KURUKSHETRA UNIVERSITY KURUKSHETRA

Scheme of Examination and Syllabus for

Under-Graduate Programme

Subject: ELECTRONICS

Under Multiple Entry-Exit, Internship and CBCS-LOCF in accordance to NEP-2020 w.e.f. 2023-24 (in phased manner)

Scheme of Examination for Under-Graduate Programme
Under Multiple Entry-Exit, Internship and CBCS-LOCF in accordance to NEP-2020
w.e.f. 2023-24 (in phased manner), Subject : Electronics

FIRST YEAR: SEMESTER-1									
Remarks	**Course**	**Paper(s)**	**Nomenclature of Paper**	**Credits**	**Hours/ Week**	**Internal marks**	**External Marks**	**Total Marks**	**Exam Duration**
Scheme A & C	**CC-1 MCC-1 4 credit**	B23-ELE-101	Electronic Devices and Network Analysis	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme C only	**MCC-2 4 credit**	B23-ELE-102	Electronic Components, Measuring Instruments and Amplifiers	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A	**CC-M1 2 credit**	B23-ELE-103	Basic Digital Electronics	1	1	10	20	30	3 hrs.
			Practical	1	2	5	15	20	3 hrs.
Scheme A & C	**MDC-1 3 credits**	B23-ELE-104	Electronics in Daily Life	2	2	15	35	50	3 hrs.
			Practical	1	2	5	20	25	3 hrs.
Scheme C only	**CC-M1 4 credit**	From Available CC-M1 of 4 credits as per NEP							
Scheme A & C	**AEC-1 2 credit**	From Available AEC-1 of two credits as per NEP							
	SEC-1 3 credit	From Available SEC-1 of three credits as per NEP							
	VAC-1 2 credit	From Available VAC-1 of two credits as per NEP							

FIRST YEAR: SEMESTER-2									
Remarks	**Course**	**Paper(s)**	**Nomenclature of Paper**	**Credits**	**Hours/ Week**	**Internal marks**	**External Marks**	**Total Marks**	**Exam Duration**
Scheme A & C	**CC-2 MCC-3 4 credit**	B23-ELE-201	Electronic Devices and Basic Digital Electronics	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme C only	**DSEC-2 4 credit**	B23-ELE-202	Power Devices & Multivibrators	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A only	**CC-M2 2 credit**	B23-ELE-203	Basic Electronic components & Devices	1	1	10	20	30	3 hrs.
			Practical	1	2	5	15	20	3 hrs.
Scheme A & C	**MDC-2 3 credits**	B23-ELE-204	Understanding of Mobiles and Computer Systems	2	2	15	35	50	3 hrs.
			Practical	1	2	5	20	25	3 hrs.
Scheme C only	**CC-M2 4 credit**	From Available CC-M2 of 4 credits as per NEP							
Scheme A & C	**AEC-2 2 credit**	From Available AEC-2 of two credits as per NEP							
	SEC-2 3 credit	From Available SEC-2 of three credits as per NEP							
	VAC-2 2 credit	From Available VAC-2 of two credits as per NEP							
Internship of 4 credits of 4-6 weeks duration after 2nd Semester									

SECOND YEAR: SEMESTER-3									
Remarks	**Course**	**Paper(s)**	**Nomenclature of Paper**	**Credits**	**Hours/ Week**	**Internal marks**	**External Marks**	**Total Marks**	**Exam Duration**
Scheme A, B & C	**CC-3 MCC-4 4 credit**	B23-ELE-301	Combinational & Sequential Circuits	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**MCC-5 4 credit**	B23-ELE-302	Digital Electronics	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A, B & C	**MDC-3 3 credits**	B23-ELE-303	Electronics in Smart World	2	2	15	35	50	3 hrs.
			Practical	1	2	5	20	25	3 hrs.
Scheme A & C	**CC-M3 4 credits**	From Available CC-M3 of 4 credits as per NEP							
Scheme B only	**CC-M3 (V) 4 credits**	From Available CC-M3(V) of 4 credits as per NEP							
Scheme A, B & C	**AEC-3 2 credit**	From Available AEC-3 of two credits as per NEP							
	SEC-3 3 credit	From Available SEC-3 of three credits as per NEP							
Scheme C only	**VAC-3 2 credits**	From Available VAC-3 of two credits as per NEP							
Scheme B only	**MCC-3**	**MCC-2 FROM SCHEME C OF FIRST SEMESTER**							
SECOND YEAR: SEMESTER-4									
Remarks	**Course**	**Paper(s)**	**Nomenclature of Paper**	**Credits**	**Hours/ Week**	**Internal marks**	**External Marks**	**Total Marks**	**Exam Duration**
Scheme A, B & C	**CC-4 MCC-6 4 credit**	B23-ELE-401	Operational Amplifier & Sinusoidal Oscillators	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**MCC-7 4 credit**	B23-ELE-402	IC Fabrication Technology	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**MCC-8 4 credit**	B23-ELE-403	Electronic Communication	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**DSE-1 4 credit Select one option**	B23-ELE-404	Optical Fiber Communication	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23-ELE-405	Wireless & Mobile Communication	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A, B & C	**CC-M4 (V) 4 credits**	From Available CC-M4(V) of 4 credits as per NEP							
	AEC-4 2 credit	From Available AEC-3 of two credits as per NEP							
Scheme C only	**VAC-4 2 credits**	From Available VAC-4 of two credits as per NEP							
Scheme A & B	**VAC-3 2 credits**	From Available VAC-3 of two credits as per NEP							
Internship of 4 credits of 4-6 weeks duration after 4th Semester (if not done after second semester)									

THIRD YEAR: SEMESTER-5									
Remarks	**Course**	**Paper(s)**	**Nomenclature of Paper**	**Credits**	**Hours/ Week**	**Internal marks**	**External Marks**	**Total Marks**	**Exam Duration**
Scheme A, B & C	**CC-5 MCC-9 4 credit**	B23-ELE-501	Transducers and Sensors	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**MCC-10 4 credit**	B23-ELE-502	Digital Signal Processing	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**DSE-2 4 credit Select one Option**	B23-ELE-503	Microprocessor Architecture and Programming with 8085	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23-ELE-504	Optoelectronic Devices	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**DSE-3 4 credit Select one Option**	B23-ELE-505	Mechatronics	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23-ELE-506	Embedded Systems	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A & C	**CC-M5 (V) 4 credits**	From Available CC-M5(V) of 4 credits as per NEP							
Scheme A, B & C	**Internship 4 credits**	Internship#4 credit after 4th semester							
THIRD YEAR: SEMESTER-6									
Remarks	**Course**	**Paper(s)**	**Nomenclature of Paper**	**Credits**	**Hours/ Week**	**Internal marks**	**External Marks**	**Total Marks**	**Exam Duration**
Scheme A, B & C	**CC-6 MCC-11 4 credit**	B23-ELE-601	Microcontroller 8051 and its Interfacing	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**MCC-12 4 credit**	B23-ELE-602	Basic Electrical Engineering & Skills	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**DSE-4 4 credit Select one Option**	B23-ELE-603	Interfacing Peripheral Devices and Applications of 8085	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23-ELE-604	Verilog and FPGA based System Design	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme B & C	**DSE-5 4 credit Select one Option**	B23-ELE-605	Introduction to C and its programming	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
		B23-ELE-606	Modern communication systems	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	3 hrs.
Scheme A only	**CC-M6 4 credits**	From Available CC-M6 of 4 credits as per NEP							
Scheme A only	**CC-M7(V) 4 credits**	From Available CC-M7(V) of 4 credits as per NEP							
Scheme B only	**CC-M5(V) 4 credits**	**From Available CC-M5(V) of 4 credits as per NEP**							
Scheme C only	**CC-M6(V) 4 credits**	**From Available CC-M6(V) of 4 credits as per NEP**							
Scheme C only	**SEC-4 2 credit**	From Available SEC-4 of two credits as per NEP							

