34(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-34(iii).1	3	2	1	3	1	3	2	2	3	1	3
MS-20-34(iii).2	3	2	1	3	1	3	2	2	3	1	3
MS-20-34(iii).3	3	2	1	3	1	3	2	3	3	1	3
MS-20-34(iii).4	3	3	1	3	1	3	2	3	3	1	3
Average	**3**	**2.25**	**1**	**3**	**1**	**3**	**2**	**2.5**	**3**	**1**	**3**

CO-PSO Mapping Matrix for the Course Code : MS-20-34(iii)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-34(iii).1	3	3	3	2
MS-20-34(iii).2	3	3	3	2
MS-20-34(iii).3	3	3	3	2
MS-20-34(iii).4	3	3	3	2
Average	**3**	**3**	**3**	**2**

Unit – I
Introduction: Background and history, Overview of AI applications areas. The predicate calculus: Syntax and semantic for propositional logic and FOPL, Clausal form, inference rules, resolution and unification. Knowledge representation: Network representation-Associative network & conceptual graphs, Structured representation- Frames & Scripts.
Unit – II
Search strategies: Strategies for state space search-data driven and goal driven search; Search algorithms- uninformed search (depth first, breadth first, depth first with iterative deepening) and informed search (Hill climbing, best first, A* algorithm, mini-max etc.), computational complexity, Properties of search algorithms - Admissibility, Monotonicity, Optimality, Dominance.
Unit – III
Production system: Types of production system-commutative and non-commutative production systems, Decomposable and non-decomposable production systems, Control of search in production systems. Rule based expert systems: Architecture, development, managing uncertainty in expert systems - Bayesian probability theory, Stanford certainty factor algebra, Nonmonotonic logic and reasoning with beliefs, Fuzzy logic, Dempster/Shaffer and other approaches to uncertainty.
Unit – IV
Knowledge acquisition: Types of learning, learning by automata, intelligent editors, learning by induction. Genetic algorithms: Problem representation, Encoding Schemes, Operators: Selection, Crossover, Mutation, Replacement etc.
Text Books: 1. George F. Luger, Artificial Intelligence, Pearson Education. 2. Dan W. Patterson Introduction to Artificial Intelligence and Expert system, PHI.
Reference Books: 1. Ben Coppin, Artificial Intelligence Illuminated, Narosa Publishing House. 2. Eugene Charniak, Drew McDermott Introduction to Artificial Intelligence, Pearson Education. 3. Nils J. Nilsson Principles of Artificial Intelligence, Narosa Publishing House. 4. Jackson Peter, Introduction to Expert systems, Pearson-Education.

MS-20-41: Mobile Application Development

Type: Compulsory
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30(i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40(i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various concepts of mobile application development especially android based applications. This course will help the students in learning to develop and publish their own mobile applications.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-41.1	know the components and structure of mobile application development frameworks for Android based mobiles;
MS-20-41.2	design and implement the user interfaces of mobile applications;
MS-20-41.3	evaluate multimedia and location based services in Android application;
MS-20-41.4	develop the interactive graphics in mobile applications.

CO-PO Mapping Matrix for Course Code: MS-20-41

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-41.1	3	1	2	3	2	2	1	1	1	1	1
MS-20-41.2	3	1	2	2	2	3	2	2	1	1	1
MS-20-41.3	3	1	2	3	2	3	2	2	1	1	1
MS-20-41.4	3	1	2	3	2	3	2	2	1	1	1
Average	**3**	**1**	**2**	**2.75**	**2**	**2.75**	**1.75**	**1.75**	**1**	**1**	**1**

CO-PSO Mapping Matrix for Course Code: MS-20-41

COs	PSO1	PSO2	PSO3	PSO4
MS-20-41.1	3	3	2	3
MS-20-41.2	3	3	2	3
MS-20-41.3	1	3	3	3
MS-20-41.4	3	3	3	3
Average	**2.5**	**3**	**2.5**	**3**

Unit – I

Introduction: Mobile Applications, Characteristics and Benefits, Application Models, Mobile devices Profiles. Basics of Android, Importance and scope, Android Versions, Features of Android, Android Architecture, Android Stack, Android Applications Structure, Android Emulator, Android SDK, Overview of Android Studio, Android and File Structure, Android Virtual Device Manager, DDMS, LogCat, Understanding Activities.
Android User Interface: Measurements – Device and pixel density independent measuring units. Layouts – Linear, Relative, Grid and Table Layouts.

Unit – II

User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers, List View, Spinner View.
Event Handling – Handling clicks or changes of various UI components.
Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS
Services- Callbacks and Override in application, Application Signing, API keys for Google Maps, Publishing application to the Android Market.

Unit – III

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities
Location and Mapping: location based services, Mapping, Google Maps activity, Working with MapView and MapActivity; Playing and Recording of Audio and Video in application; Sensors and Near Field Communication; Native libraries and headers, Building client server applications.

Unit – IV

Using Graphics: Canvas Drawing, Shadows, and Gradients.
Persisting Data to files: Saving to Internal Storage, Saving to External Storage
Introduction to SQLite database: creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

Text Books:

1. ZigurdMednieks, Laird Dornin, G,BlakeMeike and Masumi Nakamura "Programming Android", O'Reilly Publications.
2. Wei-Meng Lee, "Beginning Android Application Development", Wiley India Ltd.

Reference Books:

1. James C.S. "Android Application development for Java Programmer", CENGAGE Learning.
2. Pradeep Kothari, "Android Application Development: Black Book", Wiley India Ltd.
3. Gargenta M., Nakamura M., "Learning Android", O'Reilly Publications.

MS-20-42: Machine Learning using Python	
Type: Compulsory **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to enable student to perform experiments in Machine Learning using real-world data using Python.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-42.1	construct and execute various programs using different data structures in Python;
MS-20-42.2	use the Python programming for machine learning;
MS-20-42.3	understand the machine learning along with concept learning and decision trees;
MS-20-42.4	understand Bayesian, Computational and Instance-based learning;

CO-PO Mapping Matrix for the Course Code : MS-20-42

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-42.1	3	3	2	3	2	3	3	1	3	1	3
MS-20-42.2	3	3	2	3	2	3	3	1	3	1	3
MS-20-42.3	3	3	2	2	1	2	2	3	3	1	2
MS-20-42.4	3	3	2	2	1	2	2	3	3	1	2
Average	**3**	**3**	**2**	**2.5**	**1.5**	**2.5**	**2.5**	**2**	**3**	**1**	**2.5**

CO-PSO Mapping Matrix for the Course Code : MS-20-42

COs	PSO1	PSO2	PSO3	PSO4
MS-20-42.1	3	3	3	3
MS-20-42.2	3	3	3	3
MS-20-42.3	2	3	3	3
MS-20-42.4	2	3	3	3
Average	**2.5**	**3**	**3**	**3**

Unit – I

Python Programming: Strings - String slices, immutability, string functions and methods, string module; Lists, Tuples, Dictionaries: Lists - Lists as arrays Traversing a List, list operations, list slices, list methods, Map, Filter and Reduce, list loop, mutability, aliasing, cloning lists, list parameters; Dictionaries - operations and methods; advanced list processing - list comprehension; Tuples - tuple assignment, tuple as return value.

Files and Modules: Files and exception - text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules.

Unit – II

Packages in Python: PANDAS, NUMPY, SCIKIT-LEARN, MATPLOTLIB.

NumPy - Introduction,Ndarray Object ,Data types, Array Attributes,Array Creation Routines, Indexing & Slicing, Advanced Indexing,Broadcasting,Iterating Over Array,Array Manipulation,Binary Operators,String Functions,Mathematical Functions,Mathematical Functions,Arithmetic Operations,Statistical Functions,Linear Algebra,Matplotlib(Used for data visualization),Histogram Using Matplotlib.

Pandas: Performing data cleaning and analysis, Loading data with Pandas (data manipulation and analysis), Working with and Saving data with Pandas.

Using Scikit-Learn for Linear Regression, Logistic Regression, Decision Tree, Naive Bayes, KNN, SVN, k Mean Clustering, Random Forest.

Unit – III

Introduction to Machine Learning – Well defined learning problems, Designing a Learning System, Issues in Machine Learning.

The Concept Learning Task - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias

Decision Tree Learning - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning.

Unit – IV

Bayesian Learning: Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm.

Computational Learning Theory: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning.

Instance-Based Learning – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited.
2. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press.
3. John V Guttag, Introduction to Computation and Programming Using Python, MIT Press.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.

Reference Books:

1.Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press.

2.Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Updated for Python 3, Shroff/O„Reilly Publishers.

3.Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press.

4. Python Machine Learning, Sebastian Raschka.

MS-20-43 (i) Cryptography and Network Security	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an understanding of Security and its goals including classical and modern algorithms. Give an insight into the various techniques and algorithms related to maintaining confidentiality and integrity of information in computers and communication in Networks.

Course Outcomes: At the end of this course, the student will be able to:	
MS-20-43(i).1	have an understanding of the basic terms, concepts, and principles of cryptography and network security including threats, vulnerability, and controls along with a familiarization of various Cryptographic tools that include classical and contemporary mechanisms;
MS-20-43(i).2	learn the mechanisms and algorithms related to confidentiality, Integrity, and access control;
MS-20-43(i).3	gain awareness of the threats and attacks to which networks/Internet may be vulnerable and the security mechanisms and policies that are detailed at the network layer of the Internet architecture;
MS-20-43(i).4	have exposure to the security issues, mechanisms, and protocols related to the Transport layer of the Internet architecture, Wireless Networks, as well as E-Mails.

CO-PO Mapping Matrix for Course Code: MS-20-43(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-43(i).1	3	2	3	3	2	1	2	2	3	-	2
MS-20-43(i).2	3	3	3	3	2	2	2	2	3	-	2
MS-20-43(i).3	3	3	3	3	2	2	2	2	3	-	2
MS-20-43(i).4	3	3	3	3	2	2	2	2	3	-	2
Average	**3**	**2.75**	**3**	**3**	**2**	**1.75**	**2**	**2**	**3**	**-**	**2**

CO-PSO Mapping Matrix for Course Code: MS-20-43(i)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-43(i).1	1	3	2	3
MS-20-43(i).2	1	3	3	3
MS-20-43(i).3	1	3	3	3
MS-20-43(i).4	1	3	3	3
Average	**1**	**3**	**2.75**	**3**

Unit – I

Computer & Network Security Concepts: Overview; Security Goals; Threats, Attacks, & Assets; Vulnerabilities; Security Functional Requirements; Security Services; Security Mechanism; Secure Communications; Model for Network Security; The OSI Security Architecture.

Cryptographic Tools: Symmetric and Asymmetric Key Ciphers; Classical Encryption Techniques; Symmetric Ciphers: Confidentiality with Symmetric Encryption; One-Time Pads; User Authentication Methods; Block Cipher and Data Encryption Standard; Advanced Encryption Standard; RC2, RC4, RC5 & RC6; Block Cipher Operation; Random and Pseudo Random Numbers.

Unit – II

Asymmetric Ciphers: Public Key Cryptography and RSA; Diffie-Hellman Key Exchange; Elliptic Curve Cryptography.

Cryptographic Data integrity: Cryptographic Hash Functions and Applications; Message Authentication Codes; Digital signatures & Schemes; Hashing & Signing; Message Digests; Digital Signature Standard; Birthday attacks on Signatures.

Key Management and Distribution: Symmetric Key Distribution using Symmetric Encryption & Asymmetric Encryption; Distribution of Public Keys; X.509 Certificates; Public Key Infrastructure.

User Authentication Protocols: Remote User Authentication Principles; Remote User Authentication using Symmetric & Asymmetric Encryption; Kerberos.

Unit – III

Network Security: Threats & Attacks; Denial-of Service; Distributed Denial-of-Service; Cryptography in Network Security: Network & Browser Encryption, Onion Routing, IP Security protocol Suite (IPSec), Virtual Private Networks; Firewalls: Design & Types, Personal Firewalls, Network Address Translation (NAT); Intrusion Detection and Prevention Systems.

IP Security: Overview; IP Security Policy; Encapsulating Security Payload; Combining Security Associations; Internet Key Exchange.

Unit – IV

Transport-Level Security: Web Security: Issues & Threats; Secure Naming; Secure Socket layer (SSL); Transport Layer Security (TLS); HTTPS; Secure Shell(SSH).

Wireless Network Security: Vulnerabilities in Wireless Networks; IEEE 802.11 Wireless LAN Securities; Wireless Application Protocol Overview; Wireless Transport Layer Security; WEP & WPA.

Electronic-mail Security: E-Mail Attacks; Pretty Good Privacy (PGP); Privacy Enhanced Mail (PEM); S/MIME; DomainKeys Identified Mail (DKIM).

Text Books:

1. William Stallings, Cryptography and Network Security, Pearson Education
2. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies , Security in Computing, PHI

Reference Books:

1. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, PHI
2. Bruce Schneier, Neils Ferguson, Practical Cryptography, Wiley
3. Behrouz A. Forouzan, Cryptography & Network Security, Tata McGraw Hill.
4. Trappe, W., Washingotn, L.C., Introduction to Cryptography with Coding theory, PHI
5. Stinson, D., Cryptography. Theory and Practice, CRC Press.
6. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley.

MS-20-43(ii): Big Data and Pattern Recognition

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30(i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40(i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to help students learn, understand and practice the basic and advanced methods to big data technology and tools required to manage and analyze big data including MapReduce, NoSQL and Hadoop. The course provides an idea about pattern recognition approaches and gives the practical exposure of NoSQL.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-43(ii).1	understand fundamental concept of big data & business architecture;
MS-20-43(ii).2	learndata governance for big data along with big data tools and techniques;
MS-20-43(ii).3	understand pattern recognition strategies in big data environment;
MS-20-43(ii).4	develop solutions of big data in NoSQL programming environment.

CO-PO Mapping Matrix for Course Code: MCA-20-43(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-43(ii).1	3	3	3	3	2	2	1	3	2	2	1
MS-20-43(ii).2	3	2	3	2	3	3	2	1	3	2	2
MS-20-43(ii).3	3	3	2	2	2	1	3	3	2	3	1
MS-20-43(ii).4	3	3	3	2	3	1	3	2	3	2	2
Average	**3**	**2.75**	**2.75**	**2.25**	**2.5**	**1.75**	**2.25**	**2.25**	**2.5**	**2.25**	**1.5**

CO-PSO Mapping Matrix for Course Code: MCA-20-43(ii)

COs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
MS-20-43(ii).1	3	3	1	3
MS-20-43(ii).2	3	2	2	2
MS-20-43(ii).3	2	2	2	3
MS-20-43(ii).4	3	2	1	2
Average	**2.75**	**2.25**	**1.5**	**2.5**

Unit – I

Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data, Identifying Data Characteristics, Business Motivations and Drivers for Big Data Adoption: Business Architecture, Business Process Management, Information and Communication Technology, Big Data Analytics Lifecycle, Enterprise Technologies and Big Data Business Intelligence, Industry examples of big data.

Unit – II

Data Governance for Big Data Analytics: Evolution of Data Governance, Big Data and Data Governance, Big Datasets, Big Data Oversight, Big Data Tools and Techniques: HDFS, Map Reduce, YARN, Zookeeper, HBase, HIVE, Pig, Mahout, Developing Big Data Applications, Stepwise Approach to Big Data Analysis, Big Data Failure: Failure is common, Failed Standards, Legalities.

Unit – III

Pattern Recognition: Preview of Inductive Learning, Bigotry and Inductive Learning, Pattern Recognition Systems, Fundamental Problems in Pattern Recognition, Feature Extraction and Reduction, Paradigms, Pattern Recognition Approaches, Importance and Applications. Classifying using Decision Trees, Obtaining Patterns Rules from Decision Trees, Syntactic Pattern Recognition.

Unit – IV

An Overview of NoSQL, Characteristics of NoSQL, NoSQL Storage Types, Advantages and Drawbacks, Comparison of NoSQL Products, The CAP Theorem, Partitioning, Storage Layout, Introduction to Key-Value Store, Document Databases and Column-Oriented Databases, NoSQL Misconceptions, NoSQL over RDBMS.

Text Books:

1. Thomas Erl, WajidKhattak and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques Prentice Hall.
2. David Loshin, Big Data Analytics from Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Morgan Kaufmann.
3. Jules J. Berman, Principles of Big Data Preparing, Sharing and Analyzing Complex Information, Morgan Kaufmann.
4. GauravVaish, Getting Started with NoSQL, Packt Publishing.
5. RajjanShinghal, Pattern Recognition Techniques and Applications, Oxford Higher Education

Reference Books:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer.
2. Jay Liebowitz, Big Data and Business Analytics, Auerbach Publications, CRC press.
3. Pete Warden, Big Data Glossary, O’Reily.
4. Michael Mineli, Michele Chambers, AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications.

