UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY
KURUKSHETRA UNIVERSITY, KURUKSHETRA

('A+' Grade, NAAC Accredited)

SCHEME OF EXAMINATIONS FOR
MASTER OF TECHNOLOGY IN
ELECTRONICS & COMMUNICATION ENGINEERING

(W. E. F. SESSION: 2018-19)

SEMESTER- I

S. No.	Course Code	SUBJECT	L	T	P	Total	Minor Test	Major Test	Cr.	Dur. of Exam (Hrs.)
1	MTEC-101	RF and Microwave Circuit Design	3	-	-	3	40	60	3	3
2	MTEC-103	Wireless & Mobile Communications	3	-	-	3	40	60	3	3
3	*	Program Elective –I	3	-	-	3	40	60	3	3
4	**	Program Elective-II	3	-	-	3	40	60	3	3
5	MTEC-117	RF and Microwave Circuit Design(Lab.)	-	-	4	4	40	60	2	3
6	MTEC-119	Wireless & Mobile Communications (Lab.)	-	-	4	4	40	60	2	3
7	MTRM-111	Research Methodology and IPR	2	-	-	2	40	60	2	3
8	***	Audit Course-I	2	-	-	2	100	-	0	3
	TOTAL		**16**	**0**	**8**	**24**	**280**	**420**	**18**	
							700			

*Program Elective - I		**Program Elective- II	
MTEC-105	Advanced Communication Networks	MTEC-111	Cognitive Radio
MTEC-107	Pattern Recognition and Machine Learning	MTEC-113	Wireless Sensor Networks
MTEC-109	Statistical Information Processing	MTEC-115	High Performance Networks

*** Audit Course-I	
MTAD-101	English for Research Paper Writing
MTAD-103	Disaster Management
MTAD-105	Sanskrit for Technical Knowledge
MTAD-107	Value Education

Note1: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

*** **Note2:**Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

SEMESTER-II

S. No.	Course code	Subject	L	T	P	Total	Minor Test	Major Test	Cr.	Dur. of Exam (Hrs.)
1	MTEC-102	Antennas and Radiating Systems	3	-	-	3	40	60	3	3
2	MTEC-104	Advanced Digital Signal Processing	3	-	-	3	40	60	3	3
3	*	Program Elective-III	3	-	-	3	40	60	3	3
4	**	Program Elective-IV	3	-	-	3	40	60	3	3
5	MTEC-118	Antennas and Radiating Systems Lab		-	4	4	40	60	2	3
6	MTEC-120	Advanced Digital Signal Processing Lab	-	-	4	4	40	60	2	3
7	# MTEC-122	Mini Project	-	-	4	4	100	-	2	3
8	***	Audit Course-II	2			2	100	-	0	3
	TOTAL		**14**		**12**	**26**	**340**	**360**	**18**	
							700			

*Program Elective - III		**Program Elective - IV	
MTEC-106	Satellite Communication	MTEC-112	Optimization Techniques
MTEC-108	Internet of Things	MTEC-114	MIMO System
MTEC-110	Voice and Data networks	MTEC-116	Programmable Networks – SDN, NFV

*** Audit Course - II	
MTAD-102	Constitution of India
MTAD-104	Pedagogy Studies
MTAD-106	Stress Management by Yoga
MTAD-108	Personality Development through Life Enlightenment Skills.

Note1: The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

***Note2:**Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

#Note3: Mini project: During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks).

SEMESTER-III

S. No.	Course Code	Subject	L	T	P	Total	Minor Test	Major Test	Cr.	Duration of Exam (Hrs.)
1	*	Program Elective-V	3	-	-	3	40	60	3	3
2	**	Open Elective	3	-	-	3	40	60	3	3
3	MTEC-207	Dissertation Part-I	-	-	20	20	100	-	10	3
		TOTAL	**6**		**20**	**26**	**180**	**120**	**16**	
							300			

***Program Elective - V**	
MTEC-201	Adaptive Filter Theory
MTEC-203	Optical Networks
MTEC-205	Remote Sensing

****Open Elective**		
1.	MTOE-201	Business Analytics
2.	MTOE-203	Industrial Safety
3.	MTOE-205	Operations Research
4.	MTOE-207	Cost Management of Engineering Projects
5.	MTOE-209	Composite Materials
6.	MTOE-211	Waste to Energy

SEMESTER-IV

S. No.	Course Code		L	T	P	Total	Minor Test	Major Test	Cr.	Duration of Exam (Hrs.)
1	MTEC-202	Dissertation Part-II	-	-	32	32	100	200	16	3
	TOTAL						**300**		**16**	

Total credits of all four semesters – 68

Note 1: At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Synopsis for the Dissertation Part-I is to be submitted within three weeks of the beginning of the Third Semester.