FOURTH YEAR: SEMESTER-7 (FOR HONOURS/HONOURS WITH RESEARCH IN ELECTRONICS)									
Remarks	**Course**	**Paper(s)**	**Nomenclature of Paper**	**Credits**	**Hours/ Week**	**Internal marks**	**External Marks**	**Total Marks**	**Exam Duration**
for Honours in Electronics/ Honours with Research in Electronics (For Scheme B & C)	**CC-H1 4 credit**	B23-ELE-701	Digital Circuits and System Design	4	4	30	70	100	3 hrs.
	CC-H2 4 credit	B23-ELE-702	MOS Analog Circuits	4	4	30	70	100	3 hrs.
	CC-H3 4 credit	B23-ELE-703	Instrumentation and Control Systems	4	4	30	70	100	3 hrs.
	DSE-H1 4 credit Select one Option	B23-ELE-704	Optical Fiber Communication	4	4	30	70	100	3 hrs.
		B23-ELE-705	CAD Tools for VLSI	4	4	30	70	100	3 hrs.
	PC-H1 4 credit	B23-ELE-706	Practical Based on B23-ELE-701 TO 704/705	4	8	30	70	100	6 hrs.
	CC-HM1 4 credit	From Available Minor of 4 credits as per NEP							
SEMESTER-8 (FOR HONOURS IN ELECTRONICS)									
Remarks	**Course**	**Paper(s)**	**Nomenclature of Paper**	**Credits**	**Hours/ Week**	**Internal marks**	**External Marks**	**Total Marks**	**Exam Duration**
Honours in Electronics (For Scheme B & C)	**CC-H4 4 credit**	B23-ELE-801	Microwave devices and systems	4	4	30	70	100	3 hrs.
	CC-H5 4 credit	B23-ELE-802	MOS Digital Circuits	4	4	30	70	100	3 hrs.
	CC-H6 4 credit	B23-ELE-803	Device Models and Circuit Simulation	4	4	30	70	100	3 hrs.
	DSE-H2 4 credit Select one option	B23-ELE-804	Semiconductor Material & Device Characterization	4	4	30	70	100	3 hrs.
		B23-ELE-805	Digital Communication	4	4	30	70	100	3 hrs.
	PC-H2 4 credit	B23-ELE-806	Practical Based on B23-ELE-801 TO 804/805	4	8	30	70	100	6 hrs.
	CC-HM2 4 credit	From Available Minor of 4 credits as per NEP							
OR SEMESTER-8 (FOR HONOURS WITH RESEARCH IN ELECTRONICS)									
Remarks	**Course**	**Paper(s)**	**Nomenclature of Paper**	**Credits**	**Hours/ Week**	**Internal marks**	**External Marks**	**Total Marks**	**Exam Duration**
Honours with Research in Electronics (For Scheme B & C)	**CC-H4 4 credit**	B23-ELE-801	Microwave devices and systems	4	4	30	70	100	3 hrs.
	CC-H5 4 credit	B23-ELE-802	MOS Digital Circuits	4	4	30	70	100	3 hrs.
	Project/ Dissertation 12 credit	B23-ELE-807	Project/Dissertation	8+4	-	-	300	300	-
	CC-HM2 4 credit	From Available Minor of 4 credits as per NEP							

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FIRST		
Name of the Course	Electronic Devices and Network Analysis		
Course Code	B23-ELE-101		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-1 MCC-1		
Level of the course	100-199		
Pre-requisite for the course (if any)	Physics as a Subject at 4.0 Level (Class XII)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. understand the construction, working & applications of various semiconductor diodes 2. Learn about the use of filters in rectifiers and about Bipolar Junction Transistor. 3. understand the concept of various network circuits and its uses 4. understand the conversion of one network to another 5. present the experimental results and conclusions by having Hands-on experience in the Laboratory		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Theory + 30 Practical) Internal Assessment Marks: 20 Theory +10 Practical End Term Exam Marks: 50 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	

Part B- Contents of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**Semiconductors Devices & applications**: - Overview of Semiconductors, Junction diode and its characteristics, Zener diode, Voltage Regulation using Zener Diode, shunt and series clipping circuit, clamping circuit. **Rectifiers:** - HWR, FWR, Bridge FWR, calculation of rectifier parameters.	11
II	**Filter circuits:** L, C, LC (Calculation of ripple factor for capacitor filter only), Voltage multiplier Circuit. **Bipolar Junction Transistor: -** Potential curves in unbiased and biased transistor, Transistor current components, Static Characteristics of CB & CE configuration, active, cut off and saturation regions. Transistor current gains (Alpha, Beta, and Gama), Transistor as an Amplifier	12
III	**Network Theorems: -** Superposition theorem, Thevenin's Theorem, **Norton's** Theorem, Maximum Power Transfer Theorem, Millman's Theorem, examples and problems of each topic. **Two–port Network: -**Open Circuit Impedance(Z) Parameters, Short Circuit Admittance (Y) Parameters, Transmission (ABCD) Parameters, Inverse Transmission (A'B'C'D') Parameters, Hybrid(H) Parameters, Inverse Hybrid(g) Parameters	11
IV	Conversion of Parameters, Dependent sources (CCCS, VCVS, VCCS, CCVS), Inter Connection of Two – Port Networks, T and π Representation, Terminated Two-Port Networks, Lattice Networks, Image Parameters	11
V*	**Note:** A candidate is required to perform minimum 6 experiments out of the list provided during course of study in this semester. 1. To study the V-I characteristics of PN junction diode. 2. To study the Zener diode as voltage regulator. 3. To study HWR and FWR and measurement of ripple factor with and without C filter. 4. To study diode as shunt clipping clement. 5. To study diode as clamping element. 6. Study of Input and output CB characteristics . 7. Study of CE Input and Output characteristics 8. Measurement of voltageand Time period using CRO. 9. Measurement of resistance value using colour codes and multimeter. Also design and verify the potential divider arrangement using resistances. 10. To verify maximum power transfer theorem for DC network.	30
Suggested Evaluation Methods		

Internal Assessment:	End Term Examination:
➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Integrated Electronics by Millman and Halkias.
2. Basic Electronics and Linear Circuits by NN Bhargava, DC Kulshreshtha (TTTI)
3. Electronics Devices and Circuit by Allen Mottershead
4. Circuits and Networks by A. Sudhakar, Shyammohan
5. Network Analysis, Publication Khanna by G.K. Mithal
6. Network Analysis, Publication Pearson India by M.E. Van Valkenburg

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FIRST		
Name of the Course	Electronic Components, Measuring Instruments and Amplifiers		
Course Code	B23-ELE-102		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC-2		
Level of the course	100-199		
Pre-requisite for the course (if any)	Physics as a Subject at 4.0 Level (Class XII)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn about Passive components and their use 2. Understand the concept and use of different measuring instruments. 3. Understand the basics of Bipolar Junction Transistors 4. Understand the construction and working of different amplifiers 5. Get the Handson experience Through Lab work		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Theory + 30 Practical) Internal Assessment Marks: 20 Theory +10 Practical End Term Exam Marks: 50 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	
Part B- Contents of the Course			
Instructions for Paper- Setter 1. Nine questions will be set in all. All questions will carry equal marks. 2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.			