MS-20-43(iii): Cyber Security and Blockchain Technology	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The course has been designed to give students an extensive overview of cyber security issues, tools and techniques that are critical in solving problems in cyber security domains. The course also covers the technological underpinning of block Chain operations.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-43 (iii).1	understand IT ACT (Cyber law) to the given case/problem and analyse it;
MS-20-43 (iii).2	demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection;
MS-20-43 (iii).3	understand block chain technology;
MS-20-43 (iii).4	investigate the influence of Block chain technology for the cyber security problem and evaluate its role.

CO-PO Mapping Matrix for Course Code: MS-20-43(iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-43 (iii).1	3	2	2	3	-	2	-	1	1	1	1
MS-20-43 (iii).2	2	3	2	2	2	3	1	2	-	-	3
MS-20-43 (iii).3	3	2	1	-	-	1	-	-	-	-	-
MS-20-43 (iii).4	2	3	2	2	2	3	-	1	1	1	2
Average	**2.5**	**2.5**	**2**	**2.25**	**2**	**2.25**	**1**	**1.75**	**1**	**1**	**2**

CO-PO Mapping Matrix for Course Code: MS-20-43(iii)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-43 (iii).1	2	3	1	3
MS-20-43 (iii).2	2	3	2	3
MS-20-43 (iii).3	2	1	1	1
MS-20-43 (iii).4	2	2	1	3
Average	**2**	**2.25**	**1.25**	**2.5**

Unit – I

Introduction to Cybercrime and Laws: Definition and Origins of Cybercrime, information Security, Who are Cybercriminals? Classifications of Cybercrimes. How Criminals Plan Them – Introduction, How Criminals Plan the Attacks, Cybercafe and Cybercrimes, Botnets, Attack Vector, The Indian IT ACT 2000 and amendments.

Tools and Methods used in Cybercrime

Introduction, Proxy Server and Anonymizers, Password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQLinjection, Buffer Overflow.

Unit – II **Phishing and Identity Theft:** Introduction, Phishing – Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft – PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle. **Network Defense tools:** Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs. Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless VsStateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System.
Unit – III Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs. Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain, Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.
Unit – IV Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, HashcashPoW, BitcoinPoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.
Text Books: 1. Marjie T. Britz, Computer Forensics and Cyber Crime: An Introduction, Pearson 2. Chwan-Hwa (John) Wu,J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press 3. Josh Thompsons, Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming.
Reference Books: **1.** Bill Nelson, Amelia Phillips, Christopher Steuart, Guide to Computer Forensics and Investigations, Cengage Learning 2. Daniel Drescher, Block Chain Basics, Apress. 3. AnshulKaushik, Block Chain and Crypto Currencies, Khanna Publishing House, Delhi.

MS-20-44 (i): Optimization Techniques

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30 (i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40 (i.e. 40%)

Instructions to paper setter for End semester exam:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various linear programming problems and their solution techniques. It focuses on various optimization techniques and their applications in problem solving.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-44(i).1	understand the role and principles of optimization techniques in business world;
MS-20-44(i).2	understand the techniques to solve and use LPP and IPP;
MS-20-44(i).3	analyse the optimization techniques in strategic planning for optimal gain;
MS-20-44(i).4	understand the techniques to solve networking and inventory issues;

CO-PO Mapping Matrix for the Course Code : MS-20-44 (i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-44(i).1	3	2	1	2	1	2	1	1	2	1	1
MS-20-44(i).2	3	2	1	3	1	3	1	1	2	1	1
MS-20-44(i).3	3	2	1	3	1	3	1	2	3	1	3
MS-20-44(i).4	3	2	1	3	2	3	1	2	3	1	3
Average	**3**	**2**	**1**	**2.75**	**1.25**	**2.75**	**1**	**1.5**	**2.5**	**1**	**2**

CO-PSO Mapping Matrix for the Course Code : MS-20-44 (i)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-44(i).1	2	2	2	2
MS-20-44(i).2	2	2	2	2
MS-20-44(i).3	2	2	2	2
MS-20-44(i).4	2	2	3	2
Average	**2**	**2**	**2.25**	**2**

Unit – I

Introduction: The Historical development, Nature, Meaning and Management Application of Operations research. Modelling, Its Principal and Approximation of O.R. Models, Main characteristic and phases, General Methods of solving models, Scientific Methods, Scope, Role on Decision Making and Development of Operation Research in India.

Linear Programming: Formulation, Graphical solution, standard and matrix form of linear programming problems, Simplex method and its flow chart, Two-phase Simplex method, Degeneracy.

Unit – II
Duality in LPP: Definition of Dual Problem, General Rules for converting any Primal into its Dual, Dual Simplex method and its flow chart. Integer Programming: Importance, Applications and Classification, Gomory's all integer programming problem technique and its flow chart, Branch and Bound Method.
Unit – III
Transportation Models: Formulation of problem, Obtaining Initial Basic feasible solution, Optimality tests, Progressing towards optimal solution, Unbalanced Transportation Problems. Assignment Models: Formulation of problem, Hungarian Method for Assignment Problems, Unbalanced Assignment Problems.
Unit – IV
Inventory theory Costs involved in inventory problems - single item deterministic models-economic lot size models without shortages and with shortages having production rate infinite and finite. PERT and CPM: Basic steps in PERT/CPM, Techniques, Network Diagram Representation, Forward and Backward Pass-computation, Representation in Tabular form, Determination of Critical path, Critical activity, Floats and Slack Times, Implementation in any programming language.
Text Books: 1. Sharma, S.D., Operations Research, KedarNath and Ram Nath, Meerut. 2. Gupta P.K., Hira and D.S., Operation Research, Sultan Chand & Sons, New Delhi.
Reference Books: 1. KantiSwarup, Gupta P.K. & Man Mohan, Operation Research, Sultan Chand & sons, New Delhi. 2. Rao S.S., Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi. 3. Taha, H.A., Operation Research – An Introduction, McMillan Publishing Co, New York. 4.Gillet, B.E., "Introduction to Operations Research: A Computer Oriented Algorithmic Approach". Tata McGraw Hill, New York.

MS-20-44(ii): Soft Computing

Type: Elective
Course Credits: 04
Contact Hours: 4 hours/week
Examination Duration: 3 Hours
Mode: Lecture
External Maximum Marks: 75
External Pass Marks: 30(i.e. 40%)
Internal Maximum Marks: 25
Total Maximum Marks: 100
Total Pass Marks: 40(i.e. 40%)

Instructions to paper setter for End semester examination:
Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Introduce fundamental soft computing concepts with an exposure to non-traditional techniques for problem solving and optimization. Provide Soft Computing based research oriented direction for solving imprecisely defined problems. Provide a comprehensive introduction to nature-inspired metaheuristic methods for search and optimization, including the latest trends in evolutionary algorithms and other forms of natural computing.

Course Outcomes: At the end of this course, the student will be able to:

MS-20-44(ii).1	have a knowledge of soft computing techniques along with their applications and non-traditional metaheuristic optimization and data clustering techniques & algorithms for obtaining optimized solutions to optimization, computational intelligence, and design/scheduling applications;
MS-20-44(ii).2	apply fuzzy logic theory to imprecisely defined problems;
MS-20-44(ii).3	use Neural Networks concepts to find solutions to problems where normally algorithmic methods do not exist or are costly;
MS-20-44(ii).4	design high-quality solutions using Genetic Algorithms for optimization and search problems and have exposure to MATLAB environment for implementing solutions to problems using soft computing techniques.

CO-PO Mapping Matrix for Course Code: MS-20-44(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-44(ii).1	3	3	3	3	2	3	3	2	3	-	3
MS-20-44(ii).2	3	3	3	3	2	3	3	2	3	-	3
MS-20-44(ii).3	3	3	3	3	2	3	3	2	3	-	3
MS-20-44(ii).4	3	3	3	3	2	3	3	2	3	-	3
Average	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**-**	**3**

CO-PSO Mapping Matrix for Course Code: MS-20-44(ii)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-44(ii).1	3	3	3	3
MS-20-44(ii).2	3	3	3	3
MS-20-44(ii).3	3	3	3	3
MS-20-44(ii).4	3	2	3	3
Average	**3**	**2.75**	**3**	**3**

Unit – I

Soft Computing : Conventional AI to Computational Intelligence; Soft Computing Constituents and Applications ;
Introduction toNon-traditional Metaheuristic Optimization Techniques: Random Optimization, Simulated Annealing, Tabu Search, Ant Colony Optimization, Particle Swarm Optimization, Harmony Search, Memetic Algorithms, Other Evolutionary Algorithms such as Firefly Algorithm, Bee Algorithm, Shuffled Frog Leap algorithm,

Bat algorithm etc.
Data Clustering Algorithms: K-Means, Fuzzy C-Means, Mountain Clustering, Subtractive Clustering.

Unit – II

Fuzzy Set theory: Fuzzy Sets & Classical Sets; Operations on Fuzzy Sets, Fuzzy Relations, Linguistic Variables;
Membership Functions: Introduction, Features, &Fuzzification, Methods of Membership Value Assignment; Defuzzification.
Fuzzy Systems: Crisp Logic, Predicate Logic, Fuzzy Logic; Fuzzy Rule Base and Approximate Reasoning, Fuzzy Quantifiers; Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy Logic Control System; Fuzzy Expert Systems.

Unit – III

Neural Networks: Fundamental Concepts, Basic Models and Architecture; Machine Learning Using Neural Networks; Associative Memory Networks and their Applications.
Supervised Learning Neural Networks: Perceptron Networks, Radial Basis Function Networks: Back Propagation Neural Network: Architecture, Learning, Applications, & Research Directions; The Boltzman Machine.
Unsupervised Learning Networks: Competitive Learning networks; Kohonen Self-Organizing Networks; Hebbian learning; The Hopfield Network; Counter propagation Networks; Adaptive Resonance Theory: Introduction, Architecture, & Applications; Feed forward Networks; Reinforcement Learning.

Unit – IV

Genetic Algorithms: Introduction to Genetic Algorithms (GA) and their Terminology; Traditional Optimization and Search Techniques vs Genetic Algorithm ; Operators in Genetic Algorithms; Problem Solving using Genetic Algorithm; Classification of Genetic Algorithms; Holland's Classifier Systems; Genetic Programming; Advantages and Limitations of Genetic Algorithm; Applications of Genetic Algorithm; Applications of GA in Machine Learning.
Introduction to Hybrid Systems; MATLAB Environment for Soft Computing Techniques.

Text Books:

1. S. N. Sivanandam& S. N. Deepa, Principles of Soft Computing, Wiley - India.
2. JyhShing Roger Jang, ChuenTsai Sun, EijiMizutani, NeuroFuzzy and Soft Computing, PrenticeHall

Reference Books:

1. S.Rajasekaran and G.A.VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, Prentice-Hall of India Pvt. Ltd.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall.
3. George J. Klir, Ute St. Clair, Bo Yuan, Fuzzy Set Theory: Foundations and Applications Prentice Hall.
4. Simon O. Haykin, Neural networks: a comprehensive foundation, Pearson Education.
5. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall
6. Goldberg D. E., Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education.
7. Ahmad Lotfi, Jonathan Garibaldi, Applications and Science in Soft Computing, Springer.
8. Rajkumar Roy, Mario Koppen, Soft Computing and Industry: Recent Applications, Springer.
9. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India.
10. Du, Ke-Lin, Swamy, M. N. S., Search and Optimization by Metaheuristics: Techniques and Algorithms, Springer
11. OmidBozorg-Haddad, Mohammad Solgi, Hugo A. Loaiciga, Meta-heuristic and Evolutionary Algorithms for Engineering Optimization, Wiley

MS-20-44 (iii): Cloud Computing and IoT	
Type: Elective **Course Credits:** 04 **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To study the fundamental concepts of cloud computing, enabling technologies, cloud service models and security concerns. To learn core issues of Internet of Things, IOT communication protocols and security concerns.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MS-20-44 (iii).1	understand core issues of cloud computing and enabling technologies;
MS-20-44 (iii).2	design services based on cloud computing platforms;
MS-20-44 (iii).3	understand concepts, architecture, applications and design principles for connected devices in IoT;
MS-20-44 (iii).4	explain, analyze and design IoT-oriented communication protocols and security concerns.

CO-PO Mapping Matrix for Course Code: MS-20-44 (iii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
MS-20-44 (iii).1	3	2	3	3	3	2	2	2	3	2	1
MS-20-44 (iii).2	3	3	3	3	3	2	3	3	3	2	3
MS-20-44 (iii).3	3	2	3	3	3	2	2	2	3	2	1
MS-20-44 (iii).4	3	3	3	3	3	2	3	3	3	2	3
Average	**3**	**2.5**	**3**	**3**	**3**	**2**	**2.5**	**2.5**	**3**	**2**	**2**

CO-PSO Mapping Matrix for Course Code: MS-20-44 (iii)

COs	PSO1	PSO2	PSO3	PSO4
MS-20-44 (iii).1	2	2	3	2
MS-20-44 (iii).2	3	3	3	3
MS-20-44 (iii)3	2	2	3	2
MS-20-44 (iii).4	3	3	3	3
Average	**2.5**	**2.5**	**3**	**2.5**

Unit – I

Cloud Computing: Definition, roots of cloud computing, characteristics, cloud architecture, deployment models, service models.

Virtualization:Benefits & drawbacks of virtualization, server virtualization,virtualization of - operating system, platform, CPU, network, application, memory and I/O devicesetc.

Unit – II Cloud Computing Service Platforms – Compute services, storage services,database services, applicationservices, queuing services, e-mail services, notification services, media services, content delivery services, analytics services, deployment& management services, identity& access management services and their case studies. Security in cloud computing: issues, threats, data security and information security.
Unit – III Internet of Thing (IoT): Overview, conceptual framework, architecture, major components, common applications Design principles for connected devices: Modified OSI Model for IoT/M2M systems, ETSI M2M Domains and High-level capabilities, wireless communication technologies - NFC, RFID, Bluetooth BR/EDR and Bluetooth low energy, ZigBee, WiFi, RF transceiver and RF modules. Data enrichment, data consolidation & device management at gateway.
Unit – IV Design principles for web connectivity: web communication protocols for connected devices: constrained application protocol, CoAP Client web connectivity, client authentication, lightweight M2M communication protocol. Message communication protocols for connected devices - CoAP-SMS, CoAP-MQ, MQTT, XMPP. IoT privacy, security and vulnerabilities and their solutions.
Text Books: 1. ArshdeepBahga, Vijay Madisetti, Cloud Computing – A Hands-on Approach, University Press. 2. RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing – Principles and Paradigms, Wiley India Pvt. Ltd. 3. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hills
Reference Books: 1. Kai Hwang, Geoffrey C.Fox, and Jack J. Dongarra, Distributed and Cloud Computing, Elsevier India Private Limited 2. Saurabh Kumar, Cloud Computing, Wiley India Pvt. Ltd. 3. Shailendra Singh, Cloud Computing, Oxford 4. Coulouris, Dollimore and Kindber, Distributed System: Concept and Design,Addison Wesley 5. Michael Miller, Cloud Computing, Dorling Kindersley India 6. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud computing: A practical Approach, McGraw Hill 7. DimitriosSerpnos, Marilyn Wolf, Internet of Things (IoT) Systems, Architecture, Algorithms, Methodologies, Springer 8. Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-onApproach), VPT 9. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications

CO-PO-PSO MAPPING MATRIX FOR ALL THE COURSES OF

MASTER OF SCIENCE(COMPUTER SCIENCE (SOFTWARE))