Note 2: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

Note 3: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of two papers in a journal/International/National conference of repute like IEEE, Springer, Elsevier, ACM etc.

Note 4: The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

MTEC-101	RF and Microwave Circuit Design						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand the behavior of RF passive components and model active components. Perform transmission line analysis and demonstrate use of Smith Chart for high frequency circuit design.*						
CO2	*Able to analyze the microwave resonators, filters, couplers etc.*						
CO3	*Analyze the microwave solid state devices such as diodes and Transistors.*						
CO4	*Able to design and analyze the microwave amplifiers.*						

Unit 1

Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning. Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.

Unit 2

Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.Nonlinearity and Time Variance, Inter-symbol interference, random process &noise,definition of sensitivity and dynamic range, conversion gain and distortion.

Unit 3

Microwave Semiconductor Devices and Modeling: PIN diode, Tunnel diodes, Varactordiode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.

Unit 4

Amplifiers Design: Power gain equations, stability, impedance matching, constant gain andnoise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

References:

1) Matthew M. Radmanesh, “Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design”, Author House, 2009.
2) D.M.Pozar, “ Microwave Engineering” ,Wiley, 4th edition, 2011.
3) R.Ludwig and P.Bretchko, “R. F. Circuit Design”, Pearson Education Inc, 2009.
4) G.D. Vendelin, A.M. Pavoi, U. L. Rohde, “Microwave Circuit Design Using Linear And Non Linear Techniques”, John Wiley 1990.
5) S.Y. Liao, “Microwave circuit Analysis and Amplifier Design”, Prentice Hall 1987. Radmanesh, “RF and Microwave Electronics Illustrated” , Pearson Education, 2004.

MTEC-103	Wireless & Mobile Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques*						
CO2	*Distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages.*						
CO3	*Analyze path loss and interference for wireless telephony and their influences on a mobile-communication system's performance.*						
CO4	*Analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology, understanding upcoming technologies like 3G, 4G etc.*						

Unit 1

Cellular Communication Fundamentals:Cellular system design, Frequency reuse, cellsplitting, handover concepts, Co channel and adjacent channel interference, interference reductiontechniques and methods to improve cell coverage, Frequency management and channel assignment.GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), 2.75 G Standards: EDGE,

Unit 2

Spectral efficiency analysis based on calculations for Multiple access technologies:TDMA,FDMA and CDMA,Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas.Wireless network planning (Link budget and power spectrum calculations)

Unit 3

Mobile Radio Propagation:Large Scale Path Loss, Free Space Propagation Model,Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.Equalization, Diversity:Equalizers in a communications receiver, Algorithms for adaptiveequalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

Unit 4

Code Division Multiple Access:Introduction to CDMA technology, IS 95 systemArchitecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.Higher Generation Cellular Standards:3G Standards: evolved EDGE, enhancements in 4Gstandard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G

References:

1. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
2. V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
3. T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI,2002.
4. William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.
5. AshaMehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London,1997.

MTEC-105	Advanced Communication Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand advanced concepts in Communication Networking.*						
CO2	*Design and develop protocols for Communication Networks.*						
CO3	*Optimize the Network Design.*						
CO4	*Understand the different versions of Internet Protocol*						

Unit 1

Overview of Internet-Concepts, challenges and history.Overview of -ATM. TCP/IPCongestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.Real Time Communications over Internet. Adaptive applications.Latency and throughputissues.Integrated Services Model (intServ).Resource reservation in Internet.RSVP.Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP).Leaky bucket algorithm and its properties.