Unit	Topics	Contact Hours
I	**Passive Components:** Resistors, Capacitors, Inductors, Transformers, Relays, Fuses (their types & applications). **Introduction to Semiconductors:** Energy Band Diagram, Conductors, Semiconductors, Insulators, Intrinsic and Extrinsic Semiconductors (P&N), currents in semiconductors, Diffusion Junction, Depletion Layer, Barrier Potential.	11
II	**Measuring Instruments:** Regulated power supply, Analogue Multimeter, Digital Multimeter, Cathode Ray Oscilloscope, Function Generator (functional block diagram, basic working principle, measuring quantities). **Zener diode regulator**: circuit diagram and explanation for load and line regulation, disadvantages of Zener diode regulator.	11
III	**Bipolar Junction Transistor:** Basic working principle, Input and Output Characteristics of CB & CE configurations, Biasing, Operating point, Load line, thermal runaway, stability and stability factor, Stabilization of Operating Point, Collector to Base bias, Voltage Divider bias and Emitter bias (+VCC &–VEE bias), circuit diagrams and their working.	12
IV	**Amplifiers:** Classification of amplifiers, Class-A, B, AB and C Amplifiers, Cascading of Amplifiers, RC Coupled amplifiers. Properties of amplifiers (distortion, noise, thermal noise, shot noise, noise figure). Feedback in Amplifiers: Feedback concept, transfer gain with feedback, Effect of Negative Feedback on amplifiers performance. Transistor as a switch (circuit and working), Darlington pair and its applications.	11
V*	**Note:** A candidate is required to perform minimum 6 experiments out of the list provided during course of study in this semester. 1. Identification and study of Electronics Components. 2. Understanding the use of Function generator and draw the different wave shapes by connecting it with CRO. 3. Understand the use of Multimeter by measuring resistance, capacitance, voltage, frequency, transistor type etc. 4. Measurement of voltage. Time period and phase-shift using CRO. 5. Study of fixed bias arrangement for transistor. 6. Study of Voltage divider bias arrangement for transistor. 7. Study of Collector to base bias arrangement for transistor. 8. Study multi stage R-C coupled amplifier & to determine frequency response & gain 9. Find the gain (i) Class A. Amplifier (ii) Class B. Amplifier (iii) Class C Amplifier. 10. Verify the operation of transistor as a switch and draw the waveform.	30
Suggested Evaluation Methods		

Internal Assessment: ➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	**End Term Examination:** 50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Integrated Electronics by Millman and Halkias.
2. Basic Electronics and Linear Circuits by NN Bhargava, DC Kulshreshtha (TTTI)
3. Electronics Devices and Circuit by Allen Mottershead
4. Electronic Devices & Circuits by Sanjeev Gupta , Dhanpat Rai Publications

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FIRST		
Name of the Course	Basic Digital Electronics		
Course Code	B23-ELE-103		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	**CC-M1**		
Level of the course	100-199		
Pre-requisite for the course (if any)	Physics as a Subject at 4.0 Level (Class XII)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. To understand the basics of various Number systems and their conversions 2. To understand the basics of Boolean algebra and its theorems 3. To understand the concept and basics of different logic gates 4. To understand the concept and minimization techniques using K-maps 5. To learn and understand the use of various electronic components and equipment's used for analysis of basic digital electronic circuits		
Credits	Theory	Practical	Total
	1	1	2
Contact Hours	15	30	45
Max. Marks: 50 (30 Theory + 20 Practical) **Internal Assessment Marks: 10 Theory + 5 Practical** **End Term Exam Marks: 20 Theory + 15 Practical**		**Exam Time: 3 Hours each for Theory & Practical**	

Part B- Contents of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**Number Systems:** Introduction to Decimal, Binary, Octal, Hexadecimal Number Systems and their inter-conversions; BCD codes, Excess-3 codes, Gray codes, code conversions, binary arithmetic (addition, Subtraction, multiplication, division), 1's and 2's compliments and 9's and 10's compliments.	3
II	**Boolean Algebra:** Postulates & theorems of Boolean algebra, Duality Principle, De-Morgan's Theorem.	4
III	**Logic Gates:** Positive and Negative Logic, Basic Logic Gates: AND, OR, NOT (symbol, truth-table, circuit diagram, working); NAND, NOR, EX-OR, EX-NOR (symbol, truth table).	4
IV	**Minimization Techniques:** Reduction of Boolean expressions using Boolean Identities, SOP and POS form of Boolean functions, Karnaugh Map simplifications, implementations of SOP and POS form using NAND and NOR gates.	4
V*	**Note:** A candidate is required to perform minimum 4 experiments out of the list provided during course of study in this semester. 1. Design of basis logic gates using discrete components. 2. Study of different type of digital IC's :(functions, pin diagram, block diagram of various Digital ICs etc.). 3. Data Sheet Analysis of Digital ICs (Quote the data sheet of any two digital ICs in Laboratory File). 4. Realization of Boolean Identities on Digital Trainer Kit. 5. Digital trainer using AOI. 6. Digital trainer using NAND gates. 7. Realization of K-map expression on Digital Trainer Kit.	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory 10 Marks** • Class Participation: **4 Marks** • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam: **6 Marks** ➢ **Practicum 5 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **5 Marks** • Mid-Term Exam:	**End Term Examination:** **20 Marks** **15 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Digital Electronics by R.P. Jain
2. Digital Computer Electronics by A. P. Malvino

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FIRST		
Name of the Course	Electronics in Daily Life		
Course Code	B23-ELE-104		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	**MDC-1**		
Level of the course	100-199		
Pre-requisite for the course (if any)	Any Arts, Commerce Subject at 4.0 Level (Class XII)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand about various electronic components 2. Learn about the use of AC and DC voltages and transformers etc 3. Understand the concept of assembling and disassembling of various home appliances. 4. Learn the concept and importance of earthing 5. To get practical exposure of various electronics components and appliances		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks: 75 (50 Theory + 25 Practical) Internal Assessment Marks: 15 Theory + 5 Practical End Term Exam Marks: 35 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	
Part B- Contents of the Course			

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.
3. Medium of examination may be Hindi/English.

Unit	Topics	Contact Hours
I	**Introduction to basic Electronics components and Devices:** Resistor, Color code, Inductor, Capacitor, basic Potentiometer circuit, Multiple range Potentiometer Classification of Instruments, Analog and Digital Mode of operations, Basics of CRO, Multimeter	7
II	AC - DC Voltage, Domestic Electric supply, Transformer, Power consumption, wire, electric tester, clamp meter, Fuse, circuit breaker, Inverter, Electric consumption meter reading, BEE rating, Soldering techniques, LED, Display HD, Full HD and UHD.	8
III	Repair and Maintenance of Home Appliances(Basic idea of Internal Circuit and working): Inverters and UPS, Switch Mode Power Supply, washing Machine , Electric Iron, Microwave Oven, Rice Cooker	9
IV	Measurement of Earth Resistance: Necessity of Earth Electrode, Necessity of measurement of Earth Electrode, Factors effecting Earth Electrodes, Methods of measuring Earth Resistance	6
V*	**Note:** A candidate is required to perform minimum 4 experiments out of the list provided during course of study in this semester. 1. Measurement of alternating voltage using multimeter. 2. Measurement of voltage and Time period and using CRO. 3. Measurement of resistance value using colour codes and multimeter. 4. Design and verify the potential divider arrangement using resistances. 5. Testing of wire, measuring voltage, current and frequency using multimeter 6. Demonstrate soldering of basic electronics components using soldering iron. 7. Understanding the role of transformer.	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory 15 Marks** • Class Participation: **4 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **4 Marks** • Mid-Term Exam: **7 Marks** ➢ **Practicum 5 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **5 Marks** • Mid-Term Exam:		**End Term Examination:** **35 Marks** **20 Marks**
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. A course in Electrical and Electronic Measurements and Instrumentation by A K Sawhney.
2. Electronics Instrumentation and Measurement Techniques by W D Cooper
3. Handbook of Repair and Maintenance of Domestic Electronics Appliances, Shashi Bhushan Sinha, BPB Publications
4. Getting Down to Earth: A practical guide to earth resistance testing, Megger