SEMESTER	**COURSE CODE**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
I	**MS-20-11**	3	1	2	3	2	3	3	1	2	2	2	3	3	2	3
	MS-20-12	2.75	2.5	2.75	2.25	2.5	1.75	2.25	2.5	2.5	2	2.25	2.5	2.75	2	2.5
	MS-20-13	3	2	3	3	3	2.25	1.5	1	3	1	2	3	2	3	2.5
	MS-20-14	3	2	1	2	1.25	2.25	1	1.5	2.25	1	2	2.5	2.5	2.5	3
II	**MS-20-21**	3	2.5	1	3	2	3	2	3	3	1	2.5	2	3	2.5	3
	MS-20-22	2.75	2	3	3	3	2	1.5	2	3	1.5	2	3	2.75	2	3
	MS-20-23	3	2	3	3	3	2	2.25	2.5	3	1	2.25	2	3	3	3
	MS-20-24	3	1.75	3	3	2	1.75	1.5	2	3	-	1.75	1	1.5	2.5	3
III	**MS-20-31**	2.5	2.5	2.75	2.5	2.25	2.25	1.25	2.25	2.75	2.25	2.25	2.75	2.5	1.5	2.25
	MS-20-32	3	1.75	3	2.75	1	1	1.75	1	3	-	1.25	1.25	2.5	2.5	3
	MS-20-33(i)	3	2	2	2	1.75	2.25	2	2	3	1	2	3	3	3	3
	MS-20-33(ii)	3	2	3	3	3	1.5	1	2	3	1	1.5	2	1	3	3
	MS-20-33(iii)	3	3	1	3	1	3	2.5	3	3	1	3	3	3	3	2
	MS-20-34(i)	3	2.75	3	2.5	1	1.5	1.75	1	3	-	2	2	1.5	2	3
	MS-20-34(ii)	3	2	1	3	1	3	2	2.5	3	1	3	3	3	3	3
	MS-20-34(iii)	3	2.25	1	3	1	3	2	2.5	3	1	3	3	3	3	2
IV	**MS-20-41**	3	1	2	2.75	2	2.75	1.75	1.75	1	1	1	2.5	3	2.5	3
	MS-20-42	3	3	2	2.5	1.5	2.5	2.5	2	3	1	2.5	2.5	3	3	3
	MS-20-43(i)	3	2.75	3	3	2	1.75	2	2	3	-	2	1	3	2.75	3
	MS-20-43(ii)	3	2.75	2.75	2.25	2.5	1.75	2.25	2.25	2.5	2.25	1.5	2.75	2.25	1.5	2.5
	MS-20-43(iii)	2.5	2.5	2	2.25	2	2.25	1	1.75	1	1	2	2	2.25	1.25	2.5
	MS-20-44(i)	3	2	1	2.75	1.25	2.75	1	1.5	2.5	1	2	2	2	2.25	2
	MS-20-44(ii)	3	3	3	3	2	3	3	2	3	-	3	3	2.75	3	3
	MS-20-44(iii)	3	2.5	3	3	3	2	2.5	2.5	3	2	2	2.5	2.5	3	2.5
I to IV	**Average**	**2.94**	**2.23**	**2.26**	**2.73**	**1.96**	**2.26**	**1.89**	**1.98**	**2.69**	**1.32**	**2.11**	**2.39**	**2.59**	**2.49**	**2.74**

Kurukshetra University, Kurukshetra
(Established by the State Legislature Act XII of 1956)
('A+' Grade, NAAC Accredited)

|| योगस्थ: कुरु कर्माणि ||
समबुद्धि व योगयुक्त होकर कर्म करो
(Perform Actions while Stead fasting in the State of Yoga)

Scheme of Examination and Syllabus of

Master of Computer Application(MCA)(Non-CBCS) in Phased Manner

DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS

Non-CBCS CURRICULUM (2020-21)

Program Name: Master of Computer Applications(MCA)(Non-CBCS)

(For the Batches Admitted From 2020-2021)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SCHEME OF EXAMINATIONS
FOR
MASTER OF COMPUTER APPLICATIONS
(NON-CBCS)
(FOR INSTITUTESAFFILIATED TO KURUKSHETRA UNIVERSITY, KURUKSHETRA)
W. E. F. ACADEMIC SESSION 2020-21 IN PHASED MANNER

Paper Code	Nomenclature of Paper	Workload Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks	Total Marks	Pass Marks
				Max.	Pass			
First Semester								
MCA-20-11	Programming in Java	4	3	75	30	25	100	40
MCA-20-12	Data Structures using C++	4	3	75	30	25	100	40
MCA-20-13	Operating Systems	4	3	75	30	25	100	40
MCA-20-14	Data Communication and Computer Networks	4	3	75	30	25	100	40
MCA-20-15	Object-Oriented Analysis and Design using UML	4	3	75	30	25	100	40
MCA-20-16	S/W Lab – I Based on MCA-20-11	5	3	100	40	-	100	40
MCA-20-17	S/W Lab – II Based on MCA-20-12	5	3	100	40	-	100	40
Total		**30**		**575**	**230**	**125**	**700**	**280**
Second Semester								
MCA-20-21	Web Technologies	4	3	75	30	25	100	40
MCA-20-22	Linux and Shell Programming	4	3	75	30	25	100	40
MCA-20-23	Advanced Data Base Systems	4	3	75	30	25	100	40
MCA-20-24	Elective-I	4	3	75	30	25	100	40
MCA-20-25	Elective-II	4	3	75	30	25	100	40
MCA-20-26	S/W Lab – III Based on MCA-20-21 and MCA-20-23	5	3	100	40	-	100	40
MCA-20-27	S/W Lab – IV Based on MCA-20-22	5	3	100	40	-	100	40
	Total	**30**		**575**	**230**	**125**	**700**	**280**
Elective – I								
MCA-20-24 (i)	Principles of Programming Languages	4	3	75	30	25	100	40
MCA-20-24(ii)	High Performance Networks	4	3	75	30	25	100	40
MCA-20-24(iii)	Compiler Design	4	3	75	30	25	100	40
Elective – II								
MCA-20-25 (i)	Theory of Computation	4	3	75	30	25	100	40
MCA-20-25 (ii)	Design and Analysis of Algorithms	4	3	75	30	25	100	40
MCA-20-25(iii)	Security in Computing	4	3	75	30	25	100	40

Paper Code	Nomenclature of Paper	Workload Per Week (Hrs.)	Exam Time (Hrs.)	External Marks		Internal Marks	Total Marks	Pass Marks
				Max.	Pass			
Third Semester								
MCA-20-31	Computer Architecture and Parallel Processing	4	3	75	30	25	100	40
MCA-20-32	Data Mining and Integration using R	4	3	75	30	25	100	40
MCA-20-33	Artificial Intelligence	4	3	75	30	25	100	40
MCA-20-34	Elective-III	4	3	75	30	25	100	40
MCA-20-35	Elective-IV	4	3	75	30	25	100	40
MCA-20-36	S/W Lab – V Based on MCA-20-32	5	3	100	40	-	100	40
MCA-20-37	S/W Lab – VI Based on MCA-20-35	5	3	100	40	-	100	40
*MCA-20-38	Summer Training / Internship(Industry Based)	-	Viva Voce	150	60	50	200	80
	Total	**30**		**725**	**290**	**175**	**900**	**360**
Elective – III								
MCA-20-34 (i)	Cloud Computing and IoT	4	3	75	30	25	100	40
MCA-20-34 (ii)	Cyber Security	4	3	75	30	25	100	40
MCA-20-34(iii)	Digital Marketing	4	3	75	30	25	100	40
Elective – IV								
MCA-20-35 (i)	Advances in Java	4	3	75	30	25	100	40
MCA-20-35 (ii)	Advanced Web Technologies	4	3	75	30	25	100	40
MCA-20-35(iii)	Programming with Kotlin	4	3	75	30	25	100	40
Fourth Semester								
MCA-20-41	Big Data and Pattern Recognition	4	3	75	30	25	100	40
MCA-20-42	Computer Graphics and Animation	4	3	75	30	25	100	40
MCA-20-43	Mobile Application Development	4	3	75	30	25	100	40
MCA-20-44	Elective-V	4	3	75	30	25	100	40
MCA-20-45	Elective-VI	4	3	75	30	25	100	40
MCA-20-46	S/W Lab–VII Based on MCA-20-41 and MCA-20-42	5	3	100	40	-	100	40
MCA-20-47	Project Based on MCA-20-43	5	3	75	30	25	100	40
	Total	**30**		**550**	**220**	**150**	**700**	**280**
	Grand Total	**120**		**2425**	**970**	**575**	**3000**	**1200**
Elective – V								
MCA-20-44 (i)	Soft Computing	4	3	75	30	25	100	40
MCA-20-44 (ii)	Machine Learning	4	3	75	30	25	100	40
MCA-20-44(iii)	Digital Image Processing	4	3	75	30	25	100	40
Elective – VI								
MCA-20-45 (i)	Optimization Techniques	4	3	75	30	25	100	40
MCA-20-45(ii)	Information Systems	4	3	75	30	25	100	40
MCA-20-45(iii)	BlockchainTechnology	4	3	75	30	25	100	40

***Note 1:** Summer Training / Internship will be held immediately after 2nd Semester Examination and will behaving a minimum duration of 45 days and maximum durationof 60 days. Students have to submitthe Summer Training / Internship Report latest by 30th August. Evaluation of the Report and Viva-Voce shall be held during 3rd Semester. The Evaluation and Viva-Voce shall be held by one External and one Internal examiner.

Note 2: Evaluation procedure for internal assessment marks:
Two Mid Term Examinations should be conducted by the concerned teacher each of 10 marks. Five marks may be given by theconcernedteacher on the basis of performance during the course (puzzles/ assignments/ interactions/ attendance etc.).

Note 3: Size of groups in all practical courses should not be more than thirty students.

MCA-20-11: Programming in JAVA

Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The course aims is to equip the students with JAVA programming language concepts with object-oriented programming principles.In this course student will be able to learn the basic syntax and semantics of the Java language and programming environment; build robust applications using Java's object-oriented features; implement the interface and inheritance; understand exceptional handling and multi-threading concepts along with Applets, AWT and Event Handling.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-11.1	learn the basic features of Java;
MCA-20-11.2	develop program using different concepts of OOPs;
MCA-20-11.3	develop programming using Java I/O and Applet Programming;
MCA-20-11.4	design and Implement Graphics programming using AWT and Layouts.

Unit – I

Java History: Java features, How Java differs from C++, Java Program Structure, Java Tokens, , Java virtual machine, Constants, variables and data types, operators & expressions, control structures, arrays, class & object, garbage collection, finalize() method, Inheritance, method overriding, Abstract class, Multiple inheritance, Interfaces, extending Interfaces, Accessing Interface variables.

UNIT – II

Packages, Exception Handling & Multithreading: API Packages, Creating packages, Accessing a package, Adding a class to a package, use of super and final keywords, Wrapper classes, Exception types, uncaught exceptions, multiple catch clauses, nested try statements, built-in exceptions, creating your own exceptions, Multithreading; Java thread model, thread priorities, threads synchronization, thread suspending, resuming and stopping threads.

UNIT – III

I/O Streams & Applet: Console I/O – reading console input, writing console output, Files I/O-Byte Streams, Character Streams, Collection of inbuilt Interfaces & Classes, Applet programming, Applet life Cycle, creating executable Applet, Applet Tag, Running an applet, passing parameters to applet, Graphics programming, GUI Concepts in Java, managing Input/Output in Applet.

UNIT – IV

Event Handling: AWT Classes, AWT Button, AWT Label, AWT TextField, AWT TextArea, AWT Checkbox, Event Listeners, Java ActionListener, Java MouseListener, MouseMotionListener, Adapter Classes as Helper Classes in Event Handling. Layout managers- Grid Layout, Flow Layout, Card Layout, Border Layout, Menus.

Text Books:

1. E. Balaguruswamy, Programming with JAVA- A Primer, Tata Mc-Graw Hill publication.
2. Patrick Naughton, Herbert, Schild,The Complete reference Java 2, Tata Mc-Graw Hill.

Reference Books:

1. Patrick Nieaneyer and Joshna Peck, Exploring Java, O.Reilley.
2. Hareliy Hahn, Teacher the Internets, P.H.I.
3. Barry Boone, William Stanck, Java 2 exam Guide, Tata Mc-Graw Hill.

MCA-20-12: Data Structures using C++	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this paper is to make the students familiar with the commonly used data structures and understand their applications in real life problems.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-12.1	understand and apply the array data structure along with various operations on it;
MCA-20-12.2	understand and apply the concepts of linked list, stacks and queue data structures;
MCA-20-12.3	understand and apply the tree data structure in various fields;
MCA-20-12.4	design and analyze the algorithms for graph, sorting, searching, and hashing.

Unit – I

Introduction to Data Structures: Classification of Data Structures, Complexity of Algorithms, Abstract Data Types, Arrays, Representation of Arrays in Memory, Operations on Array, Strings and its Representation in Memory, Operations on Strings, Pointers, Sparse Matrices.
Sorting: Bubble Sort, Selection Sort, and Insertion Sort.
Searching: Linear Searching, Binary Searching.
Implementation of Arrays, String, Sorting and Searching in C++.

Unit – II

Linked Lists: Introduction, Types and Operations (Insertion, Deletion, Traversal, Searching, Sorting), Applications, Dynamic Memory Management, Polynomial Representation and Addition, Implementation of Linked Representations in C++.
Stacks & Queues: Representation of Stacks, Stack Operations, Applications, Recursion, Queues, Operations on Queues, Circular Queues, Dequeue, Priority Queues, Applications, Implementation of Stacks and Queues in C++.

Unit – III

Trees: Definition and Basic Terminologies, Representation of Trees, Binary Trees, Types of Tree, Representation of Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Binary Search Trees and Operations, AVL Trees, Heap, Heap-Sort, M-Way Search Trees, B-Trees, B^+ Trees, Applications, Implementation of trees in C++.

Unit – IV

Graphs: Definitions and Basic Terminologies, Representation of Graphs, Graph Traversals, Operations on Graphs, Shortest Path Problem (Warshall's Algorithm and Dijkstra's Algorithm), Minimum Spanning Tree (Prim's and Kruskal's Algorithm), Applications, Implementation of Graphs using C++.
Sorting and Searching: Recursive Binary Search, Types of Sorting, Implementation of Different Sorting Techniques in C++: Merge Sort, Radix Sort, Counting Sort, Bucket Sort.
Hashing: Hash functions, Collision Resolution, Implementation using Linear and Quadratic Probing, Chaining using C++.

Text Books:

1. G.A.V Pai, Data Structures and Algorithms, Tata McGraw-Hill.
2. Drozdek, Data Structure and Algorithms in C++, Cengage Learning.

Reference Books:

1. Seymour Lipschutz, Data Structures, Tata McGraw-Hill, Schaum's Outlines, New Delhi.
2. Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education.
3. Goodrich, Data Structures & Algorithms in C++, Wiley India Pvt. Ltd.
4. S. Sahni, Data structures, Algorithms, and Applications in C++, University Press (India) Pvt. Ltd.
5. Walter Savitch, Problem solving with C++, Pearson education.
6. John R. Hubbard, Data Structures with C++, Tata McGraw-Hill, Schaum's Outlines, New Delhi.

MCA-20-13: Operating Systems	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question, there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with different functions performed by operating systems.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-13.1	learn the concept of Operating Systems, processes and the CPU scheduling;
MCA-20-13.2	understand the concept of concurrent processes and deadlocks in operating systems;
MCA-20-13.3	understand the file, memory and device managementin operating systems.
MCA-20-13.4	appreciate the need of protection & security along with distributed operating systems.

Unit – I

Introductory Concepts: Operating system functions, structure, types viz. Batch processing systems, multi-programming systems,Time-sharing systems, desktop systems, multi-processor systems, distributed systems, clustered systems, real-time systems, handheld systems, open-source operating systems.

Operating System Structures: System Components, Operating system services, system calls, system programs.

CPU Scheduling: Process concepts, process operations, inter-process communication, scheduling criteria, scheduling algorithms, Comparative study of scheduling algorithms, Multiple processor scheduling.

Unit – II

Concurrent Processes: Critical section problem, Semaphores, Classical process co-ordination problems and their solutions, monitors.

Deadlocks: Deadlock characterization, Deadlock handling, Deadlock prevention and avoidance, Deadlock detection and recovery.

Unit – III

Memory Management: Swapping, Paging, Segmentation, Virtual memory concepts: Demand Paging, Page replacement Algorithms, Thrashing.

Storage Management: File concepts, File access methods, Directory Structure, File-system mounting, File sharing, Protection, File system structure and implementation, Directory implementation, File allocation methods, Recovery. Disk scheduling criteria and algorithms.

Unit – IV

Protection & Security: Goals of protection, domains of protection, access matrix. Security: Security problem, threats, security tools, classification.

Distributed Systems: Types of network-based OS, Network structure and topologies, Communication structure & Protocol, design issues. Distributed File-system: Remote file access, File replication. Distributed synchronization: Mutual exclusion, Concurrency control, deadlock handling.

Text Books:

1.Silberschatz A., Galvin P. B., Gagne G., Operating System Concepts, Wiley India Pvt. Ltd.
2. ChauhanNaresh, Principles of Operating Systems, Oxford University Press.