Unit 2

Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed serviceconnections. GPS, WFQ and Rate proportional algorithms.High speed scheduler design.Theoryof Latency Rate servers and delay bounds in packet switched networks for LBAP traffic;Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of activequeue management.

Unit 3

IP address lookup-challenges. Packet classification algorithms and Flow Identification-Grid of Tries, Cross producting and controlled prefix expansion algorithms.Admission control in Internet.Concept of Effective bandwidth.Measurement basedadmission control.Differentiated Services in Internet (Diff Serv).Diff Serv architecture and framework.

Unit 4

IPV4, IPV6, IP tunnelling, IP switching and MPLS, Overview of IP over ATM and itsevolution to IP switching.MPLS architecture and framework.MPLS Protocols. Traffic engineering issues in MPLS.

References:

1. Jean Wairand and PravinVaraiya, “High Performance Communications Networks”, 2nd edition, 2000.
2. Jean Le Boudec and Patrick Thiran, “Network Calculus A Theory of Deterministic Queueing Systems for the Internet”, Springer Veriag, 2001.
3. Zhang Wang, “Internet QoS”, Morgan Kaufman, 2001.
4. Anurag Kumar, D. Manjunath and Joy Kuri, “Communication Networking: An Analytical Approach” , Morgan Kaufman Publishers, 2004.
5. George Kesidis, “ATM Network Performance”, Kluwer Academic, Research Papers, 2005.

MTEC-107	Pattern Recognition and Machine Learning						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Study the parametric and linear models for classification Design neural network and SVM for classification.						
CO2	Develop machine independent and unsupervised learning techniques.						
CO3	Understand programming algorithms						
CO4	Understand machine learning and clustering						

Unit 1

Introduction to Pattern Recognition: Problems, applications, design cycle, learning andadaptation, examples, Probability Distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis**Linear models:** Linear Models for Regression, linear regression, logistic regression LinearModels for Classification

Unit 2

Neural Network: perceptron, multi-layer perceptron, backpropagation algorithm, error surfaces,practical techniques for improving backpropagation, additional networks and training methods, Adaboost, Deep Learning

Unit 3

Linear discriminant functions - decision surfaces, two-category, multi-category, minimum-squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

Unit 4

Algorithm independent machine learning – lack of inherent superiority of any classifier, biasand variance, re-sampling for classifier design, combining classifiers
Unsupervised learning and clustering – k-means clustering, fuzzy k-means clustering,hierar
chical clustering

References:

1) Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2nd Edition John Wiley & Sons, 2001.
2) Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

MTEC-109	Statistical Information Processing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.						
CO2	Demonstrate mathematical modelling and problem solving using such models.						
CO3	Comparatively evolve key results developed in this course for applications to signal processing, communications systems.						
CO4	Develop frameworks based in probabilistic and stochastic themes for modelling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.						

Unit 1

Review of random variables: Probability Concepts, distribution and density functions,moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebaychef inequality theorem, Central Limit theorem, Discrete &Continuous Random Variables.
Random process: Expectations, Moments,Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and auto covariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

Unit 2

Random signal modelling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model &its applications ,Linear System with random input , Forward and Backward Predictions, Levinson Durbin Algorithm.Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-aryHypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing.Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio Test ,Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum, Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate , Multiple Parameter Estimation Best Linear Unbiased Estimator ,Least-Square Estimation Recursive Least-Square Estimator.

Unit 3

Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging theperiodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.
Information Theory and Source Coding: Introduction, Uncertainty, Information andEntropy, Source coding theorem, Huffman, ShanonFano , Arithmetic , Adaptive coding , RLE , LZW Data compaction, , LZ-77, LZ-78. Discrete Memory less channels, Mutual information, channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles.

Unit 4

Application of Information Theory: Group, Ring & Field, Vector, GF addition,multiplication rules. Introduction to BCH codes, Primitive elements ,Minimal polynomials, Generator polynomials in terms of Minimal polynomials, Some examples of BCH codes,& Decoder, Reed- Solomon codes & Decoder, Implementation of Reed Solomon encoders and decoders.