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	SECOND		
Name of the Course	Electronic Devices and Basic Digital Electronics		
Course Code	B23-ELE-201		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-2 MCC-3		
Level of the course	100-199		
Pre-requisite for the course (if any)	Electronics as a Subject (CC-1)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: Student will be able 1. To describe the basic Biasing Techniques. 2. To understand the basics of Field effect transistors 3. To learn about the number systems, conversions and K-map's 4. To understand the basics of Logic gates and Families 5. Hands-on practice of the analog and Digital based experiments		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Theory + 30 Practical) Internal Assessment Marks: 20 Theory + 10 Practical End Term Exam Marks: 50 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	
Part B- Contents of the Course			

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**Transistor Biasing Techniques: -**Why Bias a Transistor, Selection of Operating Point, need for Bias Stabilization, Requirement of a Biasing Circuit, Different Biasing Circuits: Bias Circuit with Emitter Resistor, Voltage Divider Biasing Circuit, Emitter-Bias Circuit, Gain of a multi-stage amplifier.	12
II	**Field Effect Transistor: -** Junctions Field Effect Transistor, Qualitative Description of JFET, Drain and transfer characteristics of JFET, FET small signal low frequency model, CS & CD low frequency model, MOSFET -Depletion and enhancement and their drain & transfer characteristics, CMOS (Basic idea).	12
III	**Number Systems:** - Binary, Octal, Hexadecimal number system and base conversions, Binary Arithmetic operations, 1's and 2's complement representation and their arithmetic, Binary codes-BCD, Gray, Error detecting and correcting codes, BCD addition, Boolean Algebra: Postulates, Duality Principle, De Morgan's Law, Simplification of Boolean Identities, Standard SOP & POS Forms, Simplification using K-map (upto 4 variables), don't care condition, implementation of SOP & POS form using NAND and NOR Gate.	11
IV	**Logic Gates:** Positive and Negative logic level, Logic Gates: AND, OR, NOT, XOR, XNOR, NOR, NAND (Definition, Symbols & Truth table). **Logic families:** Unipolar & Bipolar Logic families, characteristics of Digital IC's (fan in, fan out, propagation delay. Noise Margin), RTL (NOR), DTL (NAND), TTL (NAND), CMOS Logic gate (NAND, NOR).	10
V*	**Note:** A candidate is required to perform minimum 6 experiments out of the list provided during course of study in this semester. 1. Study of fixed bias arrangement for transistors. 2. Study of voltage divider biasing arrangement for transistors. 3. Study of two stage R-C coupled transistor amplifier. 4. Study of JFET characteristics. 5. Study of different type of digital IC's :(functions, pin diagram, block diagram of various Digital ICs etc.). 6. Design of basis logic gates using discrete components. 7. Study of DTL NAND gate. 8. Study of TTL NAND gate. 9. Digital trainer using AND, OR & NOT gates. 10. Digital trainer using NAND gates.	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	**End Term Examination:** 50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Basic Electronics and Linear Circuits by NN Bhargava, D C Kulshreshtha
2. Integrated Electronics by Millman and Halkias
3. Electronics Devices and Circuit by Allen Mottershead
4. Digital Electronics by R.P. Jain
5. Digital Computer Electronics by Albert Paul Malvino

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FIRST		
Name of the Course	Power Devices and Multivibrators		
Course Code	B23-ELE-202		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	**DSEC-2**		
Level of the course	100-199		
Pre-requisite for the course (if any)	Electronics as a Subject (CC-1)		
Course Learning Outcomes (CLO):	After completing this course, the student will be able to: 1. Understand the working of Power Device SCR 2. Understand the working and applications of DIAC, TRIAC & UJT 3. Understand the use and working of Choppers 4. Understand the working and design of multivibrators. 5. Hands-on practice of the power devices and multivibrators based experiments		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Theory + 30 Practical) Internal Assessment Marks: 20 Theory + 10 Practical End Term Exam Marks: 50 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	

Part B- Contents of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours

I	**POWER SEMI CONDUCTOR DEVICES-I**: Introduction to Thyristors, comparison of Transistors and Thyristors, Thyristors Family, Silicon Controlled Rectifiers (SCR's), Two transistor analogy - Static and Dynamic characteristics - Turn on and turn off methods, Rating and specifications of SCR, Series and Parallel connection of SCR, Applications of SCR	12
II	**POWER SEMI CONDUCTOR DEVICES-II:** DIAC: Construction, working and Characteristics, TRIAC: Construction, working and Characteristics, Unijunction Transistor: Construction, working and Characteristics, UJT as relaxation oscillators	10
III	**POWER SEMI CONDUCTOR DEVICES-III:** CHOPPERS: Basic chopper circuit, types of choppers step-down chopper, step-up chopper, operation of D.C. chopper circuits using self-commutation, cathode pulse turn-off chopper, load sensitive cathode pulse turn-off chopper (Jones Chopper), Morgan's chopper	11
IV	**Switching Circuits (Multivibrators):** Construction and working of**:** Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator, Comparison of different Multivibrators, Applications of Multivibrators, Schmitt Trigger (Emitter Coupled Binary) applications of Schmitt Trigger	12
V*	**Note:** A candidate is required to perform minimum 6 experiments out of the list provided during course of study in this semester. 1. Characteristics of SCR 2. Characteristics of UJT 3. Characteristics of DIAC 4. Characteristics of TRIAC 5. UJT Relaxation Oscillator 6. Study of Astable multivibrator and plot the waveform 7. Study of Monostable Multivibrator and plot the waveform 8. Study of Bistable Multivibrator and plot the waveform 9. To observe and note down the output waveforms of Schmitt trigger using transistors 10. Study of triagular wave form generator using UJT.	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:		**End Term Examination:** 50 Marks 20 Marks
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. Power Electronics, M.D.Singh & K.B.Khanchandani,TMH
2. Power Electronics, P.C.Sen,TMH
3. Power Electronics Circuits, Devices and Applications, 3rd Edition, M.H. Rashid, Pearson Education
4. Industrial electronics – G.K. Mithal, Khanna Publications – Delhi – 15thEd.1992.
5. Industrial and power electronics – C. Harish – Raj Umesh Publications – 4th Edn.1992.
6. Industrial and Power Electronics by G.K. Mithal
7. Integrated Electronics by Millman and Halkias, TMH
8. Electronic Devices and Circuits by Sanjeev Gupta, Dhanpat Rai Publicaions