3. Tanenbaum A.S., Operating System- Design and Implementation, PHI Learning.
Reference Books: 1. Deitel H.M., Operating Systems, Pearson Education. 2. Stallings William, Operating System, PHI Learning. 3. Godbole A.S., Operating Systems, Tata McGraw-Hill, New Delhi.

MCA-20-14 Data Communication and Computer Networks

Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an in-depth coverage of various concepts, components, and technologies of Computer Networks and Data Communication. Provide the architectural overview of the Internet. Expose the students to the current trends in wired and wireless communication technologies and real-world networking scenario

Course Outcomes(COs)	At the end of this course, the student will be able to:
MCA-20-14.1	characterize various types of computer networks and standards along with an insight into the principles of networking by using protocol layering of the Internet and the TCP/IP protocol suite;
MCA-20-14.2	comprehend the notion of data communication and its related functional components and aspects;
MCA-20-14.3	understand design issues related to Local area Networks and get acquainted with the prevailing wired and wireless LAN technology standards;
MCA-20-14.4	get versed with the routing, addressing and congestion control issues in Networks and the Internet architecture.

Unit – I

Network Characterization: Goals and Applications; Categorization according to Size, Purpose, Design issues & Transmission Technologies; Network Architecture and Service Models; Design issues for the Layers; OSI and TCP/IP Reference Models; Functions of layers and protocols of TCP/IP; Comparison of OSI & TCP/IP ; Data Transmission using TCP/IP.

Networking Models & Applications: Centralized, Decentralized, and Distributed; Client-Server and Peer-to-Peer; File sharing & Web- based; Content Distribution Networks.

Introduction to Example Networks: The Internet and its Conceptual View ; Accessing The Internet; Connection-Oriented Networks: X.25, Frame Relay and ATM.

Unit – II

Data Communication Concepts & Components: Digital and Analog Data and Signals, Asynchronous and Synchronous transmission; bit rate, baud, bandwidth& Channel Capacity; Nyquist Bit Rate, Shannon Capacity; Network Performance Parameters; Transmission Impairment.

Connecting Devices & Transmission Media: Network Interface Cards, Connectors, Hubs, Transceivers & Media Connectors; Link-Layer Switches, Bridge, Routers, Gateways, Virtual LANs; Guided Transmission Media; Wireless transmission; Satellite communication.

Data Encoding & Modulation Techniques: NRZ, NRZ-I, Manchester and Differential Manchester encoding; 4B/5B ; Pulse Code Modulation & Delta Modulation; Digital to Analog encoding.

Switching and Bandwidth Utilization: Methods of Switching; Virtual Circuit & Datagram Networks; Multiplexing; Spread Spectrum.

Wired Networks and The Local Loop: Telephone Networks; Modems and Modulation Techniques; Broadband and ADSL; Internet over Cable; ADSL Versus Cable; Hybrid Fiber-Coaxial Network;Fiber-to-the-Home Broadband.

Unit – III

Data Link Layer: Communication at the Data Link Layer; Nodes and Links; Link Layer Addressing; Examples of Data Link layer protocols.

Design Issues: Framing techniques: Byte Oriented and Bit Oriented Protocols; Error Control: Error Detection and Correction; Sliding Window Flow Control Protocols.

Media Access Control: Aloha, CSMA, CSMA/CD, CSMA/CA; Collision free protocols with Controlled Access; Limited Contention Protocols; Channelization: FDMA, TDMA, CDMA; Wavelength Division Multiple access for Fiber-Optic Data Communication.

IEEE LAN standards: Ethernet (Physical specifications, Encoding, Frame Format & MAC protocol); Binary Exponential Backoff algorithm; Token Ring and FDDI.

Introduction to Wireless Networks: IEEE 802.11 Wireless LAN; Wi-Max; Bluetooth and other wireless PAN technologies & their applications; Cellular Networks: Generations; GSM & CDMA Technologies.

Unit – IV

Transport layer: Addressing, Services and Protocols; TCP and UDP services & header formats.

Network Layer : Services, Routing Algorithms: Shortest path Routing, Flooding , Distance Vector Routing, Link State Routing, Hierarchical Routing, Multi Cast Routing, Routing for Mobile hosts.

Network layer in TCP/IP: Basic characteristics of IP protocol; addressing and header format of IPv4; IPv6: Major goals& features.

Congestion Control & Quality of Service: General Principals; Congestion control in Virtual – Circuit Subnets; Congestion Control in Datagram Subnets: Choke packets, Load Shedding; Random Early Detection, Jitter Control; Over provisioning, Buffering, Traffic Shaping, Leaky bucket, token bucket, Resource Reservation, Admission Control, Packet Scheduling.

Text Books:

1. Andrew S. Tanenbaum, Computer Networks, PHI.
2. Behrouz A Forouzan, Data Communications and Networking, Mc-Graw Hill Education.

Reference Books:

1. Michael A. Gallo, William M. Hancock, Computer Communications and Networking Technologies, CENGAGE learning.
2. William Stallings, Data and Computer Communications, PHI.

MCA-20-15: Object-Oriented Analysis and Design Using UML	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To understand the concepts of UML and its use for class modeling, state modeling, use case modeling, interactionmodeling, activity modeling etc. and to analyse & design software systems using object-oriented approach.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-15.1	understand basics of modeling and fundamentals of UML such as things, relationships, diagrams, extensibility mechanisms and views;
MCA-20-15.2	to practically apply knowledge of class modeling and state modeling using object-oriented analysis and design methods with a clear emphasis on UML;
MCA-20-15.3	to practically apply knowledge of use case modeling, interaction modeling and activity modelling using UML;
MCA-20-15.4	have a working ability and grasping attitude to analyse and design software systems based on object-oriented thinking using UML.

Unit – I

ModelingasaDesignTechnique: Principles of modeling, abstraction, encapsulation,modularity,hierarchy,typing,concurrency, persistence ofobjects,purposeofmodelling;
UML:Principlesofmodeling,UML things–structural,behavioral,grouping, annotationalrelationshipsin UML–dependency,association,generalization,realization; OverviewofUML diagrams, Mechanisms in the UML–specifications, adornments, common divisions, extensibility mechanisms - stereotypes, tagged values, constraints, UML profiles, UML views.

Unit – II

Class Modeling:Object &Class, Links &Associations, Generalization &Inheritance,Association Ends-scope, visibility, Multiplicity,Rolenames,Ordering,bags & sequences, Qualified association,Aggregation,association attributes &associationclasses,propagation of operations,Abstractclass, Metadata, reification, Constraints, derived data, packages, elements of class diagrams, constructingclassdiagrams.
StateModeling:Events,States,Transitions & Conditions, Activity Effects, Do-Activities, Entry & Exit Activities, CompletionTransitions, Sending Signal,Elements of Statediagrams,Nestedstatediagrams, signalgeneralization, concurrency, constructing state diagrams.

Unit – III

Use Case modeling: Actors, Use Cases, relationships - between actors, between use cases and between actor and use case, elements of use case diagram, constructing use case diagrams.
Interaction Modeling: Elements of sequence diagram and communication diagram, constructing sequence diagram and communication diagram;
Activity Modeling: Elements of activity diagram, constructing activity diagram.

Unit – IV

SystemAnalysis&design:Systemdevelopmentstages,systemconception,analysis, domainclassmodel, domain state model,iteratingthe analysis.

Applicationinteraction model, application class model, application state model, addingoperations
SystemDesign:estimatingperformance,makeareuseplan,organizethesystemintosubsystem,identifying concurrency, allocating subsystems to processors and tasks, management of data stores, handling global resources, choosing software control strategies, handling boundary conditions, setting trade-off priorities, selectingan architectstyle.
Class Design: bridging gap, realize use cases with operations, designing algorithms, design optimization, adjustmentofinheritance, organize classes&associations.

Text Books:

1. GradyBooch,JamesRumbaugh,IvarJacobson,TheUnifiedModelingLanguageUserGuide, Pearson education.
2. M. Blaha,J. Rumbaugh, Object-OrientedModelingand Design with UML, Pearson Education.

Reference Books:

1. J.Rumbaugh,M.Blaha,W.Premerlani,F.Eddy,W.Lorensen,Object-OrientedModelingandDesign, Prentice HallofIndia.
2. Satzinger,Jackson, Burd,Object-OrientedAnalysis& Design withthe UnifiedProcess,Thomson.
3. GradyBooch, ObjectOrientedAnalysis & Design, Pearson Education.

MCA-20-21: Web Technologies	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide fundamentals concepts of Web Services, JavaScript and lays foundations for the advanced studies in the area of web services.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-21.1	design web pages using HTML5 and CSS;
MCA-20-21.2	understand objects and data validation in JavaScript;
MCA-20-21.3	build Dynamic web site using server side PHP Programming and Database connectivity;
MCA-20-21.4	create web applications with Ajax.

Unit – I

Introduction: Web browsers and its functions, web optimizations; Static page design; designing static web pages with HTML5.0-HTML basic, multimedia, Graphics, Form tags, CSS 2.0 concept and its properties & CSS 3.0 properties i.e. borders, backgrounds, fonts, text effects, Buffering, Weblog, Web Cache Poisoning.

Unit – II

JavaScript: Document Object Model (DOM), Obtaining user inputs, memory concepts, Operators, Control Structures, Looping constructs, break, continue statements, Programmer defined functions, Scoping rules, Recursion and iteration, Array declaration and allocation, passing arrays to function, Objects: String, Date, Boolean, Window, document; using cookies, form validation in Java Script, Handling Events Using JavaScript.

Unit – III

PHP: Installing and Configuring MySQL and PHP, Basic Security Guidelines, Variables, Data Types, Operators and Expressions, Constants, Flow Control Functions; Switching Flow, Loops, Code Blocks and Browser Output, Objects, Strings Processing, Form processing, Connecting to database, cookies, Session, dynamic contents.

Unit – IV

Introduction to AJAX: Exploring different web technologies, Creating a simple AJAX application, Interacting with the Web Server Using the XMLHttpRequest Object, Create an XMLHttpRequest Object, Interact with the Web Server. Differentiating AJAX and Non-AJAX application.

Working with PHP and AJAX: Introduction, Process Client Requests, Accessing Files Using PHP,

Implementing Security and Accessibility in AJAX applications: Introduction, Secure AJAX Applications, Accessible Rich Internet Applications.

Text Books:

1. Deitel H.M., Deitel P.J., Internet & World Wide Web: How to program, Pearson Education.
2. Kogent Learning, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book, Wiley India Pvt. Ltd.

Reference Books:

1. Boronczyk, Naramore, Beginning PHP, Apache, MySQL Web Development, Wiley India Pvt.Ltd.
2. Thomas Powell, Ajax: The Complete Reference Book.

MCA-20-22: Linux and Shell Programming	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objectives of this course are to provide the in-depth coverage of various concepts of Linux. Linux administration is an essential course for the students.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-22.1	understand the concepts and commands of Linux;
MCA-20-22.2	understand the file management and process manipulation in Linux;
MCA-20-22.3	understand the C environment under Linux and do the system administration andcommunication in Linux;
MCA-20-22.4	developshell programs in Linux.

Unit – I

Introduction: History, Basic features, architecture, distributions. Installing Linux, Logging in / Logging out.
File System: Introduction to files, Organization, Assessing File systems, Structure - boot block, super block, inode block, data block.
Basic and Advanced Commands: Directory oriented commands, File oriented commands, File access permissions: chmod, umask, chgrp, groups. General purpose commands.

Unit – II

File management and Compression: Computer devices, Disk related commands: dd, du, df, dfspace, fdisk, compressing and uncompressing files.
Manipulating Processes and Signals:Basics, process states and transitions, zombie and orphan processes, process oriented commands. Handling foreground and background jobs. Process scheduling using cron, crontab, at, batch. Changing priority. Signal generation and Handling.
System calls: Files related system calls for opening, creating, reading, writing, relocating file descriptors, closing, duplicating file descriptors, linking, unlinking, accessing file status information, checking permissions, changing ownership, groups and permissions of files. Process related system calls: exec, fork, wait, exit.

Unit – III

System Administration: Booting and shutting down process. Creating, mounting and unmounting file systems. Managing User accounts**:** creating, modifying & deleting user accounts and groups.
Networking Tools: Communication oriented commands. ping, nslookup, telnet, arp, netstat, route, ftp, trivial file transfer protocol, finger, rlogin.
C language compiler, the make command and makefiles, general debugging techniques, debugging with gdb.

Unit – IV

Pipes and filters: Connecting processes with pipes, redirecting input and output. Filters: sort, grep, egrep, fgrep, uniq, more, pr, cut, paste, tr.
Shell Programming: Shell meaning & types; Introduction to shell scripting, shell variables, exporting shell variables, Escape mechanisms, Shell meta characters, read command, conditional statements, looping and case

statements, expr statement, command line arguments, sleep and basename commands, Bourne Shell Commands, string handling, arrays, shell functions, shell programs to automate system tasks.
Text Books: 1. Harwani B.M., Unix and Shell Programming, Oxford University Press. 2. Goerzen John, Linux Programming Bible, IDG Books, New Delhi.
Reference Books: 1. Matthew Neil, Stones Richard, Beginning Linux Programming, Wiley India Pvt. Ltd. 2. Christopher Negus, Linux Bible, Wiley India Pvt. Ltd. 3. Das Sumitabha, You UNIX – The Ultimate Guide, Tata McGraw Hill 4. Richard Peterson, Linux – The Complete Reference, Tata McGraw Hill

MCA-20-23: Advanced Data Base Systems	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The aim of this course is to provide an in-depth exposure of SQL and PL/SQL to implement database management system in an organization. The course covers the variety of databases to meet real life problem scenario.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-23.1	understand database architecture, designing of databases using ER and EER model;
MCA-20-23.2	to write complex queries in SQL and can design PL/SQL blocks for database implementation;
MCA-20-23.3	learn query optimization and concurrency control techniques;
MCA-20-23.4	gain knowledge of variety of databases to meet real life problem scenario.

UNIT – I

Database Systems Concepts and Architecture: Schema and Instances, DBMS architecture and Data Independence, Database languages and Interfaces, DBMS Functions and Component Modules. Entity Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships Types & Instances, Roles and Structural Constraints, E-R Diagrams, Design of an E-R Database Schema.

The Enhanced Entity-Relationship (EER) Model: Subclasses, Super classes, Inheritance, Specialization and Generalization.

UNIT – II

SQL: Data Definition and Data Types, DDL, DML, and DCL, Views & Queries in SQL, Specifying Constraints & Indexes in SQL. PL/SQL: Architecture of PL/SQL, Basic Elements of PL/SQL, PL/SQL Transactions, Cursors and Triggers.

Relational Database Design: Functional Dependencies, Decomposition, Normal Forms Based on Primary Keys-(1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF, Domain Key Normal Form.

UNIT – III

Query Processing and Optimization, Transaction Processing: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Concurrency Control Techniques: Two-Phase Locking Techniques, Timestamp Ordering, Serializability. Database Backup and Recovery: Recovery facilities, Recovery Techniques.

UNIT – IV

Databases for Advance Applications: Architecture for Parallel Database and Distributed Database, Active Database Concept and Triggers, Temporal Databases Concepts, Spatial and Multimedia Databases, Deductive Databases, Geographical Information System, Mobile Databases, Web Databases, XML Schema, Object- Based Databases, OLTP Vs OLAP.

Text Books: 1. Elmasri&Navathe: Fundamentals of Database systems, Pearson Education. 2. Ivan Bayross: SQL, PL/SQL- The Program Language of ORACLE, BPB Publication. 3. Alexis Leon & Mathews Leon: Database Management System, Leon Vikas Publication.
Reference Books: 1. Korth&Silberschatz: Database System Concept, McGraw Hill International Edition. 2. Raghu Ramakrishnan& Johannes Gehrke: Database Management Systems, Mcgraw Hill. 3. Peter Rob, Carlos Colonel: Database system Design, Implementation, and Measurement, Cengage Learning. 4. Abbey, Abramson & Corey: Oracle 8i-A Beginner's Guide, Tata McGraw Hill.

MCA-20-24(i): Principles of Programming Languages	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this paper is to make the students familiar with different elements of programming languages such as data types/operators/statements/control constructs and their implementation with the understanding that it will help them in becoming a better programmer.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-24(i).1	understand the programming language hierarchy and basics of compilation;
MCA-20-24(i).2	understand the different types of grammar;
MCA-20-24(i).3	understand the features of object oriented language and different methods of sequence control;
MCA-20-24(i).4	understand the implementation of different type of functions.