References:

1) Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes",4th Edition, McGraw-Hill, 2002.
2) D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.
3) MouradBarkat , "Signal Detection and Estimation", Artech House, 2nd Edition, 2005.
4) R G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968. . J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", New
5) York, North-Holland, 1977.
6) Rosen K.H, "Elementary Number Theory", Addison-Wesley, 6th edition, 2010.

MTEC-111	Cognitive Radio						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand the fundamental concepts of cognitive radio networks.*						
CO2	*Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.*						
CO3	*Understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.*						
CO4	*Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimisation techniques for better spectrum exploitation.*						

Unit 1

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture,functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Unit 2

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborativesensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convexprogramming, non-linear programming, integer programming, dynamic programming, stochastic programming.

Unit 3

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radioarchitectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Unit 4

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading,radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross-layer design for cognitive radio networks.

References:

1) EkramHossain, DusitNiyato, Zhu Han, “Dynamic Spectrum Access and Management in Cognitive Radio Networks”, Cambridge University Press, 2009.
2) Kwang-Cheng Chen, Ramjee Prasad, “Cognitive radio networks”, John Wiley & Sons Ltd., 2009.
3) Bruce Fette, “Cognitive radio technology”, Elsevier, 2nd edition, 2009.
4) HuseyinArslan, “Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems”, Springer, 2007.
5) Francisco Rodrigo Porto Cavalcanti, SorenAndersson, “Optimizing Wireless Communication Systems” Springer, 2009.
6) Linda Doyle, “Essentials of Cognitive Radio”, Cambridge University Press, 2009.

MTEC-113	Wireless Sensor Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Design wireless sensor network system for different applications under consideration.*						
CO2	*Understand the hardware details of different types of sensors and select right type of sensor for various applications.*						
CO3	*Understand radio standards and communication protocols to be used for wireless sensor network based systems and application.*						
CO4	*Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms and able to handle special issues related to sensors like energy conservation and security challenges.*						

Unit 1

Introduction and overview of sensor network architecture and its applications, sensornetwork comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun

SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

Unit 2

Programming tools: C, nesC. Performance comparison of wireless sensor networkssimulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

Unit 3

Overview of sensor network protocols (details of atleast 2 important protocol per layer):Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Unit 4

Data dissemination and processing; differences compared with other database managementsystems, data storage; query processing.Specialized features: Energy preservation and efficiency; security challenges; fault-tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

References:

1) H. Karl and A. Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, India, 2012.
2) C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, “Wireless Sensor Networks”, Springer Verlag, 1st Indian reprint, 2010.
3) F. Zhao and L. Guibas, “Wireless Sensor Networks: An Information Processing Approach”, Morgan Kaufmann, 1st Indian reprint, 2013.
4) YingshuLi, MyT. Thai, Weili Wu, “Wireless sensor Network and Applications”, Springer series on signals and communication technology, 2008.

MTEC-115	High Performance Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Apply knowledge of mathematics, probability, and statistics to model and analyze some networking protocols.*						
CO2	*Design, implement, and analyze computer networks.*						
CO3	*Identify, formulate, and solve network engineering problems.*						
CO4	*Show knowledge of contemporary issues in high performance computer networks. Use techniques, skills, and modern networking tools necessary for engineering practice*						

Unit 1

Types of Networks, Network design issues, Data in support of network design. Networkdesign tools, protocols and architecture. Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, and RSVP-differentiated services.

Unit 2

VoIP system architecture, protocol hierarchy, Structure of a voice endpoint, Protocols forthe transport of voice media over IP networks.Providing IP quality of service for voice, signaling protocols for VoIP, PSTN gateways, VoIP applications.VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

Unit 3

Traffic Modeling: Little's theorem, Need for modeling, Poisson modeling, Non-poissonmodels, Network performance evaluation.Network Security and Management: Principles of cryptography, Authentication, integrity,key distribution and certification, Access control and fire walls, attacks and counter measures, security in many layers.

Unit 4

Infrastructure for network management, The internet standard management framework –SMI, MIB, SNMP, Security and administration, ASN.1.