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	SECOND		
Name of the Course	Basic Electronic Components & Devices		
Course Code	B23-ELE-203		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M2		
Level of the course	100-199		
Pre-requisite for the course (if any)	Physics as a Subject at 4.0 Level (Class XII)		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn about active, Passive components and junction diode's 2. Understand the applications of junction diode and Zener diode 3. Understand the Concept of Bipolar Junction Transistor 4. Understand various R, L and C circuits 5. Practical exposure of the different active and passive components in their uses		
Credits	Theory	Practical	Total
	1	1	2
Contact Hours	15	30	45
Max. Marks: 50 (30 Theory + 20 Practical) **Internal Assessment Marks: 10 Theory + 5 Practical** **End Term Exam Marks: 20Theory + 15 Practical**		**Exam Time: 3 Hours each for Theory & Practical**	

Part B- Contents of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**Passive Components:** Resistors, Capacitors, Inductors, Transformers, Relays, Fuses (their types & applications). **Junction Diodes:** Rectifying diode, Forward and reverse bias characteristics, Varactor Diode, Light Emitting Diode, Photo diode and Photo transistors (qualitative only).	4
II	**Rectifiers:** Half wave, Full wave, Bridge, Clipping and Clamping circuits. **Zener diode:** Zener diode as voltage regulator**.**	3
III	**Bipolar Junction Transistor:** Basic working principle, Input and Output Characteristics of CB & CE configurations. Transistor as an amplifier, Transistor as a switch.	4
IV	**Sinusoidal Circuit Analysis**: for RL, RC and RLC Circuits, Resonance in Series and Parallel RLC Circuits, Frequency Response of Series and Parallel RLC Circuits, Quality (Q) Factor and Bandwidth.	4
V*	**Note:** A candidate is required to perform minimum 4 experiments out of the list provided during course of study in this semester. 1. Measurement of resistance value using colour codes and multimeter. 2. To study the V-I characteristics of PN junction diode. 3. To study the zener diode as voltage regulator. 4. To study HWR and measurement of ripple factor without filter. 5. To study FWR and measurement of ripple factor without filter. 6. To study diode as shunt clipping circuit. 7. To study diode as clamping element. 8. Study of CB characteristics. 9. Study of CE characteristics. 10. Measurement of voltage and Time period using CRO.	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory 10 Marks** • Class Participation: **4 Marks** • Seminar/presentation/assignment/quiz/class test etc.: • Mid-Term Exam: **6 Marks** ➢ **Practicum 5 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **5 Marks** • Mid-Term Exam:		**End Term Examination:** **20 Marks** **15 Marks**
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. Integrated Electronics by Millman and Halkias.
2. Basic Electronics and Linear Circuits by NN Bhargava, DC Kulshreshtha (TTTI)
3. Electronics Devices and Circuit by Allen Mottershead
4. Basic Electronics SOLID STATE by B L Theraja

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	SECOND		
Name of the Course	Understanding of Mobiles and Computer Systems		
Course Code	B23-ELE-204		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC-2		
Level of the course	100-199		
Pre-requisite for the course (if any)	B.A. & B.Com. Ist Sem.		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Identify the different parts of Computer or Laptop systems. 2. Know about various backup systems and cable connections 3. Learn about different printers available 4. Understand the Setting of Internet Connection with computer/Laptop systems 5. Hands-on with the different parts and peripherals of computer		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	30	30	60
Max. Marks: 75 (50 Theory + 25 Practical) Internal Assessment Marks: 15 Theory + 5 Practical End Term Exam Marks: 35 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	

Part B- Contents of the Course

Instructions for Paper- Setter

1.Nine questions will be set in all. All questions will carry equal marks.

2.Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

3.Medium of examination may be Hindi/English.

Unit	Topics	Contact Hours

I	Identification of various parts of Computer/ Laptop, Understanding the computer configuration/Laptop configuration and Mobile Configuration	8
II	Power Backup: Inverter, UPS, Dry Battery Various Interfacing Cables, connectors and converters for computer, Laptop and Mobile	8
III	Printer Scanner Configuration Projector: Types of Projectors and their Installation	7
IV	Setting Up of Internet Connection: Wired & Wi-fi Setting Up of a complete ICT solution using Computer/laptop and Mobile and interactive Panel	7
V*	**Note:** A candidate is required to perform minimum 4 experiments out of the list provided during course of study in this semester. 1. Introduction of Computer Peripherals (input devices, output devices etc) 2. Disassembling computer system. 3. Reassembling computer system 4. Familiarization with Motherboard and its Components. 5. Troubleshooting and Repairing of Keyboard and Scanner. 6. Troubleshooting and Repairing of Printer 7. Troubleshooting and Repairing of Speaker and Web camera.	30
Suggested Evaluation Methods		
Internal Assessment: ➢ **Theory 15 Marks** • Class Participation: **4 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **4 Marks** • Mid-Term Exam: **7 Marks** ➢ **Practicum 5 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **5 Marks** • Mid-Term Exam:		**End Term Examination:** **35 Marks** **20 Marks**
Part C-Learning Resources		

Recommended Books/e-resources/LMS:

1. Computer Fundamentals by Pradeep K. Sinha BPB Publications
2. IBM PC & Clones: Hardware Trouble Shooting and Maintenance by B.Govindarajalu, Tata McGraw Hill
3. PC Upgrade & Repair Bible , Wiley India.
4. PC Systems, Installation and Maintenance, Second Edition by R. P. Beales,
5. PC Upgrade & Repair Black Book by Ron Gilster.
6. Computer Installation and Servicing by D Balasubramanian

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	THIRD		
Name of the Course	Combinational & Sequential Circuits		
Course Code	B23-ELE-301		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-3 MCC-4		
Level of the course	100-199		
Pre-requisite for the course (if any)	Basic Knowledge of Electronics in B.Sc. Ist Year		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the Design principle of basic combinational circuit 2. Understand the design and working of different advanced combinational circuits 3. Learn the basic concepts and working of sequential circuits 4. Learn the working and design principle of asynchronous and synchronous counters 5. Use of Combinational and sequential circuits using digital trainer kits		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100(70 Theory + 30 Practical) Internal Assessment Marks: 20 Theory + 10 Practical End Term Exam Marks: 50 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	
Part B- Contents of the Course			

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**Combinational Circuit-I:** Design principle of combinational circuit: Half adder, full adder, half subtractor, full subtractor, Railway track switching system, common light switching for a group of flats, Parity Generator.	10
II	**Combinational Circuits-II**: Multiplexers, Demultiplexer, Decoder, Encoder, Parity bit generator and checker, Code Converter: BCD to Seven Segment, Binary to Gray, Gray to Binary, Binary to Excess-3, Excess-3 to Binary, Application of combinational circuit: adder circuit using Multiplexers, Boolean expression implementation using Multiplexer, Boolean expression implementation using Demultiplexer	12
III	**Sequential Circuits**: Basic Sequential circuit, Asynchronous and Synchronous circuits, RS FF and JK Flip Flop, Race Around Condition, Master Slave JK flip flop, T and D Flip Flop, Excitation Table, Conversion of Flip Flop, State Diagram.	12
IV	**Counters:** Asynchronous Binary Counters, Asynchronous Mod-N Counter, Synchronous counter: Design principle of Modulo- N Counters, UP-Down counters, Decade Counter, BCD Counter.	10
V*	**Note:** A candidate is required to perform minimum 6 experiments out of the list provided during course of study in this semester. 1. Study of different types of digital IC's: functions, pin diagram, block diagram of 7400, 7402, 7404, 7408, 7432, 7474, 7476, 7490, 74153, 74155 2. Design a half adder using IC 7400. 3. Design a full adder using two half adders. 4. Study of parity generator/checker. 5. To study a 4:1 Multiplexer. 6. To study a 1:4 De- Multiplexer. 7. To study and design a Code Converter. 8. To verify the functionality of J-K, D and T Flip-Flops using 7476 and 7474 ICs. 9. To design a Ripple Binary Counter. 10. To study and design a MOD-N Counter (Synch/Asynch).	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	**End Term Examination:** 50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Digital Electronics & Micro computers - R. K. Gaur (4th edition)
2. Modern Digital Electronics - R.P. Jain (4th edition)
3. Digital Principles and Applications by Leach Donald, Malvino AP (6th Edition)
4. Digital fundamentals by R.P. Jain & Floyd.