Unit – I

Preliminaries: History, Impact of Programming Paradigms, Role of Programming Languages, Good Language, Effects of Programming Environment, Translators and virtual architectures, Binding and Binding time, Language Syntax, Analysis of Program, Synthesis of Object program, Formal translation models: BNF Grammars, General parsing, Language translation, Recursive descent parsing.

Unit – II

Formal languages and automata: The Chomsky hierarchy of formal languages, regular grammars, Regular expressions, Finite State Automata, Context-free grammars, Pushdown automata, Ambiguous grammars.
Language Semantics: Attribute grammars, Denotational semantics, Program verification and validation, Data objects, variables, constants, data types, declaration, type checking, type casting, type promotion, Enumerators, Composite data types.

Unit – III

Object Orientated concepts: Structured data types, Abstract data types, Information hiding, Subprogram concepts, Good program design, Type definitions, Type equivalence, Inheritance, Derived classes, Abstract classes, Polymorphism, Inheritance and software reuse.
Sequence control: Implicit and explicit sequence control, Sequence control within arithmetic expressions, sequence control between statements, sequencing with non-arithmetic expressions, Subprogram Sequence control.

Unit – IV

Miscellaneous topics: Parameter passing techniques, Static & Dynamic Scoping, Storage of variables, Static storage, Heap Storage management, Distributed Processing, Exceptions and Exception handlers, Co-routines, Scheduled subprograms, Parallel programming, Processor design, Hardware and Software architectures, Network Programming, Evolution of scripting languages, Applets, XML.

Text Books:

1. Pratt T.W., Zelkowitz M.V., Gopal T.V., Programming Languages Design and Implementation, Pearson

Education. 2. Sebesta W. Robert, Concepts of Programming Languages, Pearson Education.
Reference Books: 1. Appleby Doris &VandeKopple J. Julius, Programming Languages-Paradigm and practice, Tata McGraw Hill. 2. Sethi Ravi, Programming Languages: Concepts & Constructs, Pearson Education. 3. Scott M., Programming Language Pragmatics, Elsevier India.

MCA-20-24 (ii) :High Performance Networks

Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Highlight and Characterize the constituent features of the Internet and other communication technologies for high speed networking and demanding applications. Apprise the students with the prevalent developments in High Performance Network technologies.

Course Outcomes: At the end of this course, the student will be able to:

MCA-20-24(ii).1	have an insight into the modern wired and wireless technologies and architectures for high speed networks from a design and performance perspective;
MCA-20-24(ii).2	understand addressing and analyze performance issues related to the Internet;
MCA-20-24(ii).3	figure out the techniques involved to support real-time traffic and congestion control in the Internet along with an exposure to the Internet and Adhoc Network routing protocols;
MCA-20-24(ii).4	analyze the architectural issues of the application level services of the Internet and will be able to do Client-server programming for applications.

Unit – I

TCP/IP Networks: Standards and Administration; Internet Structure; ISPs and Backbone Networks; Internet Architecture; Key Requirements for Efficiency of Networks: Scalable Connectivity, Cost-Effective Resource Sharing, Support for Services, Manageability; Performance Parameters for High-Speed Networks; Application Performance Needs.

Network Technologies for High-Speed Networks: Ethernet and its High speed versions, FDDI, Frame Relay Networks; SONET; DWDM; ATM: Design goals, Architecture and Logical Connection, ATM Cells, connection establishment and release, Switching, ATM Layers.

Wireless Networks: 802.11 Wireless LANs/Wi-Fi: Architecture, MAC Protocol, Frame, Mobility in the same IP subnet; LAN Interoperability; 802.16 Wireless MAN/Wi-Max: Services, Layers; **Cellular Internet Access:** Architecture, Cellular Standards and Technologies, Managing Mobility in Cellular Networks.

Unit – II

Link Layer addressing & protocols: Types of Addresses and Address Resolution Protocol (ARP); HDLC; PPP.

Network Layer Performance and Protocols in TCP/IP : Delay, Throughput, Packet Loss, Congestion Control; Internet Protocol (IPv4); Fragmentation; Type of Service; Classful and Classless addressing; Subnetting&Supernetting; DHCP; CIDR.

Private Network Interconnection: Virtual Private Network; Network Address Translation (NAT).

Next Generation IP: IPv6; ICMP; Mobile IP; Address Mapping: Multicasting & IGMP.

Unit – III

TCP/IP Transport Layer and Congestion Control: Client/Server paradigm; Peer-to-Peer Paradigm; Port numbers; TCP connection; TCP flow and congestion control; Congestion –Avoidance Mechanisms: DECbit, Random Early Detection(RED), Source-Based Congestion Avoidance; UDP services and applications; SCTP Services & Features.

Quality of Service in IP Networks: Application Requirements; Data flow characteristics; Integrated Services (RSVP); Differentiated Services ; Multiprotocol Label Switching; Real-Time Transport Protocol.
Internet Routing Protocols: Unicast Routing Protocols (RIP; OSPF; BGP); Multicast Routing and Protocols (DVMRP, MOSPF, PIM, MBGP).
Mobile Adhoc Networks: Introduction; Table-Driven and On-Demand Routing Protocols.

Unit – IV

Standard Client-Server Protocols and Applications: WWW and HTTP; Web Services; FTP connections; Electronic-Mail architecture & Security; Remote logging using TELNET.
Domain Name System: Name Space, DNS in the Internet, Caching, Resource records, messages.
Client-server programming: Application Programming Interface; Introduction to Sockets; Socket Descriptors; Ports and Connection.
Network Management: Introduction , Management Information Base (MIB); SNMP.

Text Books:

1. William Stallings, High-Speed Networks and Internets, Performance and Quality of Service”. Pearson Education.
2. Peterson, L.L. & Davie, B.S. Computer networks: a systems approach. Morgan Kaufmann.
3. Jean Walrand and Pravinvariya, High performance Communication networks, Harcourt and Morgan Kauffman

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Edition, McGraw Hill.
2. B Muthukumaran, Introduction to High Performance Networks, McGraw-Hill
3. Adrian Farrel, The Internet and Its Protocols: A Comparative Approach,Elsevier Science
4. Douglas E. Comer, Internetworking with TCP/IP Volume – I, Principles, Protocols, and Architectures, Pearson Education.
5. Mahbub Hassan, Raj Jain, High Performance TCP/IP Networking, Concepts, Issues, and Solutions, Pearson Education.
6. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Pearson Education.
7. Andrew S. Tanenbaum, Computer Networks, PHI.

MCA-20-24(iii): Compiler Design	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of the course is to provide in-depth coverage of underlying concepts & techniques used in compiler design and to cover major topics in compilation Theory. This course will make students ready for job assignments involving compilers and prepare students to undertake projects on compilers Construction.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-24(iii).1	understand overall process of compilation;
MCA-20-24(iii).2	understand the process of parsing in compilers;
MCA-20-24(iii).3	analyze semantic analysis, building a symbol table, handle storage management and error-detection in the process of compiler designing;
MCA-20-24(iii).4	design a compiler and understand the concept of code generation and optimization.

Unit – I

Compilers and Translators, Need of Translators, Tools used for compilation, Structure of Compiler, Single-Pass and Multi-Pass Compilers, Bootstrapping, Compiler Construction Tools, Phases of Compilation process, Classification of grammars.

Lexical Analysis: Design, Finite Automata and Regular Expressions, Process of Lexical Analysis, Lexical Analyzer generators, Derivations and parse trees.

Unit – II

Parsing Techniques: Top down Parsing- Predictive Parsers, Left Recursion and its removal, Recursive Descent Parsers, LL Grammars.

Bottom-up parsing: Shift Reduce Parsing, Operator Precedence Parsing, LR Parsers, LR grammars, Comparison of parsing methods, Parser Generators.

Unit – III

Semantic Analysis: Syntax-Directed Translation Schemes.

Building Symbol Table, Data Structures for symbol table, representing scope information.

An overview of Run-time Storage Administration.

Error Detection and Recovery: Errors, Lexical-Phase Errors, Syntactic Phase Errors, Semantic Errors.

Unit – IV

Intermediate Source Forms: Postfix Notation, Syntax Trees, Triples & Quadruples.

Code Optimization: Potential cases of Code Optimization, Optimization of basic blocks, Local and Global optimizations, Code Improving Transformation.

Code Generator: Issues in the design of a code generator.

Text Books:

1. Alfred V Aho, Principles of Compiler Design, Narosa Publishing House.
2. Jean Paul Tremblay and Sorenson, The Theory and Practice of Compiler Writing, McGraw Hill.

Reference Books:

1. Dhamdhere D.M, System programming and operating system, McGraw Hill.
2. Beck L. Leland, System Software, Pearson Education.
3. Aho, Sethi, & Ullman, Compilers Principles, Techniques and Tools, Pearson Education.
4. Fischer, Crafting a compiler in C, Pearson Education.

MCA-20-25(i): Theory of Computation

Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of theoretical computer science. It provides an insight about design of all types of machines and their applications.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-25(i).1	design various finite state machines for real life problems;
MCA-20-25(i).2	differentiate between the applications of different kind of machines;
MCA-20-25(i).3	solve the tractable and intractable problems using various approaches;
MCA-20-25(i).4	understand the need and importance of Turing machines and their suitability.

Unit – I

Finite State Machines: Finite Automata, Designing of DFA and NDFA, NFA with E-Transitions, Equivalence of DFA and NFA with proof, Regular Expressions and Regular languages, Laws of Regular Expressions, Kleene's Theorem 1 and 2, Properties and Limitations of FSM

FSM with Output: Moore and Mealy Machines, Arden's Theorem with proof, Closure Properties of Regular Sets, Pumping Lemma for Regular Grammers, Minimization of FA.

Unit – II

Formal Grammars: Definition, Construction of Regular & Context Free Grammar, Derivation, Parse Trees, Ambiguity, Removal of Ambiguity, Simplification of Context Free Grammar, CNF and GNF, Closure properties of CFL, Pumping Lemma for CFL.

Pushdown Automaton: Introduction, Types of PDA, Designing of PDA's, Conversion from PDA to CFG and vice-versa.

Unit – III

Linear Bounded Automata (LBA), Turing Machines (TM), General Model of Computation, TM as Language Acceptors, TM as Computing Partial Functions, Combining TM, Multi-Tape TM, Restricted and Universal TM; TM and Computers.

Recursive and recursively-enumerable languages and Properties, More General Grammars

Unit – IV

Reductions and the Halting Problem, Post's correspondence problem, Rice's theorem, Cook's Theorem, decidability of membership, emptiness and equivalence problems of languages, Decidable languages and problems, Diagonalization method.

Computable Functions: Primitive recursive functions, Godel Numbering, Tractable and Intractable problems, Computable Complexity.

Text Books:

1. John C. Martin, Introduction to Languages and the Theory of Computation, McGraw Hill.
2. Peter Linz, An introduction to formal language & automata, Jones & Bartlett publications.

Reference Books:

1. Hopcroft J. E. & Ullman J. D, Formal languages and their relation to Automata, Pearson Education.
2. Lewis, H.R. &Papadimitrious, C. H., Elements of the theory of computation. PHI Learning.
3. Michael Sipser, Introduction to the Theory of Computation, Cengage Learning.

MCA-20-25 (ii): Design and Analysis of Algorithms

Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various algorithm design techniques. It focuses on various problems and their solutions using different algorithm design techniques.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-25(ii).1	understand the complexity of problems and apply the solutions accordingly;
MCA-20-25(ii).2	categorize problems based on their characteristics and practical importance;
MCA-20-25(ii).3	design solutions to problems using various algorithmic techniques;
MCA-20-25(ii).4	classifying and solving problems as P, NP or NP Complete.

Unit – I

Introduction: Algorithms, Role of algorithms in computing, Analysing algorithms, Designing algorithms, Asymptotic notations.

Divide and Conquer: Solving recurrence equations: Back substitution method, Recursion tree method, Masters theorem.

Probabilistic Analysis and Randomized Algorithms: The hiring problem, Indicator random variables, Randomized algorithms, Probabilistic analysis and further uses of indicator random variables

Unit – II

Trees: Red-black trees and Splay trees.

Dynamic Programming (DP): Elements of DP, Matrix chain multiplication, Longest common subsequence, optimal binary search trees.

Greedy Techniques (GT): Elements of GT, Activity selection problem, Huffman codes, Knapsack Problem.

Unit – III

Graph Algorithms: Topological sort, Strongly connected components, Single source shortest path: Analysis of Dijkstra's Algorithm, Limitations of Dijkstra's Algorithm, Negative weight cycle, Bellman-Ford algorithm. All Pairs Shortest Path: Relation of Shortest path and matrix multiplication, Analysis of Floyd Warshall algorithm. Maximum Flow: Flow network, Ford-Fulkerson method.

Strings: Storage of strings, Naive string-matching algorithm, Rabin-Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm

Unit – IV

Computational Geometry: Line-segment properties, Convex hull, Closest pair of points.

Computational complexity: Notion of Polynomial time algorithms, Complexity classes: P, NP, NP-Hard and NP-Complete, Polynomial time verification, Reducibility, NP-Completeness, Examples of NP-Complete and NP-Hard problems: Traveling Salesman Problem, Knapsack, Bin Packing, Satisfiability, Vertex Cover, Clique, Independent Set.

Text Books:

1. Cormen, Leiserson, Rivest, Introduction to Algorithms, PHI India.

2. Neapolitan R., Foundations of Algorithms, Jones and Bartlett Learning.

Reference Books:

1.. Cooper A., Computability Theory, Chapman and Hall/ CRC Press.
2. A.V.Aho, J.E.Hopcroft, and J.D.Ullman, The Design and Analysis of Computer Algorithms, Pearson Education India
3. AnanyLevitin: Introduction to the Design and Analysis of Algorithms, Pearson Education.
4. R.C.T Lee, S.S. Tseng, R.C. Chang, Y.T. Tsai, Introduction to Design and Analysis of Algorithms: A Strategic Approach, Tata McGraw Hill
5. Steven Skiena, The Algorithm Design Manual, Springer India.

MCA-20-25 (iii): Security in Computing

Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the coverage of various security parameters and vulnerabilities. This course enables the students to handle various security issues in real-world.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-25 (iii).1	learn the concepts of computer security and various cryptographic techniques for securing a system;
MCA-20-25 (iii).2	understand the concepts of database security and various network security controls;
MCA-20-25 (iii).3	get familiar with various Internet security protocols;
MCA-20-25 (iii).4	understand various physical security breaches and Intellectual property rights.

Unit – I

Computer Security Concepts, Threats, Attacks and Assets, Security Functional Requirements, Security Architecture and Scope of Computer Security, Computer Security Trends and Strategies. Cryptography: Terminology and Background, Substitution Ciphers, Transpositions, Cryptanalysis,

Program Security: Secure Program, Non-malicious Program Error, Viruses and other Malicious Code, Targeted Malicious Code, Control against Program Threats.

Unit – II

Database Security: Database Management System, Relational Databases, Database Access Control, Inference, Security Requirements, Reliability and Integrity, Sensitive Data, Database Encryption.

Network Security: Threats in Network, Network Security Controls, and Firewall- Need for firewall, Characteristics, Types of firewall, Firewall Basing, Intrusion Detection System- Types, Goals of IDS, IDS strengths and Limitations.

Unit – III

Internet Security Protocols and Standards: Secure Socket Layer (SSL) and Transport Layer Security (TLS), IPv4 and IPv6 Security, Kerberos 672, X.509, Public Key Infrastructure.

Linux Security Model, File System Security, Linux Vulnerability, Linux System Hardening, Application Security. Window Security Architecture, Windows Vulnerability, Windows Security Defense, Browser Defenses.

Unit – IV

Physical Security Threats, Physical Security Prevention and Mitigation Measures, Recovery form Physical Security Breaches, Security Auditing Architecture, Security Audit Trail, Security Risk assessment, Security Controls or Safeguard, IT Security Plan, Implementation of Controls, Cybercrime and Computer Crime, Intellectual Property, Privacy, Ethical Issues.