References:

1) Kershenbaum A., "Telecommunications Network Design Algorithms", Tata McGraw Hill, 1993.
2) Larry Peterson & Bruce David, "Computer Networks: A System Approach", Morgan Kaufmann, 2003.
3) Douskalis B., "IP Telephony: The Integration of Robust VoIP Services", Pearson Ed. Asia, 2000.
4) Warland J., Varaiya P., "High-Performance Communication Networks", Morgan Kaufmann, 1996.
5) Stallings W., "High-Speed Networks: TCP/IP and ATM Design Principles", Prentice Hall, 1998.
6) Leon Garcia, Widjaja, "Communication networks", TMH 7threprint 2002.
7) William Stalling, "Network security, essentials", Pearson education Asia publication, 4th Edition, 2011.

MTEC-117	RF and Microwave Circuit Design (Lab.)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Learn to use HFSS (High Frequency Structural Simulator) to simulate, verify, and optimize their design.						
CO2	Learn to fabricate RF and Microwave circuits and then measure, and evaluate their prototype of Network Analyzer.						

List of Experiments:

1. To learn through demonstration the Radio-Frequency Characteristics of Components.
2. To Design, Characterize, fabricate and test the Microstrip Line.
3. To Design, Characterize,fabricate and test Wilkinson Power Divider.
4. To Design, Characterize, fabricate and test Hybrid Network.
5. To Design, Characterize, fabricate and test Phase Shifter.
6. To Design, Characterize, fabricate and test Microwave Filters.
7. To Design and Characterize Coaxial Cavity Resonator.
8. To study Impedance Matching and Tuning Techniques for microwave circuits.
9. To design and characterize Directional Coupler.
10. To study Characteristics of Gunn Diode.

MTEC-119	Wireless & Mobile Communications(Lab.)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Understanding Cellular concepts, GSM and CDMA networks						
CO2	To study GSM handset by experimentation and fault insertion techniques						
CO3	Understating of 3G communication system by means of various AT commands usage inGSM						
CO4	Understanding CDMA concept using DSSS kit						

List of Experiments:

1. Introduction to LabVIEW/MATLAB/SciLab with its basic functions and study of modulation toolkit.
2. Learn how to Perform Basic Arithmetic and Boolean operations, Maximum and Minimum of an Array, Flat and Stacked sequence, Bundle and Unbundle cluster.
3. Design and verify the MSK modulator.
4. Design and verify the MSK demodulator
5. Design and verify the FSK modulator.
6. Design and verify the FSK demodulator.
7. Design and verify the BPSK modulator.
8. Design and verify the BPSK demodulator.
9. Design and verify the QPSK modulator.
10. Design and verify the QPSK demodulator
11. Design and verify the QAM modulator.
12. Design and verify the QAM demodulator.

MTRM-111	Research Methodology and IPR						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to Research Methodology and IPR 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 (CO)							
CO1	Understand research problem formulation.						
CO2	Analyze research related information						
CO3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.						
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.						

Unit 1

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 2

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 3

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 4

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 Biological Systems, Computer Software etc.Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C.R. Kothari, "Research Methodology: Methods & Techniques, 2nd edition or above, New Age Publishers.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 ndEdition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

MTEC-102	Antennas and Radiating Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Compute the far field distance, radiation pattern and gain of an antenna for given current distribution and study antenna parameters.*						
CO2	*Design and analyze linear wire and linear array antennas.*						
CO3	*Design antennas and antenna arrays for various desired radiation pattern characteristics.*						
CO4	*Able to design and analyze different types of Microstrip antenna.*						

Unit 1

Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Arrayantennas Reflector antennas, Lens antennas, Radiation Mechanism, Current distribution on thin wire antenna.

Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friis Transmission equation, Antenna Temperature.

Unit 2

Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite lengthdipole, half wave dipole, Ground effects.Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non-uniform current.LinearArrays: Two element array, N Element array: Uniform Amplitude and spacing,Broadside and End fire array, Super directivity, Planar array, Design consideration.

Unit 3

Aperture Antennas: Huygen's Field Equivalence principle, radiation equations,Rectangular Aperture, Circular Aperture.Horn Antennas: E-Plane, H-plane Sectoral horns, Pyramidal and Conical horns.Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introductionto MIMO.

Unit 4

Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis,Rectangular Patch, Circular Patch.