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	THIRD		
Name of the Course	Digital Electronics		
Course Code	B23-ELE-302		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MCC-5		
Level of the course	100-199		
Pre-requisite for the course (if any)	Basic Knowledge of Electronics in B.Sc. Ist Year		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn the basic concepts of flip flops and working of sequential circuits 2. Learn the design of asynchronous and synchronous counters 3. Understand the concept of shift registers and its applications 4. Understand the logics and theory of the semiconductor memories 5. Use of Combinational and sequential circuits using digital trainer kits		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100(70 Theory + 30 Practical) Internal Assessment Marks: 20 Theory + 10 Practical End Term Exam Marks: 50 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	
Part B- Contents of the Course			

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**Basic Sequential circuit**: Asynchronous and Synchronous circuits, RS Flip-Flop, JK Flip Flop, Race Around Condition, Master Slave JK flip flop, T and D Flip Flop, Excitation Table, Conversion of Flip Flop.	11
II	**Counters:** Asynchronous Binary Counters, Asynchronous Mod-N Counter, Synchronous counter: Design principle of Modulo-N Counters, UP-Down counters, Decade Counter, skipping state counter.	12
III	**Shift Registers**: SISO, SIPO, PISO, PIPO, Bidirectional Shift register, Universal Shift register Applications of shift register: Ring counter, Johnson Counter, Time delay generation.	11
IV	**Memories:** Memory Organization and Operation, Expanding Memory Size, Classification and Characteristics of Memories, Read Only Memory (ROM Organization, Programming Mechanisms, Read and Write Memory (Static and Dynamic), Bipolar RAM Cell, MOS RAMs, Charge Couple Device Memory (Basic concept of CCD, Operation of CCD)	11
V*	**Note:** A candidate is required to perform minimum 5 experiments out of the list provided during course of study in this semester. 1. Study of JK and T type flip flops using IC 7476. 2. Study of D flip flops using IC 7474. 3. Design a 4-bit Ripple counter 4. Design an asynchronous decade counter 5. Design of Up- Down Counter 6. Design a Ring counter 7. Realization of shift Register using Trainer Kit. 8. Realization of Bidirectional shift Registers using Trainer Kits	30
Suggested Evaluation Methods		

Internal Assessment: ➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	**End Term Examination:** 50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Digital E1ectronics & Micro computers - R. K. Gaur (4th edition)
2. Modern Digital Electronics - R.P. Jain (4th edition)
3. Digital Principles and Applications by Leach Donald, Malvino AP (6th Edition)
4. Digital fundamentals by R.P. Jain & Floyd.

Session: 2023-24

Part A - Introduction

Subject	ELECTRONICS
Semester	THIRD
Name of the Course	Electronics in Smart World
Course Code	B23-ELE-303
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC-3
Level of the course	100-199
Pre-requisite for the course (if any)	1. No Programming language or Experience needed 2. Interest and passion about Automotive Electronics

Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. understand applications of electronics in smart homes. 2. understand applications of electronics in education sector and agriculture sector. 3. understand applications of electronics in smart homes. 4. understand applications of electronics in smart healthcare. 5. get the insight knowledge by experiential learning

Credits	Theory	Practical	Total
	2	1	4
Contact Hours	30	30	60

Max. Marks: 75 (50 Theory + 25 Practical) Internal Assessment Marks: 15 Theory + 5 Practical End Term Exam Marks: 35 Theory + 20 Practical	Exam Time: 3 Hours each for Theory & Practical

Part B- Contents of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	Evolution of smart homes; Video monitoring, Security and alarms, CCTV;	8
II	Role of Electronics in Education and Agriculture (Drones for survey, Smart-irrigation);	6
III	Electronics in Smart watch, Auto-mobiles, ATM. RF-ID cards: Working and applications	11
IV	Electronics in Healthcare: Digital Thermometers, BP measurement, Digital X-Ray, MRI, USG, ECG (Basic principle only).	11
V*	**Perform at least two activities and make the report on it:** 1. Prepare a project report on proposed features of smart Homes 2. Prepare a PowerPoint presentation on any one electronic instrument used in Health care. 3. Prepare a project report on proposed features of smart City 4. Prepare a report on ATM systems	30

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory 15 Marks** • Class Participation: **4 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **4 Marks** • Mid-Term Exam: **7 Marks** ➢ **Practicum 5 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **5 Marks** • Mid-Term Exam:	**End Term Examination:** **35 Marks** **20 Marks**

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Ribbens, "Understanding Automotive Electronics", 7th Edition, Elsevier, Indian Reprint, 2013.
2. Tom Denton, “Automotive Electric and Electronic Systems”, 3rd Edition, Elsevier, 2004
3. https://kanchiuniv.ac.in/coursematerials/autotronics.pdf
4. Sensors and Actuators, D. Patranabis, 2nd Ed., PHI, 2013.
5. Make sensors: Terokarvinen, Kemo, Karvinen and Villey Valtokari, 1st edition, maker media, 2014.
6. Sensors Handbook- Sabrie Soloman, 2nd Ed. TMH, 2009

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FOUR		
Name of the Course	Operational Amplifier & Sinusoidal Oscillators		
Course Code	B23-ELE-401		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-4 MCC-6		
Level of the course	200-299		
Pre-requisite for the course (if any)	Basic Knowledge of Electronics in B.Sc. Ist Year		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the concept and working of operational amplifier. 2. Understand the op-amp parameters and its applications 3. Learn about various amplifiers circuits and negative feedback 4. Understand the concept of positive feedback and working of different oscillators 5. Hands-on with various op-amp circuits and oscillators		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Theory + 30 Practical) Internal Assessment Marks: 20 Theory + 10 Practical End Term Exam Marks: 50 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	
Part B- Contents of the Course			

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**Operational Amplifier- I:** Ideal operational amplifier, Op-amp internal circuit (Emitter Coupled Differential amplifier, level translator, output stage), Differential Amplifier, Use of Current Mirror as Constant Current Source, CMRR, Voltage follower, Op-amp as Inverting Amplifier, Non-inverting amplifier.	11
II	**Operational Amplifier- II:** Practical Op-Amp: Input Offset Voltages, input bias Current, input offset current, thermal drift, effect of error sources, summing amplifier, subtractor, Integrator, Differentiator circuit, Log and Antilog Amplifier, Divider and Multiplier.	11
III	**Amplifiers & Feedback:** Classification of Amplifiers (voltage, current, Transconductance, Transresistance amplifier), Feedback concept, calculation of transfer gain in degenerative and regenerative feedbacks, Feedback topologies, Effect of negative feedback on gain, Non-linear distortion, Frequency response, Effect of negative voltage shunt feedback on input and output resistance, Effect of negative voltage series feedback on input and output resistance, Effect of negative current shunt feedback on input and output resistance, Effect of negative current series feedback on input and output resistance.	12
IV	**Oscillators:** Principle of oscillations, condition for sustained oscillation (Barkhausen criterion), stability of oscillator, Principle, working and frequency calculation of RF oscillators (Hartley oscillator, Colpitts oscillator, crystal oscillator) and AF Oscillators (Wien Bridge oscillator, R-C Phase-shift oscillator)	11
V*	**Note:** A candidate is required to perform minimum 6 experiments out of the list provided during course of study in this semester. **1.** Operational amplifier as Unity gain buffer amplifier. **2.** Operational amplifier as an Inverting amplifier and Non-inverting amplifier. 3. Operational amplifier as Summing amplifier. 4. Operational amplifier as Difference amplifier. 5. Measurement of offset voltage, bias currents & CMRR of an operational amplifier. 6. Study and design of an integrating circuit using op-amp IC 741. 7. Study and design of a differentiating circuit using op-amp IC	30

	741. 8. To study the design of Hartley oscillator & measure its frequency. 9. To study the design of Colpitt's oscillator & measure its frequency. 10. To study the design of Phase shift oscillator & measure its frequency. 11. To study the design of Wein bridge oscillator & measure its frequency.	