Text Books:

1. Charles. P. Pfleeger& Shari Lawrence Pfleeger, Security in Computing, Pearson Education.

Reference Books:

1. William Stalling, Lawrie Brown, Computer Security Principles and Practice, Pearson Education.
2. AtulKahate, Cryptography and Network Security, Tata McGraw-Hill Education

MCA-20-31: Computer Architecture and Parallel Processing	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To know parallel processing and new trends and developments in computer architectures. Understand design and development of ILP based processors and evaluate their performance. Understand MIMD architectures and different topologies used in these architectures. Study the cache coherence problems and their solutions.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-31.1	learn the concepts of parallel architectures and exploitation of parallelism at instruction level;
MCA-20-31.2	understand architectural features of multi-issue ILP processors;
MCA-20-31.3	learn MIMD architectures and interconnection networks used in them and evaluate their comparative performances;
MCA-20-31.4	analyze causes of cache coherence problem and learn algorithm for its solution.

Unit – I

Computational Model: Basic computational models, evolution and interpretation of computer architecture, concept of computer architecture as a multilevel hierarchical framework. Classification of parallel architectures, Relationships between programming languages and parallel architectures

Parallel Processing: Types and levels of parallelism, Instruction Level Parallel (ILP) processors, dependencies between instructions, principle and general structure of pipelines, performance measures of pipeline, pipelined processing of integer, Boolean, load and store instructions, VLIW architecture, Code Scheduling for ILP-Processors - Basic block scheduling, loop scheduling, global scheduling.

Unit – II

Superscalar Processors: Emergence of superscalar processors, Tasks of superscalar processing – parallel decoding, superscalar instruction issue, shelving, register renaming, parallel execution, preserving sequential consistency of instruction execution and exception processing, comparison of VLIW & superscalar processors

Branch Handling: Branch problem, Approaches to branch handling – delayed branching, branch detection and prediction schemes, branch penalties and schemes to reduce them, multiway branches, guarded execution.

Unit – III

MIMD Architectures: Concepts of distributed and shared memory MIMD architectures, UMA, NUMA, CC-NUMA & COMA models, problems of scalable computers.

Direct Interconnection Networks: Linear array, ring, chordal rings, star, tree, 2D mesh, barrel shifter, hypercubes.

Unit – IV

Dynamic interconnection networks: single shared buses, comparison of bandwidths of locked, pended & split transaction buses, arbiter logics, crossbar, multistage networks – omega, butterfly

Cache coherence problem, hardware based protocols – snoopy cache protocol, directory schemes, hierarchical

cache coherence protocols.
Text Books: 1. Sima, Fountain, Kacsuk, Advanced Computer Architecture, Pearson Education. 2. D. A. Patterson and J. L. Hennessey, Computer Architecture – A Quantitative Approach, Elsevier India.
Reference Books: 1. Kai Hwang, Advanced Computer Architecture, McGraw Hill. 2. Nicholas Carter, Computer Architecture, McGraw Hill. 3. Harry F. Jordan, Gita Alaghband, Fundamentals of Parallel Processing, Pearson Education.

MCA-20-32: Data Mining and Integration using R	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in- depth coverage of data mining and integration aspects along with its implementation in R programming language.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-32.1	understand the fundamental concepts of data warehousing and data mining;
MCA-20-32.2	acquire skills to implement data mining techniques;
MCA-20-32.3	learn schema matching, mapping and integration strategies;
MCA-20-32.4	implement data mining techniques in R to meet the market job requirements.

UNIT – I

Data Warehouse: A Brief History, Characteristics, Architecture for a Data Warehouse. Data Mining: Introduction: Motivation, Importance, Knowledge Discovery Process, Data Mining Functionalities, Interesting Patterns, Classification of Data Mining Systems, Major issues, Data Preprocessing: Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization, Outliers.

UNIT – II

Data Mining Techniques: Clustering- Requirement for Cluster Analysis, Clustering Methods- Partitioning Methods, Hierarchical Methods, Decision Tree- Decision Tree Induction, Attribute Selection Measures, Tree Pruning. Association Rule Mining- Market Basket Analysis, Frequent Itemset Mining using Apriori Algorithm, Improving the Efficiency of Apriori. Concept of Nearest Neighborhood and Neural Networks.

UNIT – III

Data Integration: Architecture of Data Integration, Describing Data Sources: Overview and Desiderate, Schema Mapping Language, Access Pattern Limitations, String Matching: Similarity Measures, Scaling Up String Matching, Schema Matching and Mapping: Problem Definition, Challenges, Matching and Mapping Systems, Data Matching: Rule- Based Matching, Learning- Based Matching, Matching by Clustering.

UNIT – IV

R Programming: Advantages of R over other Programming Languages, Working with Directories and Data Types in R, Control Statements, Loops, Data Manipulation and integration in R, Exploring Data in R: Data Frames, R Functions for Data in Data Frame, Loading Data Frames, Decision Tree packages in R, Issues in Decision Tree Learning, Hierarchical and K-means Clustering functions in R, Mining Algorithm interfaces in R.

Text Books:

1. J Hanes, M. Kamber, Data Mining Concepts and Techniques, Elsevier India.
2. A.Doan, A. Halevy, Z. Ives, Principles of Data Integration, Morgan Kaufmann Publishers.
3. S. Acharya, Data Analytics Using R, McGraw Hill Education (India) Private Limited.

Reference Books:

1. G.S. Linoff, M.J.A. Berry, Data Mining Techniques, Wiley India Pvt. Ltd.
2. Berson, S.J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw-Hill.
3. J.Horbulyk, Data Integration Best Practices.
4. Jared P. Lander, R For Everyone, Pearson India Education Services Pvt. Ltd.

MCA-20-33: Artificial Intelligence	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of Artificial Intelligence techniques and their applications. It focuses on various search techniques and expert systems along with other parts of artificial intelligence in computer science.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-33.1	understand the different knowledge representation schemes specially FOPL;
MCA-20-33.2	apply various search methods to solve AI problems efficiently;
MCA-20-33.3	understand the Expert System and techniques to manage the uncertainty in Expert Systems;
MCA-20-33.4	understand the learning techniques and Genetic Algorithm.

Unit – I

Introduction: Background and history, Overview of AI applications areas.

The predicate calculus: Syntax and semantic for propositional logic and FOPL, Clausal form, inference rules, resolution and unification.

Knowledge representation: Network representation-Associative network & conceptual graphs, Structured representation- Frames & Scripts.

Unit – II

Search strategies: Strategies for state space search-data driven and goal driven search; Search algorithms-uninformed search (depth first, breadth first, depth first with iterative deepening) and informed search (Hill climbing, best first, A* algorithm, mini-max etc.), computational complexity, Properties of search algorithms - Admissibility, Monotonicity, Optimality, Dominance.

Unit – III

Production system: Types of production system-commutative and non-commutative production systems, Decomposable and non-decomposable production systems, Control of search in production systems.

Rule based expert systems: Architecture, development, managing uncertainty in expert systems - Bayesian probability theory, Stanford certainty factor algebra, Nonmonotonic logic and reasoning with beliefs, Fuzzy logic, Dempster/Shaffer and other approaches to uncertainty.

Unit – IV

Knowledge acquisition: Types of learning, learning by automata, intelligent editors, learning by induction.

Genetic algorithms: Problem representation, Encoding Schemes, Operators: Selection, Crossover, Mutation, Replacement etc.

Text Books: 1. George F. Luger, Artificial Intelligence, Pearson Education. 2. Dan W. Patterson Introduction to Artificial Intelligence and Expert system, PHI.
Reference Books: 1. Ben Coppin, Artificial Intelligence Illuminated, Narosa Publishing House. 2. Eugene Charniak, Drew McDermott Introduction to Artificial Intelligence, Pearson Education. 3. Nils J. Nilsson Principles of Artificial Intelligence, Narosa Publishing House. 4. Jackson Peter, Introduction to Expert systems, Pearson-Education.

MCA-20-34 (i): Cloud Computing and IoT

Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: To study the fundamental concepts of cloud computing, enabling technologies, cloud service models and security concerns. To learn core issues of Internet of Things, IOT communication protocols and security concerns.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-34(i).1	understand core issues of cloud computing and enabling technologies;
MCA-20-34(i).2	design services based on cloud computing platforms;
MCA-20-34(i).3	understand concepts, architecture, applications and design principles for connected devices in IoT;
MCA-20-34(i).4	explain, analyze and design IoT-oriented communication protocols and security concerns.

Unit – I

Cloud Computing: Definition, roots of cloud computing, characteristics, cloud architecture, deployment models, service models.
Virtualization: benefits& drawbacks of virtualization, server virtualization,virtualization of - operating system, platform, CPU, network, application, memory and I/O devicesetc.

Unit – II

Cloud Computing Service Platforms – compute services, storage services,database services, applicationservices, queuing services, e-mail services, notification services, media services, content delivery services, analytics services, deployment& management services, identity& access management services and their case studies.
Security in cloud computing: issues, threats, data security and information security

Unit – III

Internet of Thing (IoT): overview, conceptual framework, architecture, major components, common applications
Design principles for connected devices: Modified OSI Model for IoT/M2M systems, ETSI M2M Domains and High-level capabilities, wireless communication technologies - NFC, RFID, Bluetooth BR/EDR and Bluetooth low energy, ZigBee, WiFi, RF transceiver and RF modules. Data enrichment, data consolidation & device management at gateway.

Unit – IV

Design principles for web connectivity: web communication protocols for connected devices: constrained application protocol, CoAP Client web connectivity, client authentication, lightweight M2M communication protocol. Message communication protocols for connected devices - CoAP-SMS, CoAP-MQ, MQTT, XMPP.
IoT privacy, security and vulnerabilities and their solutions.

Text Books:

1. ArshdeepBahga, Vijay Madisetti, Cloud Computing – A Hands-on Approach, University Press.
2. RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing – Principles and Paradigms, Wiley India Pvt. Ltd.

3. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hills

Reference Books:

1. Kai Hwang, Geoffrey C.Fox, and Jack J. Dongarra, Distributed and Cloud Computing, Elsevier India Private Limited
2. Saurabh Kumar, Cloud Computing, Wiley India Pvt. Ltd.
3. Shailendra Singh, Cloud Computing, Oxford
4. Coulouris, Dollimore and Kindber, Distributed System: Concept and Design, Addison Wesley
5. Michael Miller, Cloud Computing, Dorling Kindersley India
6. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud computing: A practical Approach, McGraw Hill
7. DimitriosSerpnos, Marilyn Wolf, Internet of Things (IoT) Systems, Architecture, Algorithms, Methodologies, Springer
8. Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-on Approach), VPT
9. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications

MCA-20-34(ii): Cyber Security

Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The course has been designed to give students an extensive overview of cyber security issues, tools and techniques that are critical in solving problems in cyber security domains.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-34(ii).1	learn various challenges and constraints in cyber security;
MCA-20-34(ii).2	learn IT ACT (Cyber law) to the given case/problem and analyze it;
MCA-20-34(ii).3	understand the need for Computer Cyber forensics;
MCA-20-34(ii).4	demonstrate the network defence tools to provide security of information.

Unit- I

Introduction to Cyber Security: Overview of Cyber Security, Internet Governance: Challenges and Constraints, Cyber Threats, Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, International convention on Cyberspace.

Unit – II

Introduction to Cybercrime and Laws: Origins of Cybercrime, Classifications of Cybercrimes, information Security, Cybercriminals, Criminals Plan for Attacks, Cybercafe, Botnets, Attack Vector, The Indian IT ACT 2000 and amendments.

Tools and Methods used in Cybercrime: Introduction, Proxy Server and Anonymizers, Password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, DOS and DDOS attack, SQLinjection.

Unit – III

Phishing and Identity Theft: Introduction to Phishing, Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft: PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle.

Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law –types of intellectual property rights.

Unit – IV

Network Defence tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, Packet Characteristic to Filter, Stateless VsStateful Firewalls, Network Address Translation (NAT) and Port Forwarding, Virtual Private Networks, Linux Firewall, Windows Firewall, Snort Detection System, Introduction to block chain technology and its applications.

Text Books:

1. Mike Shema, Anti-Hacker Tool Kit (Indian Edition), Publication McGraw Hill.
2. Nina Godbole and SunitBelpure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Publication Wiley.

Reference Books:

1. Marjie T. Britz, Computer Forensics and Cyber Crime: An Introduction, Pearson Education
2. Chwan-Hwa (John) Wu,J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press
3. Bill Nelson, Amelia Phillips, Christopher Steuart, Guide to Computer Forensics and Investigations, Cengage Learning
4. DebiragE.Bouchoux, Intellectual Property,CengageLearning.

MCA-20-34 (iii): Digital Marketing	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The purpose of this syllabus is to make students aware about the basics of marketing. The course discusses about the important role of Digital Marketing in present age of Information Technology.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-34 (iii).1	understand basics of marketing and digital marketing;
MCA-20-34 (iii).2	analyse the role of search engine in improving digital marketing and understand about the basics and importance of email marketing;
MCA-20-34 (iii).3	analyse role of social media marketing for the given problem;
MCA-20-34 (iii).4	understand about the basics and importance of web marketing and mobile marketing.

Unit – I

Introduction to Marketing, Importance and Scope of Marketing, Elements of Marketing - Needs, Wants, Demands, Consumer, Markets and Marketers; Marketing vs. Sales. Introduction to Digital Marketing, Benefits & Opportunity of Digital Marketing, Inbound and Outbound Marketing, Content Marketing, Understanding Traffic, Understanding Leads, Digital Marketing use in 'Business to Business' (B2B), 'Business to Consumer' (B2C) and 'Not-for Profit' marketing

Unit – II

Search Marketing (SEO): Introduction to Search Engine , Search Engine Optimization (SEO), importance of SEO for business websites, Search Results & Positioning, Benefits of Search Positioning, Role of Keywords in SEO, Meta Tags and Meta Description, On-page & Off-page optimization, Back Link, Internal & External Links, Ranking, SEO Site Map, Steps for B2B SEO and B2C SEO, Advantages & Disadvantages of SEO

Email Marketing: Introduction to Email Marketing, Elements of Email, Email List Generation, Email Structure, Email Delivery, Online Data Capture, Off Line data Capture, Creating an Email campaign, Campaign Measurement, Concept of A/B testing &its use in email marketing.

Unit – III

Digital Display Advertising: Concepts, Benefits, Challenges, Ad Formats, Ad Features, Ad Display Frequency. Overview of Google AdWords.

Social Media Marketing: Key Concepts, Different Social Media Channels – Facebook, YouTube, Twitter, Instagram, Business Page- Setup and Profile, Social Media Content, Impact of Social Media on SEO, Basic concepts – CPC, PPC, CPM, CTR, CR. Importance of Landing Page. How to create & test landing Pages. User Generated Content (Wikipedia etc.), Multi-media - Video (Video Streaming, YouTube etc), Multi-media - Audio & Podcasting (iTunes etc), Multimedia - Photos/Images (Flickr etc).

Unit – IV

Introduction to Mobile Marketing, Overview of the B2B and B2C Mobile Marketing, Use of Mobile Sites, Apps (Applications) and Widgets, Overview of Blogging Web Analytics: Introduction to Web Analytics, Web Analytics – Types & Levels, Introduction of Analytics Tools and it’s use case (Google Analytics and others),

Analytics Reporting, Traffic and Behaviour Report, Evaluate Conversions.
Text Books: 1. Stanton William J., Fundamentals of Marketing, McGraw Hill, N. Delhi. 2. VandanaAhuja, Digital Marketing, Oxford Higher Education. 3. Seema Gupta, Digital Marketing, McGrawHill
Reference Books: 1. Kotler Philip & Armstrong Graw, Principles of Marketing, Pearson Education, New Delhi. 2. Neelamegham S., Indian Cases in Marketing, Vikas Publication, New Delhi. 3. Ian Dodson,The Art of Digital Marketing, Wiley. 4.Puneet Singh Bhatia, Fundamentals of Digital Marketing, Pearson Education.

MCA-20-35(i) Advances in JAVA	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The course develops programming ability of students to create dynamic web applications using server side technology with Java Database Connectivity. Students can learn networking and remote method invocation using Java API. Advanced Java features will increase ability of students in web application development.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-35(i).1	develop programming using AWT, Layout, Menu and Frames;
MCA-20-35(i).2	gain the knowledge of Server Side programming by implementing Servlet and write the deployment descriptor and enterprise application deployment;
MCA-20-35(i).3	design and Develop various application using JSPs;
MCA-20-35(i).4	learn to access database through Java programs, using Java Data Base Connectivity (JDBC).

UNIT-I

GUI Programming: AWT Classes, AWT Controls, AWT Button, AWT Label, AWT TextField, AWT TextArea, AWT Checkbox, AWTCheckboxGroup, AWT Choice, AWT List, AWT Scrollbar, AWT MenuItem& Menu, AWT PopupMenu, AWT Panel, MouseListener, MouseMotionListener, Java ItemListener, Java KeyListener, Java WindowListener. Adapter Classes, Layout managers; Grid Layout, Flow Layout, Card Layout, Border Layout, Menus, Java Frames.