References:

1) Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 4th edition, 2016.
2) John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas for All Applications", Tata McGraw-Hill, 2002.
3) R.C.Johnson and H.Jasik, "Antenna Engineering hand book", Mc-Graw Hill, 1984. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

MTEC-104	Advanced Digital Signal Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	To understand theory of different filters and algorithms						
CO2	To understand theory of multirate DSP, solve numerical problems and write algorithms						
CO3	To understand theory of prediction and solution of normal equations						
CO4	To know applications of DSP at block level.						

Unit-1

Review of Filter concepts- Review of design techniques and structures for FIR and IIR filters, representation of numbers, quantization of filter coefficients, round-off effects in digital filters.

Unit-2

Multirate Digital Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, sampling rate conversion by rational factor I/D, implementation of sampling rate conversion, multistage implementation of sampling rate conversion, sampling rate conversion of band pass signals, sampling rate conversion by an arbitrary factor, application of Multirate signal processing, digital filter bank, two-channel quadrature-mirror filter bank, M-channel QMF bank.

Unit-3

Wavelet Transform: Introduction to wavelet transform- Short Time Fourier Transform (STFT), Wavelet transform, Haar wavelet and Multirate resolution analysis, Daubechies wavelet, some other standard wavelets, applications of wavelet transform.

Unit-4

Power Spectrum Estimation: Estimation of spectra from finite-duration observation of signals, non-parametric methods for power spectrum estimation, parametric methods for power spectrum estimation, filter bank methods, Eigen analysis algorithms for spectrum estimation.

Text Books:

1. Digital Signal Processing : Principles, Algorithms, and Applications, 4/e, Authors : John G. ProakisDimitris G Manolakis Imprint : Pearson Education
2. Digital Signal Processing, Authors, Oppenheim, Alan V, Schafer, Ronald W., PHI

Reference Books:

1. Advanced Digital Signal Processing, Authors: Dr. Shaila D. Apte, Imprint: Wiley
2. Digital Signal Processing, 3/e, Authors: S.K.Mitra, Imprint : McGraw Hill
3. Digital Signal Processing and Applications with the TMS 320C6713 and TMS 320C6416 DSK, 2/e,Authors: RulphChassaing,DonaldReay, Imprint : Wiley
4. Digital Signal Processing, Authors: Tarun Kumar Rawat, Imprint: Oxford
5. Digital Signal Processing, Spectral Computation and Filter Design, Authors:CHI-Tsong Chen, Indian Edition, Imprint: Oxford
6. Theory and Applications of Digital Signal Processing,Authors: Lawrence R. Rabiner, Bernard Gold,Imprint:Prentice- Hall
7. Digital Signal Processing, Authors:Thomas J. Cavicchi, Imprint: Wiley
8. Modern Digital Signal Processing,Authors:V.Udayshankar,Imprint:PHI
9. Digital Signal Processing using MAT and Wavelets,2/e,Authors:MichaelWeeks,Imprint: Jones & Bartlett Publishers.

MTEC-106	Satellite Communication						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Visualize the architecture of satellite systems as a means of high speed, high range communication system.						
CO2	State various aspects related to satellite systems such as orbital equations,						
CO3	Understand sub-systems in a satellite, link budget, modulation and multiple access schemes.						
CO4	Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.						

Unit 1

Architecture of Satellite Communication System: Principles and architecture of satelliteCommunication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks.

Unit 2

Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee andPerigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.

Unit 3

Satellite sub-systems: Architecture and Roles of various sub-systems of a satellite systemsuch as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems, antenna sub-system.Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects,remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Unit 4

Satellite link budget: Flux density and received signal power equations, Calculation ofSystem noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.Modulation and Multiple Access Schemes used in satellite communication.Typicalcasestudies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO. GPS.

References:

1. S. K. Raman, "Fundamentals of Satellite Communication", PearsonEducation India, 2011. Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2009.
2. Dennis Roddy, "Satellite Communication", McGraw Hill, 4th Edition, 2008.