Suggested Evaluation Methods

Internal Assessment: ➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	**End Term Examination:** 50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Basic Electronics Solid state by B.L. Theraja.
2. Opamp and linear circuits by Ramakant A Gayakward.
3. Electronics for Scientist & Engineers by Vishvanathan & Mehta.

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FOUR		
Name of the Course	I C Fabrication Technology		
Course Code	B23-ELE-402		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	**MCC-7**		
Level of the course	200-299		
Pre-requisite for the course (if any)	Basic Knowledge of Electronics in B.Sc. Ist Year		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Learn about basic IC Fabrication Processes 2. Understand the concept of Thermal Oxidation, Diffusion and other thin film processes. 3. Learn about various photolithography methods and their applications 4. Learn about various etching methods of different semiconductor substrates. 5. Get the exposure of the field visit to IC Fabrication Laboratory and other hands-on experiences.		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100 (70 Theory + 30 Practical) Internal Assessment Marks: 20 Theory + 10 Practical End Term Exam Marks: 50 Theory + 20 Practical		Exam Time: 3 Hours each for Theory & Practical	

Part B- Contents of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**Microelectronics processing**: Introduction, Clean Room, Basics of Vacuum Science and Technology, Deposition Technique: Thermal evaporation, Sputtering, Chemical Vapor Deposition, PECVD, Metallization, Epitaxy: Introduction, Vapor phase Epitaxy, Liquid phase epitaxy and Molecular beam epitaxy.	11
II	Thermal Oxidation of Silicon, Oxide Formation, Properties of Thermal Oxides of Silicon, Uses of Silicon Oxide, Basic diffusion process, Diffusion Equation, Diffusion Profiles, Diffusion in Silicon, Lateral Diffusion, Introduction to Ion Implatation Process , Ion Stopping, Ion Channeling, Disorder and Annealing	12
III	Photolithography, Negative and Positive Photo resist, Resist Application, Exposure and Development, Photolithographic Process Control. E-Beam Lithography, X-Ray Beam Lithography and Ion Beam Lithography.	11
IV	Wet Chemical Etching, Chemical Etchants for SiO_2, Si_3N_4, Polycrystalline Silicon and other microelectronic materials, Plasma Etching, Plasma Etchants, Photoresist Removal, Lift off process, Etch Process Control	11
V*	**Perform at least two activities and make the report on it:** 1. Visit a nearest IC Processing lab and prepare a project report/ PPT. 2. Prepare a PowerPoint presentation on any one fabrication process. 3. Simulation of any of the IC fabrication process using open Source tool.	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	**End Term Examination:** 50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Microelectronic Processing: An Introduction to the Manufacture of Integrated Circuits by W. Scot Ruska (McGraw Hill International Edition).
2. VLSI Technology By S.M.Sze (2nd Edition)
3. VLSI Fabrication Principles: Silicon and Gallium Arsenide by Sorab K. Ghandhi (John Wiley & Sons).

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FOUR		
Name of the Course	Electronic Communication		
Course Code	B23-ELE-403		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	**MCC-8**		
Level of the course	200-299		
Pre-requisite for the course (if any)	Basic Knowledge of Electronics in B.Sc. Ist Year		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Develop the concept of basics of communication systems 2. Familiar with modulation & demodulation methods 3. Familiar with AM, FM and pulse modulation. 4. Learn the different Digital Modulation Techniques. 5. Get the hands-on practice of different communication techniques and methods		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100(70 Theory +30 Practical) Internal Assessment Marks: 20 Theory +10 Practical End Term Exam Marks: 50 Theory +20 Practical		Exam Time: 3 Hours each for Theory & Practical	

Part B- Contents of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**Communication Systems:** Elements of Communication Systems, Basic Terminology in communication system, Bandwidth of Signal, Bandwidth of Transmission medium, Propagation of Electromagnetic waves: Ground Wave, Sky wave, Space Wave	11
II	**Modulation & Demodulation** : Principle of modulation , Amplitude Modulation ,Percent Modulation ,upper & lower side frequencies ,upper & lower side bands, mathematical analysis of a modulated carrier wave, power relations in an AM wave, simple idea about different forms of amplitude modulation. A) DSB-SC B) SSB-TC C) SSBSC	12
III	**Frequency Modulation:** Frequency modulation , FM Sidebands, modulation index and number of side bands, mathematical expression for FM wave, Demodulation, diode detector for AM signals.FM detector , Limited and phase shift detectors, comparison between AM & FM.	12
IV	**Pulse Analog Modulation:** Channel capacity, Sampling theorem, PAM, PWM, PPM modulation and detection techniques, Multiplexing: TDM and FDM.	10
V*	**Note:** A candidate is required to perform minimum 6 experiments out of the list provided during course of study in this semester: 1. Study of Amplitude Modulation, plot the waveform and calculation of modulation index (using Kit) 2. Study of Amplitude demodulation and plot the waveform (using Kit) 3. Study of Frequency Modulation. Wave form tracing (using Kit). 4. Study of Pulse Amplitude Modulation using IC 555 (using Kit). 5. Study Pulse width Modulation using IC 555 (using Kit). 6. Study of Pulse Position Modulation using IC 555 (using Kit). 7. Multiplexing Techniques: FDM 8. Multiplexing Techniques: TDM	30
Suggested Evaluation Methods		

Internal Assessment:	End Term Examination:
➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Kennedy, George & Davis, Bernard "Electronic Communication Systems" Tata McGraw-Hill 4thEd.
2. Modem Analog & Digital Communication Systems: B.P. Lathi; Oxford Univ. Press.
3. Communication Systems S. Haykin, John Willy & Sons.
4. Taub, Herbert & Schilling, Donald L. "Communication Systems" Tata McGraw-Hill
5. Electronic Communication Systems: Fundamentals through Advanced (4^{th}ed.) Wayne Tomasi, Prentice Hall
6. Radio Engineering by G K Mithal

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FOUR		
Name of the Course	Optical Fiber Communication		
Course Code	B23-ELE-404		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	**DSE-1**		
Level of the course	200-299		
Pre-requisite for the course (if any)	Basic Knowledge of Electronics in B.Sc. Ist Year		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able to: 1. Understand the basics of Optical Fibers 2. Learn the characteristics of optical fibers and sources and detectors of optical fibers 3. Learn about different couplers and connectors use in optical fiber 4. Understand various analog and digital link 5. Practice of various optical fiber communication techniques		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100(70 Theory +30 Practical) Internal Assessment Marks: 20 Theory +10 Practical End Term Exam Marks: 50 Theory +20 Practical		Exam Time: 3 Hours each for Theory & Practical	
Part B- Contents of the Course			

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.