UNIT-II

Servlet API and Overview: Servlet Introduction, Servlet Life Cycle, Types of Servlet, Servlet Configuration with Deployment Descriptor, Working with ServletContext and ServletConfig Object, Attributes in Servelt, Response and Redirection using Request Dispacher and using sendRedirect Method, Filter API, Manipulating Responses using Filter API, Session Tracking: using Cookies, HTTPSession, Hidden Form Fields and URL Rewriting,Types of Servlet Event: ContextLevelandSessionLevel.

UNIT-III

Java Server Pages: Introduction to JSP , Comparison with Servlet, JSP Architecture, JSP Life Cycle, JSP Scripting Elements, JSP Directives, JSP Action, JSP Implicit Objects, JSP Expression Language, JSP Standard Tag Libraries, JSP Custom Tag, JSP Session Management, JSP Exception Handling, MVC in JSP, Custom tags; Attributes, Iteration, Custom URI.

UNIT-IV

JDBC Programming: JDBC Architecture, Types of JDBC Drivers, Introduction to major JDBC Classes and Interface, Creating simple JDBC Application, Types of Statement (Statement Interface, Prepared Statement, Callable Statement), Exploring ResultSet Operations, Batch Updates in JDBC, Managing Database Transaction.

Text Books:-

1. Patrick Naughton, Herbert, Schild, The Complete reference Java 2, Tata Mc-Graw Hill.
2. Kathy walrath,Java server programming, J2EE, Black Book, Dream Tech Publishers.
3. SubrahmanyamAllamaraju, Cedric Buest, Professional Java Server Programming, Wiley Publication.

Reference Books:

1. Michael Morgan, Java 2 for Professionals Developers, SAMS Techmedia, New Delhi, India
2. Kito D. Mann,Java Server Faces in Action, Manning Publication
3. Maydene Fisher, Jon Ellis, Jonathan Bruce,JDBC™ API Tutorial and Reference, Addison Wesley.
4. GiulioZambon, Beginning JSP, JSF andTomcat, Apress.

MCA-20-35 (ii):Advanced Web Technologies	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the coverage of advanced technologies used in the design and development of web based applications such as Ajax/Node JS/Angular JS etc.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-35 (ii).1	apply various jQuerymethods in building UI projects;
MCA-20-35 (ii).2	design single-page applications using Angular JS;
MCA-20-35 (ii).3	handle the HTTP request by using Node JS;
MCA-20-35 (ii).4	manage and optimize the web applications.

Unit – I

Advanced Client side programming: Fundamentals of jQuery, Element Selector, Document ready function, Events, jQuery UI, Unobtrusive client validation, working with AJAX and jQuery.
Feature detection: Browser detection, Feature detection, Modernizer.

Unit – II

Introduction to AngularJS: Controllers, Models, Directives and Services, Single Page Applications, Angular User Interfaces: Angular Forms, Using Angular with Angular UI and Angular Bootstrap, Angular Services, Developing Custom Directives, Enhanced End-to End Testing.

Unit – III

Introduction to Node JS: Node JS process model, Advantages, Traditional web server model. Setup Install Node.js on windows, REPL, Node JS console, Node JS modules, Events: Event Emitter class, inheriting events, Node Package Manager, Creating web server: handling http requests, sending requests, File System, Debugging Node JS application, Database Connectivity.

Unit – IV

Search engines: Searching techniques used by search engines, keywords, advertisements, Search engine optimization for individual web pages: header entries, tags, selection of URL, alt tags, Search engine optimization for entire website: Hyperlinks and link structure, page rank of Google, click rate, residence time of website, frames, scripts, content management system, cookies, robots, Pitfalls in Optimization: optimization and testing, keyword density, doorway pages, duplicate contents, quick change of topics, broken links, poor readability, rigid layouts, navigation styles.

Text Books:

1. ShyamSeshadri& Brad Green, AngularJS: Up and Running, O'Relly.
2. Peter Smith, Professional Website performance, Wiley India Pvt. Ltd.

Reference Books:

1. Brad Dayley, Node.js, MongoDB, and AngularJS Web Development (Developer's Library), Addison Wesley.
2. Simon Holmes, Getting MEAN with Mongo, Express, Angular, and Node, Manning Publications.
3. Black Book, HTML5, Dreamtech Press.

4. Maro Fischer, Website Boosting: Search Engine, Optimization, Usability, Website Marketing, Firewall Media, New Delhi.

MCA-20-35(iii): Programming withKotlin

Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this paper is to make the students familiar with the Programming Language Kotlin so that they shall be able to design the Mobile Applications.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-35(iii).1	understand the different collection implementation using Kotlin;
MCA-20-35(iii).2	implement different types of functions;
MCA-20-35(iii).3	understand the concepts of classes and interfaces and implement them;
MCA-20-35(iii).4	design and develop Android using Kotlin.

Unit – I

Variables and Data types, Handling of Strings, Arrays: Generic arrays, arrays of primitives, List, Map and Set. Ranges, Null safety: Nullable and Non-nullable types, Elvis operator (?:)

Unit – II

Conditional Statements: if, when; Loops in Kotlin: for, repeat, while; break and continue.
Functions: Inline Function, Lambda Functions, Function Reference, Vararg parameters in Functions.

Unit – III

Class: Final class, open class, Inheritance: inheriting methods and fields from a class, Overriding properties and methods, Visibility modifiers, Abstract class, Data Class, Enum class, Sealed class, Nested class, Inner class, Interfaces, Programming asynchronous applications with Coroutines, Annotations.

Unit – IV

Exception Handling: Try, Catch, Finally block, Throw.
Android development using Kotlin. Views: TextView, EditView, ScrollView, ImageView, ListView, Recycler view etc. Android UI Layouts: Linear, Relative and Constraint, Creating Activities, Intents and Fragments.

Text Books:

1. Sommerhoff Peter, Kotlin for Android App Development, Pearson.
2. VenkatSubramaniam, Programming Kotlin, Pragmatic Bookshelf.

Reference Books:

1. Stephen Samuel & Stefan Bocutiu, Programming Kotlin, Packt Publishing Ltd.
2. Antonio Leiva, Kotlin for Android Developers, Leanpub.
3. MarcinMoskala& Igor Wojda, Android Development with Kotlin, Packt Publishing Ltd.

MCA-20-41: Big Data and Pattern Recognition

Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The aim of this course is to develop knowledge of big data tools including MapReduce, NoSQL and Hadoop. The course provides an idea about data analysis; pattern recognition approaches and gives the practical exposure of NoSQL.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-41.1	understand Big Data strategies in Big Data Environment;
MCA-20-41.2	learn Basics of HDFS and Learn map-reduce analytics using Hadoop;
MCA-20-41.3	acquire knowledge of pattern recognition approaches and methods;
MCA-20-41.4	todevelop solutions in NoSQL to meet the current job requirements.

UNIT – I

Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data, Identifying Data Characteristics, Business Motivations and Drivers for Big Data Adoption: Business Architecture, Business Process Management, Information and Communication Technology, Big Data Analytics Lifecycle, Enterprise Technologies and Big Data Business Intelligence, Industry examples of big data.

UNIT – II

Data Governance for Big Data Analytics: Evolution of Data Governance, Big Data and Data Governance, Big Datasets, Big Data Oversight, Big Data Tools and Techniques: HDFS, Map Reduce, YARN, Zookeeper, HBase, HIVE, Pig, Mahout, Developing Big Data Applications, Stepwise Approach to Big Data Analysis, Big Data Failure: Failure is common, Failed Standards, Legalities.

UNIT – III

Data Analysis and Pattern Recognition: Quantitative and Qualitative Analysis, Pattern Recognition Systems, Fundamental Problems in Pattern Recognition, Feature Extraction and Reduction, Paradigms, Pattern Recognition Approaches, Importance and Applications. Data Domain for Pattern Recognition. Pattern Recognition using Nearest Neighbour Classifier and Modeling an AND Gate Neural Nets.

UNIT – IV

An Overview of NoSQL, Characteristics of NoSQL, NoSQL Storage Types, Introduction of NoSQL Products, NoSQL Data Management for Big Data: Schema Less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph databases, NoSQL Misconceptions, NoSQL over RDBMS.

Text Books:

1. Thomas Erl, WajidKhattak and Paul Buhler, Big Data Fundamentals Concepts, Drivers & Techniques Prentice Hall.
2. David Loshin, Big Data Analytics from Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph Morgan Kaufmann.
3. Jules J. Berman, Principles of Big Data Preparing, Sharing and Analyzing Complex Information, Morgan Kaufmann.

4. GauravVaish, Getting Started with NoSQL, Packt Publishing.
5. RajjanShinghal, Pattern Recognition Techniques and Applications, Oxford Higher Education.

Reference Books:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer.
2. Jay Liebowitz, Big Data and Business Analytics, Auerbach Publications, CRC press.
3. Pete Warden, Big Data Glossary, O'Reily.
4. Michael Mineli, Michele Chambers, AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications.

MCA-20-42:Computer Graphics and Animation

Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an introduction to the theory and practice of Computer Graphics and Animation. Provide an insight to applications of Graphics and the graphics hardware devices and software used. Introduce the principles needed to design a graphics system and the algorithms related with them.

Course Outcomes: At the end of this course, the student will be able to:	
MCA-20-42.1	have a knowledge of graphics applications and components and devices required to support the applications;
MCA-20-42.2	develop algorithms for scan converting geometrical primitives such as lines, circles, ellipses, and curves along with algorithms for filling polygons, required for designing real-world applications;
MCA-20-42.3	design algorithms for carrying out manipulations in pictures using geometric transformations, viewing transformations , and clipping operations;
MCA-20-42.4	model 3-dimensional objects and apply viewing, visible –surface determination, and shading techniques to the models for achieving realism. The student will also learn to design and develop animation sequences.

Unit – I

Introduction to Computer Graphics and its Components: Overview of Computer Graphics, its functions & elements; Introduction to GUI, Computer Vision, Augmented Reality and other Applications of Graphics; Popular Graphics Software; Components and Working of Interactive Graphics; Raster Scan and Random Scan systems and Display Processors; Look-up table; Loading the Frame Buffer; Coordinate Systems.
Graphics Devices: Display Technologies: Resolution, Aspect Ratio, Refresh CRT ,Color CRT , Flat Panel Displays; Interactive Input Devices for Graphics , Image and Video Input Devices.

Unit – II

Scan Conversion: Drawing Geometry; Output Primitives; Lines and Pixel Graphics; AntiAliasing; Scan Converting Lines: DDA line drawing algorithms, Bresenham's line Algorithm; Scan Converting Circles: Polynomial method for circle drawing, circle drawing using polar coordinates, Bresenham's circle drawing; Algorithms for Generation of ellipse; Line Styles; Generation of Bar Charts, Pie-Charts.
Curve Representation: Parametric Curves, Parametric Representation of a Circle, Parametric representation of cubic curves, drawing Bezier curves.
Filled-Area Primitives: Basic Stack based fill algorithms: Flood fill algorithm, Boundary fill algorithm; Scan-line polygon fill algorithm and its computational structures.

Unit – III

Two-Dimensional Transformations: Coordinate and Geometric Transformations; Translation, Rotation, Scaling; Matrix representations and Homogeneous coordinates, Composite transformations, General Pivot Point rotation, General Fixed Point Scaling, Shearing; Reflection ; Reflection about an arbitrary line.
2-D Viewing: Viewing pipeline; Window, Viewport, Window-to-Viewport transformation; Zooming, Panning; Pointing and Positioning techniques; Rubber band technique; Dragging.
Clipping operations: Point and Line clipping, Cohen-Sutherland line clipping, Mid-Point Subdivision line

clipping, Liang-Barsky line clipping, Sutherland-Hodgman polygon clipping; Weiler-Atherton polygon clipping.

Unit – IV

3-D Graphics & Modeling: Visualization techniques for Realism; 3D Object Representation; Solid Model Representation Schemes; Euclidean Geometry methods: Regularized Boolean Set Operations, Primitive Instancing, Boundary Representations, Curved lines and surfaces, Sweep Representations, Spatial-Partitioning Representations - Octree representation, Constructive Solid Geometry; Procedural Methods: Fractals, Shape Grammars, Particle systems, Physically Based modeling, Visualization techniques; 3D transformations.

Three-Dimensional Viewing: Viewing Pipeline**; P**arallel Projection: Orthographic and Oblique Projection; Perspective Projection.

Visible-Surface Determination: Z-buffer, Depth-Sorting, Area Subdivision, BSP-Tree method; Ray casting.

Illumination and Shading: Modeling Light Intensities; Basic Illumination Models; Gouraud Shading; Phong Shading.

Introduction to Animation: Designing of Animation Sequences; Key-Frame Systems; Animation Techniques: Tweening, Morphing.

Text Books:

1. Donald Hearn, M. Pauline Baker, Computer Graphics, Pearson Education.
2. J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics - Principles and Practice, Pearson Education.

Reference Books:

1. Newmann&Sproull, Principles of Interactive Computer Graphics, McGraw Hill.
2. Rogers, David F., Procedural Elements of Computer Graphics, McGraw Hill.
3. Zhigang Xiang, Roy Plastock, Computer Graphics, Tata McGraw Hill.
4. Malay K. Pakhira, Computer Graphics, Multimedia and Animation, PHI
5. Steven Harrington, Computer Graphics, A Programming Approach, McGraw Hill.

MCA-20-43: Mobile Application Development	
Type: Compulsory **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various concepts of mobile application development especially android based applications. This course will help the students in learning to develop and publish their own mobile applications.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-43.1	know the components and structure of mobile application development frameworks for Android based mobiles;
MCA-20-43.2	design and implement the user interfaces of mobile applications;
MCA-20-43.3	implement fragments and location based services in Android application;
MCA-20-43.4	understand the basics of SQLite and develop interactive graphics in mobile applications.

Unit – I

Introduction: Mobile Applications, Characteristics and Benefits, Application Models, Mobile devices Profiles. Basics of Android, Importance and scope, Android Versions, Features of Android, Android Architecture, Android Stack, Android Applications Structure, Android Emulator, Android SDK, Overview of Android Studio, Android and File Structure, Android Virtual Device Manager, DDMS, LogCat, Understanding Activities.

Android User Interface: Measurements – Device and pixel density independent measuring units. Layouts – Linear, Relative, Grid and Table Layouts.

Unit – II

User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers, List View, Spinner View.

Event Handling – Handling clicks or changes of various UI components.

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Services- Callbacks and Override in application, Application Signing, API keys for Google Maps, Publishing application to the Android Market.

Unit – III

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

Location and Mapping: location based services, Mapping, Google Maps activity, Working with MapViewandMapActivity; Playing and Recording of Audio and Video in application; Sensors and Near Field Communication; Native libraries and headers, Building client server applications.

Unit – IV

Using Graphics: Canvas Drawing, Shadows, Gradients.

Persisting Data to files: Saving to Internal Storage, Saving to External Storage

Introduction to SQLite database: creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update).
Text Books: **1.** ZigurdMednieks, Laird Dornin, G,BlakeMeike and Masumi Nakamura, Programming Android, O'Reilly Publications. **2.** Wei-Meng Lee, Beginning Android Application Development, Wiley India Ltd.
Reference Books: 1. James C.S., Android Application development for Java Programmer, CENGAGE Learning. 2. Pradeep Kothari, Android Application Development: Black Book, Wiley India Ltd. 3. Gargenta M., Nakamura M., Learning Android, O'Reilly Publications.

MCA-20-44(i): Soft Computing	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Introduce fundamental soft computing concepts with an exposure to non-traditional techniques for problem solving and optimization. Provide Soft Computing based research oriented direction for solving imprecisely defined problems. Provide a comprehensive introduction to nature-inspired metaheuristic methods for search and optimization, including the latest trends in evolutionary algorithms and other forms of natural computing.

Course Outcomes: At the end of this course, the student will be able to:	
MCA-20-44(i).1	have a knowledge of soft computing techniques along with their applications and non-traditional metaheuristic optimization and data clustering techniques & algorithms for obtaining optimized solutions to optimization, computational intelligence, and design/scheduling applications;
MCA-20-44(i).2	apply fuzzy logic theory to imprecisely defined problems;
MCA-20-44(i).3	use Neural Networks concepts to find solutions to problems where normally algorithmic methods do not exist or are costly;
MCA-20-44(i).4	design high-quality solutions using Genetic Algorithms for optimization and search problems and have exposure to MATLAB environment for implementing solutions to problems using soft computing techniques.