MTEC-108	Internet of Things						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand what IoT technologies are used for today, and what is required in certain scenarios.*						
CO2	*Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions.*						
CO3	*Apply these technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications.*						
CO4	*Understand operating system requirements of IOT.*						

Unit 1

Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M and peer networkingconcepts, Ipv4 and IPV6.Software Defined Networks SDN, From Cloud to Fog and MIST networking for IoTcommunications, Principles of Edge/P2P networking, Protocols to support IoT communications, modular design and abstraction, security and privacy in fog.

Unit 2

Wireless sensor networks: introduction, IOT networks (PAN, LAN and WAN), Edgeresource pooling and caching, client side control and configuration.

Unit 3

Smart objects as building blocks for IoT, Open source hardware and Embedded systemsplatforms for IoT, Edge/gateway, IO drivers, C Programming, multithreading concepts.

Unit 4

Operating systems requirement of IoT environment, study of mbed, RIoT, andContikioperating systems, Introductory concepts of big data for IoTapplications.Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectorsusingIoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation.

References:

1) A Bahaga, V. Madisetti, “Internet of Things- Hands on approach”, VPT publisher, 2014. A. McEwen, H. Cassimally, “Designing the Internet of Things”, Wiley, 2013.
2) CunoPfister, “Getting started with Internet of Things”, Maker Media, 1st edition, 2011. Samuel Greenguard, “Internet of things”, MIT Press, 2015.

Web resources:

1) http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things-1.html
2) https://developer.mbed.org/handbook/AnalogIn
3) http://www.libelium.com/50_sensor_applications
4) M2MLabs Mainspring http://www.m2mlabs.com/framework Node-RED http://nodered.org/

MTEC-110	Voice and Data Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Protocol, algorithms, trade-offs rationale.*						
CO2	*Routing, transport, DNS resolutions*						
CO3	*Understand different Queuing models of Networks*						
CO4	*Network extensions and next generation architectures.*						

Unit 1

Network Design Issues, Network Performance Issues, Network Terminology, centralizedand distributed approaches for networks design, Issues in design of voice and data networks.Layered and Layer less Communication, Cross layer design of Networks, Voice Networks(wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

Unit 2

Data Networks and their Design, Link layer design- Link adaptation, Link LayerProtocols, Retransmission.Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

Unit 3

Queuing Models of Networks, Traffic Models , Little's Theorem, Markov chains, M/M/1and other Markov systems, Multiple Access Protocols , Aloha System , Carrier Sensing , Examples of Local area networks.

Unit 4

Inter-networking, Bridging, Global Internet, IP protocol and addressing, Sub netting ,Classless Inter domain Routing (CIDR) , IP address lookup , Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control , Additive Increase/Multiplicative Decrease , Slow Start, Fast Retransmit/ Fast Recovery,Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in PacketNetworks. Network Calculus, Packet Scheduling Algorithms.

References:

1) D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, Prentice Hall, 1992.
2) L. Peterson and B. S. Davie, “Computer Networks: A Systems Approach”,5th Edition, Morgan Kaufman, 2011.
3) Kumar, D. Manjunath and J. Kuri, “Communication Networking: An analytical approach”, 1st Edition, Morgan Kaufman, 2004.
4) Walrand, “Communications Network: A First Course”, 2nd Edition, McGraw Hill, 2002.
5) Leonard Kleinrock, “Queueing Systems, Volume I: Theory”, 1st Edition, John Wiley and Sons, 1975.
6) Aaron Kershenbaum, “Telecommunication Network Design Algorithms”, McGraw Hill, 1993.
7) Vijay Ahuja, “Design and Analysis of Computer Communication Networks”, McGraw Hill, 1987

MTEC-112	Optimization Techniques						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand importance of optimization*						
CO2	*Apply basic concepts of mathematics to formulate an optimization problem*						
CO3	*Analyze and appreciate variety of performance measures for various optimization problems*						
CO4	*Understand Genetic algorithm and particle swarm Optimization.*						

Unit 1

Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers. Linear Programming Problem, Simplex method, Two-phase method, Big-M method, Duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.

Unit 2

Single Variable Optimization Problems: Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method, Cubic search method.