2.Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
I	**OVERVIEW OF OPTICAL FIBER COMMUNICATION:** Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber, single mode fiber, cutoff wave length, mode filed diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fiber.	12
II	**TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS**: Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra modal dispersion, Inter modal dispersion **OPTICAL SOURCES AND DETECTORS:** Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors	12
III	**FIBER COUPLERS AND CONNECTORS**: Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers. OPTICAL RECEIVER: Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver operation, Analog receivers.	11
IV	**ANALOG AND DIGITAL LINKS:** Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics. Digital links – Introduction, point–to–point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping	10
V*	**Note:** A candidate is required to perform minimum 6 experiments out of the list provided during course of study in this semester: 1. To establish analog link using Optical Fiber. 2. To establish voice link using optical fiber. 3. To Transmit and receive Pulse Amplitude Modulated (PAM) signal 4. To measure Propagation loss in optical fiber 5. To measure bending loss in optical fiber 6. To measure numerical aperture of optical fiber 7. To study splicing & connectors. 8. Study of I-V Characteristics of Fiber optic LED and Photodetector	30

Suggested Evaluation Methods	
Internal Assessment: ➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	**End Term Examination:** 50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Optical Fiber Communication – Gerd Keiser, 4th Ed., MGH, 2008.
2. Optical Fiber Communications– – John M. Senior, Pearson Education. 3 rd Impression, 2007.
3. Fiber optic communication – Joseph C Palais: 4th Edition, Pearson Education.

Session: 2023-24			
Part A - Introduction			
Subject	ELECTRONICS		
Semester	FOUR		
Name of the Course	Wireless and Mobile Communication		
Course Code	B23-ELE-405		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	**DSE-1**		
Level of the course	200-299		
Pre-requisite for the course (if any)	Basic Knowledge of Electronics in B.Sc. Ist Year		
Course Learning Outcomes (CLO):	After completing this course, the learner will be able: 1. To understand the evolution of wireless communication system 2. To inculcate the skill of the link budget design of cellular system. 3. To understand the effects of small scale fading and large scale path loss. 4. To learn the modulation and multiple access techniques used for cellular systems. 5. To Practice of wireless and mobile communication technologies on trainer kit		
Credits	Theory	Practical	Total
	3	1	4
Contact Hours	45	30	75
Max. Marks: 100(70 Theory +30 Practical) Internal Assessment Marks: 20 Theory +10 Practical End Term Exam Marks: 50 Theory +20 Practical		Exam Time: 3 Hours each for Theory & Practical	
Part B- Contents of the Course			

Instructions for Paper- Setter

1.Nine questions will be set in all. All questions will carry equal marks.

2.Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from

each unit.

Unit	Topics	Contact Hours
I	**Introduction to Wireless Communication Systems**: Evolution, Mobile Systems around the World, Example of the mobile radio systems, Recent trends, 2G, 3G, 4G and 5G Cellular networks. The Cellular Concept: Frequency reuse, Channel assignment, Hand off process, Types of Interference, Cellular capacity	10
II	**Mobile Radio Propagation:** Path loss, Radio wave propagation, Reflection, Diffraction, Scattering, Link budget Design, Outdoor and indoor propagation models **Principle of multi path propagation:** impulse response model of channels, parameters for mobile multi path channels, concept of fading, Rayleigh and Rician fading, Simulation of fading channels.	12
III	**Modulations techniques for mobile communication:** Pulse shaping, Linear and non-linear Modulation techniques, constant envelop modulation, QPSK, MSK, GMSK. Spread spectrum modulation techniques - Direct sequence and Frequency Hopping Spread Spectrum and their applications **Equalization, Diversity and Channel coding:** Fundamentals of equalization, General adaptive equalizer, Linear and non-linear equalizers, diversity techniques, RAKE receivers, Basic concept of coding.	12
IV	**Multiple access techniques:** Introduction, FDMA, TDMA, CDMA, SDMA, capacity of cellular systems **Introduction to Multicarrier systems:** OFDM and wireless LAN, WiMAX, GSM, WCDMA, 3GPP LTE and other 4G standards.	11
V*	**Note:** A candidate is required to perform minimum 6 experiments out of the list provided during course of study in this semester: Study of wireless Communications using Communication Trainer Kits : 1. Baseband Communication 2. Adaptive Linear Equalizer 3. Code Division Multiple Access (CDMA) - Multipath 4. Code Division Multiple Access (CDMA) – Multiuser 5. Study of TDMA Trainer Kit 6. Study of FDMA Trainer kit 7. Global System for Mobile Communication (GSM) Trainer Kit 8. Study of QPSK Trainer Kit 9. Study of GMSK Trainer Kit	30
Suggested Evaluation Methods		

Internal Assessment: ➢ **Theory 20 Marks** • Class Participation: **5 Marks** • Seminar/presentation/assignment/quiz/class test etc.: **5 Marks** • Mid-Term Exam: **10 Marks** ➢ **Practicum 10 Marks** • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: **10 Marks** • Mid-Term Exam:	**End Term Examination:** 50 Marks 20 Marks

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. T.S. Rappaport, "Wireless Communications – Principles and Practice", Prentice Hall of India Pearson Education India, 2002.
2. Andrea Goldsmith, "Wireless Communication", Cambridge University Press, 2005
3. W C Y Lee, "Mobile Communication Engineering", Tata McGraw Hill, India, 2008
4. G. Stuber, Principles of Mobile Communication, Springer, 2001
5. Frenzel, "Communication Electronics", Tata McGraw Hill
6. William C. Y. Lee, "Wireless and Cellular Communications", Third Edition, , TMH

ANNEXURE-I

Levels of Courses

Levels of Courses: Courses shall be coded based on the learning outcomes, level of difficulty, and academic rigor. The coding structure is as follows:

0-99: Pre-requisite courses required to undertake an introductory course which will be a pass or fail course with no credits. It will replace the existing informal way of offering bridge courses that are conducted in some of the colleges/ universities.

100-199: Foundation or introductory courses that are intended for students to gain an understanding and basic knowledge about the subjects and help decide the subject or discipline of interest. These courses may also be prerequisites for courses in the major subject. These courses generally would focus on foundational theories, concepts, perspectives, principles, methods, and procedures of critical thinking in order to provide a broad basis for taking up more advanced courses. These courses seek to equip students with the general education needed for advanced study, expose students to the breadth of different fields of study; provide a foundation for specialized higher-level coursework; acquaint students with the breadth of (inter) disciplinary fields in the arts, humanities, social sciences, and natural sciences, and to the historical and contemporary assumptions and practices of vocational or professional fields; and to lay the foundation for higher level coursework.

200-299: Intermediate-level courses including subject-specific courses intended to meet the credit requirements for minor or major areas of learning. These courses can be part of a major and can be pre-requisite courses for advanced-level major courses.

300-399: Higher-level courses which are required for majoring in a disciplinary/interdisciplinary area of study for the award of a degree.

400-499: Advanced courses which would include lecture courses with practicum, seminar-based course, term papers, research methodology, advanced laboratory experiments/software training, research projects, hands-on-training, internship/apprenticeship projects at the undergraduate level or First year Postgraduate theoretical and practical courses.

500-599: Courses at first-year Master's degree level for a 2-year Master's degree programme

600-699: Courses for second-year of 2-year Master's or 1-year Master's degree programme

700 -799 & above: Courses limited to doctoral students