Unit – I

Soft Computing : Conventional AI to Computational Intelligence; Soft Computing Constituents and Applications.

Introduction toNon-traditional Metaheuristic Optimization Techniques: Random Optimization, Simulated Annealing, Tabu Search, Ant Colony Optimization, Particle Swarm Optimization, Harmony Search, Memetic Algorithms, Other Evolutionary Algorithms such as Firefly Algorithm, Bee Algorithm, Shuffled Frog Leap algorithm, Bat algorithm etc.

Data Clustering Algorithms: K-Means, Fuzzy C-Means, Mountain Clustering, Subtractive Clustering.

Unit – II

Fuzzy Set theory: Fuzzy Sets & Classical Sets; Operations on Fuzzy Sets, Fuzzy Relations, Linguistic Variables.

Membership Functions: Introduction, Features, &Fuzzification, Methods of Membership Value Assignment; Defuzzification.

Fuzzy Systems: Crisp Logic, Predicate Logic, Fuzzy Logic; Fuzzy Rule Base and Approximate Reasoning, Fuzzy Quantifiers; Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy Logic Control System; Fuzzy Expert Systems.

Unit – III

Neural Networks: Fundamental Concepts, Basic Models and Architecture; Machine Learning Using Neural Networks; Associative Memory Networks and their Applications.

Supervised Learning Neural Networks: Perceptron Networks, Radial Basis Function Networks: Back Propagation Neural Network: Architecture, Learning, Applications, & Research Directions; The Boltzman

Machine.
Unsupervised Learning Networks: Competitive Learning networks; Kohonen Self-Organizing Networks; Hebbian learning; The Hopfield Network; Counterpropagation Networks; Adaptive Resonance Theory: Introduction, Architecture, & Applications; Feed forward Networks; Reinforcement Learning.

Unit – IV

Genetic Algorithms: Introduction to Genetic Algorithms (GA) and their Terminology; Traditional Optimization and Search Techniques vs. Genetic Algorithm ; Operators in Genetic Algorithms; Problem Solving using Genetic Algorithm; Classification of Genetic Algorithms; Holland's Classifier Systems; Genetic Programming; Advantages and Limitations of Genetic Algorithm; Applications of Genetic Algorithm; Applications of GA in Machine Learning.
Introduction to Hybrid Systems; MATLAB Environment for Soft Computing Techniques.

Text Books:

1. S. N. Sivanandam& S. N. Deepa, Principles of Soft Computing, Wiley - India.
2. JyhShing Roger Jang, ChuenTsai Sun, EijiMizutani, NeuroFuzzy and Soft Computing, Prentice Hall.

Reference Books:

1. S.Rajasekaran and G.A.VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, Prentice-Hall of India Pvt. Ltd.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall.
3. George J. Klir, Ute St. Clair, Bo Yuan, Fuzzy Set Theory: Foundations and Applications Prentice Hall.
4. Simon O. Haykin, Neural Networks: a comprehensive foundation, Pearson Education.
5. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall
6. Goldberg D. E., Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education.
7. Ahmad Lotfi, Jonathan Garibaldi, Applications and Science in Soft Computing, Springer.
8. Rajkumar Roy, Mario KoppenSoft Computing and Industry: Recent Applications, Springer.
9. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India.
10. Du, Ke-Lin, Swamy, M. N. S., Search and Optimization by Metaheuristics: Techniques and Algorithms, Springer
11. OmidBozorg-Haddad, Mohammad Solgi, Hugo A. Loaiciga, Meta-heuristic and Evolutionary Algorithms for Engineering Optimization, Wiley

MCA-20-44(ii): Machine Learning	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to enable student to perform experiments in Machine Learning using real-world data.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-44(ii).1	understand the basics of machine learning and supervised learning;
MCA-20-44(ii).2	analyse and implement the concepts of Naïve-Bayes and Regression;
MCA-20-44(ii).3	understand the unsupervised learning using clustering algorithms;
MCA-20-44(ii).4	perform dimensionality reduction and understand the basics of reinforcement learning.

Unit – I

Machine Learning: Introduction to Machine Learning, Overview of Machine Learning, Key Terminology and task of ML, Applications of ML;

Supervised Learning: Classification, Decision Tree Representation- Appropriate problem for Decision Learning, Decision Tree Algorithm, Hyperspace Search in Decision Tree;

Unit – II

Naive Bayes- Bayes Theorem, Classifying with Bayes Decision Theory , Conditional Probability, Bayesian Belief Network;

Regression: Linear Regression- Predicting numerical value, Finding best fit line with linear regression, Regression Tree- Using CART for regression.

Unit – III

Logistic Regression - Classification with Logistic Regression and the Sigmoid Function;

Clustering: Learning from unclassified data –Introduction to clustering, K-Mean Clustering, Expectation-Maximization Algorithm(EM algorithm), Hierarchical Clustering, Supervised Learning after clustering.

Unit – IV

Dimensionality reduction- Dimensionality reduction techniques, Principal component analysis, Anomaly Detection, Recommender Systems;

SVM, Reinforcement Learning.

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited.
2. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press.

Reference Books:

1. Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press.
2. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press.
3. Peter Harrington, Machine Learning in Action, Manning
4. ShaiShalev-Shwartz and Shai Ben David, Understanding Machine Learning From Theory to Algorithms, Cambridge University Press

MCA-20-44 (iii): Digital Image Processing	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: Provide an introduction to the basic concepts and methodologies for digital image processing. To develop a foundation that can be used as a basis for further studies and research. Introduce the students to the fundamental techniques and algorithms used for acquiring, processing and extracting useful information from digital images.

Course Outcomes: At the end of this course, the student will be able to:

MCA-20-44(iii).1	get acquainted with digital image fundamentals and its applications and get acquainted with the image representation and description methods;
MCA-20-44(iii).2	Learn and perform image pre-processing and enhancement to improve the image for further processing;
MCA-20-44(iii).3	reconstruct photometric properties degraded by the imaging process and partition a digital image into multiple segments;
MCA-20-44(iii).4	represent and analyse images at different resolutions , process images according to their shapes, and apply compression techniques to reduce the storage space of images.

Unit – I

Digital Image Fundamentals: Introduction to Digital Image Processing and its applications; Components of an Image Processing System.

Image Representation and Description: Image Representation ; Digital Image Properties; Boundary descriptors; Regional descriptors; Steps in Digital Image Processing; Elements of Visual perception; Image Sensing and Acquisition; Image Sampling and Quantization; Relationship between Pixels; Color Representation.

Data Structures for Image Analysis: Levels of Image Data Representation; Traditional Image Data Structures: Matrices, Chains, Topological Data Structures, Relational Structures; Hierarchical Data Structures: Pyramids, Quadtrees, Other Pyramidal Structures.

Unit – II

Image Pre-Processing: Pixel Brightness Transformations: Position-Dependent Brightness Correction, Gray-Scale Transformation; Geometric Transformations: Pixel Co-ordinate Transformations, Brightness Interpolation; Local Pre-Processing.

Image Enhancement: Spatial Domain: Gray level transformations; Histogram processing; enhancement using arithmetic and logic operators; Basics of Spatial Filtering; Smoothing and Sharpening Spatial Filtering.

Frequency Domain: Introduction to Fourier Transform; Filtering in the Frequency Domain; Smoothing and Sharpening frequency domain filters; Homomorphic Filtering.

Unit – III

Image Restoration and Segmentation: Noise models; Mean Filters; Order Statistics; Adaptive filters; Noise Reduction by Frequency Domain Filtering; Inverse and Wiener filtering; Constrained Least Squares Filtering.

Segmentation: Point, line, and Edge Detection; Edge Linking and Boundary detection; Thresholding; Region based segmentation; Edge based Segmentation; Segmentation by Morphological Watersheds; Matching.

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing.

Unit – IV

Wavelets and MultiresolutionProcessing: Background: Image Pyramids; Subband coding; Multiresolution expansions.

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.

Compression – Fundamentals ; Image Compression models; Error-Free Compression; Variable Length Coding, LZW coding, Bit-Plane Coding, Lossless Predictive Coding; Lossy Compression: Lossy Predictive Coding, Transform Coding, wavelet Coding; Image Compression Standards.

Text Books:

1. Rafael C. Gonzales, Richard E. Woods, Digital Image Processing, Pearson Education.

Reference Books:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, Third Edition ,Tata McGraw Hill .
2. Anil Jain K., Fundamentals of Digital Image Processing, PHI Learning.
3. Willliam K Pratt, Digital Image Processing, John Willey.
4. Malay K. Pakhira, Digital Image Processing and Pattern Recognition, First Edition, PHI Learning.
5. S. Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing, McGraw Hill
6. B. Chanda ,D.DuttaMajumder, Digital Image Processing and Analysis, Prentice Hall of India.

MCA-20-45 (i): Optimization Techniques	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide the in-depth coverage of various linear programming problems and their solution techniques. It focuses on various optimization techniques and their applications in problem solving.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-45 (i).1	understand the role and principles of optimization techniques in business world;
MCA-20-45 (i).2	understand the techniques to solve and use LPP and IPP;
MCA-20-45 (i).3	analyse the optimization techniques in strategic planning for optimal gain;
MCA-20-45 (i).4	understand the techniques to solve networking and inventory issues;

Unit – I

Introduction: The Historical development, Nature, Meaning and Management Application of Operations research. Modelling, Its Principal and Approximation of O.R. Models, Main characteristic and phases, General Methods of solving models, Scientific Methods, Scope, Role on Decision Making and Development of Operation Research in India.

Linear Programming: Formulation, Graphical solution, standard and matrix form of linear programming problems, Simplex method and its flow chart, Two-phase Simplex method, Degeneracy.

Unit – II

Duality in LPP: Definition of Dual Problem, General Rules for converting any Primal into its Dual, Dual Simplex method and its flow chart.

Integer Programming: Importance, Applications and Classification, Gomory's all integer programming problem technique and its flow chart, Branch and Bound Method.

Unit – III

Transportation Models: Formulation of problem, Obtaining Initial Basic feasible solution, Optimality tests, Progressing towards optimal solution, Unbalanced Transportation Problems.

Assignment Models: Formulation of problem, Hungarian Method for Assignment Problems, Unbalanced Assignment Problems.

Unit – IV

Inventory theory Costs involved in inventory problems - single item deterministic models-economic lot size models without shortages and with shortages having production rate infinite and finite.

PERT and CPM: Basic steps in PERT/CPM, Techniques, Network Diagram Representation, Forward and Backward Pass-computation, Representation in Tabular form, Determination of Critical path, Critical activity, Floats and Slack Times, Implementation in any programming language.

Text Books:

1. Sharma, S.D., Operations Research, KedarNath and Ram Nath, Meerut.
2. Gupta P.K., Hira and D.S., Operation Research, Sultan Chand & Sons, New Delhi.

Reference Books:

1. KantiSwarup, Gupta P.K. & Man Mohan, Operation Research, Sultan Chand & sons, New Delhi.
2. Rao S.S., Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi.
3. Taha, H.A., Operation Research – An Introduction, McMillan Publishing Co, New York.
4. Gillet, B.E., Introduction to Operations Research: A Computer Oriented Algorithmic Approach, Tata McGraw Hill, New York.

MCA-20-45(ii): Information Systems

Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30(i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40(i.e. 40%)	**Instructions to paper setter for End semester examination:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide an in-depth exploration of how businesses successfully manage information and provide insight into how today's businesses leverage information technologies and systems to achieve corporate objectives.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-45(ii).1	gain skills sought after in today's workplace;
MCA-20-45(ii).2	gain knowledge about IT Infrastructure & Emerging Technologies and their impact on business models and managerial decision-making;
MCA-20-45(ii).3	learn the security issues in information systems and various Enterprise Applications;
MCA-20-45(ii).4	understand, participate in, and eventually lead management discussions and drivedecisions about the firm's information systems.

Unit – I

Fundamental of Management Information systems: The Fundamental Roles of Information System in business, Trends in Information Systems, Types of Information Systems, Managerial Challenges of Information Technology.
The Components of Information Systems: System Concept, Components of an Information System, Information System Resources, Information System Activities, Recognizing Information Systems.

Unit – II

IT Infrastructure and Emerging Technologies: IT Infrastructure, Infrastructure Components, Software/Hardware Platform Trends and Emerging Technologies, Management Issues.
Foundation of Business Intelligence: Databases and Information Management: Organizing Data in a Traditional File Environment, The Database Approach to Data Management, Using Database to Improve Business Performance and Decision Making, Managing Data Resources.

Unit – III

Securing Information Systems: System Vulnerability and Abuse, Business Value of Security and Control, Establishing a Framework for Security and Control, Technologies and Tools for Security.
Key System Applications for the Digital Age.
Enterprise Applications: Enterprise Systems, Supply Chain Management Systems, Customer Relationship Management Systems, Enterprise Applications: New Opportunities and Challenges.

Unit – IV

Managing Knowledge: The Knowledge Management Landscape, Enterprises-Wide Knowledge Management Systems, Knowledge Work Systems, Intelligent Techniques.
Enhancing Decision Making: Decision Making and Information Systems, Systems for Decision Support, Executive Support Systems (ESS), Group Decision-Support Systems (GDSS).

Text Books:

1. Kenneth C.Laudon, Jane P.Laudon, Management Information Systems: Managing the Digital Firm, Pearson Education. 2. James A O'Brien, George M Marakas, Management Information Systems, Tata McGraw-Hill.
Reference Books: 1. Laudon&Laudon, Essentials of Management Information Systems, Pearson Education. 2. McLeod & Schell, Management Information Systems, Pearson Education. 3. Jawadekar, W.S., Management Information Systems, Tata McGraw-Hill. 4. Robert G.Mudrick, CoelE.Ross, James R.Claggett,Information Systems for Modern Management.

MCA-20-45 (iii): Blockchain Technology	
Type: Elective **Contact Hours:** 4 hours/week **Examination Duration:** 3 Hours **Mode:** Lecture **External Maximum Marks:** 75 **External Pass Marks:** 30 (i.e. 40%) **Internal Maximum Marks:** 25 **Total Maximum Marks:** 100 **Total Pass Marks:** 40 (i.e. 40%)	**Instructions to paper setter for End semester exam:** Total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective type questions from complete syllabus. In addition to compulsory first question there shall be four units in the question paper each consisting of two questions. Student will attempt one question from each unit in addition to compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to introduce the concept of Blockchain. This course introduces the concept of Bitcoin and makes students familiar with Bitcoin network, payments, clients and APIs.

Course Outcomes (COs)	At the end of this course, the student will be able to:
MCA-20-45 (iii).1	understand the concept of Blockchain and Decentralization;
MCA-20-45 (iii).2	understand the usage of Block chain and Bitcoin implementation;
MCA-20-45 (iii).3	understand and analyse the Bitcoin network and payments;
MCA-20-45 (iii).4	analyze the various platforms used for Blockchain.

Unit – I

Discover Blockchain Technology: Blockchain, Growth of blockchain technology, Distributed systems, History of blockchain and Bitcoin, Types of blockchain.

Decentralization: Methods of decentralization, Routes of decentralization, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized organizations and platforms for decentralization.

Unit – II

Blockchain: Architecture, Versions, Variants, Use cases, Life use cases of blockchain, Blockchainvs shared Database, Introduction to cryptocurrencies, Types, Applications.

Bitcoins: Introducing Bitcoin, Bitcoin digital keys and addresses, Transactions, Blockchain mining. Alternative Coins. Limitations of Bitcoin

Unit – III

Concept of Double Spending, Hashing, Proof of work.

Bitcoin Network and payments, Bitcoin network, Wallets, Bitcoin payments, Innovation in Bitcoin, Bitcoin Clients and APIs.

Unit – IV

Introduction to Blockchain Platforms: Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, etc., Advantages and Disadvantages, EthereumvsBitcoin, Design a new blockchain, Potential for disruption, Design a distributed application, Blockchain applications.

Text Books:

1. Imran Bashir, Mastering Blockchain, PACKT Publication.
2. ArshdeepBikramadityaSingal, GautamDhameja, PriyansuSekhar Panda., Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions, APress.
3. Bahga, Vijay Madisetti, Blockchain Applications: A Hands-On Approach.
4. Melanie Swan, Blockchain, OReilly

Reference Books:

1. Aravind Narayan. Joseph Bonneau, Bitcoin and Cryptocurrency Technologies, Princton
2. Arthu.T Books, Bitcoin and Blockchain Basics: A non-technical introduction for beginners.