Unit 3

Multi Variable and Constrained Optimization Technique, Optimality criteria, Direct search Method, Simplex search methods, Hooke-Jeeve'spatternsearch method, Powell's conjugate direction method, Gradient based method, Cauchy's Steepest descent method, Newton's method, Conjugate gradient method. Kuhn - Tucker conditions, Penalty Function, Concept of Lagrangian multiplier, Complex search method, Random search method.

Unit 4

Genetic Algorithm: Types of reproduction operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO) – Example Problems

References:

1) S. S. Rao, "Engineering Optimization: Theory and Practice", Wiley, 2008.
2) K. Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall, 2005.
3) Mohan, C. and Deep, K.: "Optimization Techniques", New Age India Pvt. Ltd., 2009
4) Belegundu, A. D. and Chandrupatla, T. R. "Optimization Concepts and Applicationsin Engineering", Pearson Education Pvt. Ltd., 2002
5) D. E. Goldberg, "Genetic algorithms in Search, Optimization, and Machine learning", Addison-Wesley Longman Publishing, 1989.

MTEC-114	MIMO Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Understand channel modelling and propagation, MIMO Capacity, space-time coding, MIMO receivers, MIMO for multi-carrier systems, multi-user communications, multi-user MIMO and diversity techniques.						
CO2	Understand equalising MIMO systems and pre-distortion in MIMO system						
CO3	Understand cooperative and coordinated multi-cell MIMO, introduction to MIMO in 4G (LTE, LTE-Advanced, WiMAX).						
CO4	Perform Mathematical modelling and analysis of MIMO systems.						

Unit 1

Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems,MIMO vs. multi-antenna systems.Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, TheAlamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation.

Unit 2

The generic MIMO problem, Singular Value Decomposition, Eigenvalues andeigenvectors, Equalising MIMO systems, Disadvantages of equalising MIMO systems, Pre-distortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of pre-coding and combining, Channel state information.

Codebooks for MIMO, Beamforming, Beamforming principles, Increasedspectrumefficiency, Interference cancellation, Switched beamformer, Adaptive beamformer, Narrowband beamformer, Wideband beamformer

Unit 3

Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatialmultiplexing, Pre-coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models

Unit 4

Channel Estimation, Channel estimation techniques, Estimation and tracking, Trainingbased channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

References:

1) Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design",Academic Press, 1st edition, 2010.
2) MohinderJanakiraman, “Space - Time Codes and MIMO Systems”, Artech House Publishers, 2004.

MTEC-116	Programmable Networks - SDN, NFV						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand advanced concepts in Programmable Networks.*						
CO2	*Understand Software Defined Networking, an emerging Internet architectural framework. Implement the main concepts, architectures, algorithms, protocols and applications in SDN and NFV.*						
CO3	*Understand Programming for SDNs.*						
CO4	*Understand Network topologies.*						

Unit 1

Introduction to Programmable Networks, History and Evolution of Software DefinedNetworking (SDN), Fundamental Characteristics of SDN, Separation of Control Plane and Data Plane, Active Networking.Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the basicsofOpenFlow protocol.

Unit 2

Network Virtualization: Concepts, Applications, Existing Network VirtualizationFramework, Mininet A simulation environment for SDN.Control Plane: Overview, ExistingSDN Controllers including Floodlight andOpenDaylight projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts. Data Plane: Software-based and Hadrware-based; Programmable Network Hardware.

Unit 3

Programming SDNs: Northbound Application Programming Interface, Current Languagesand Tools, Composition of SDNs. Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

Unit 4

Data Center Networks: Packet, Optical and Wireless Architectures, NetworkTopologies.Use Cases of SDNs: Data Centers, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.

References:

1) Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies”, O'Reilly Media, August 2013.
2) Paul Goransson, Chuck Black, Timothy Culver. “Software Defined Networks: A Comprehensive Approach”, Morgan Kaufmann Publishers, 2016.
3) Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, CRC Press, 2014.
4) Vivek Tiwari, “SDN and OpenFlow for Beginners”, Amazon Digital Services, Inc., ASIN: , 2013.
5) Nick Feamster, Jennifer Rexford and Ellen Zegura, “The Road to SDN: An Intellectual History of Programmable Networks” ACM CCR April 2014.
6) Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015. OpenFlow standards, http://www.openflow.org, 2015.

MTEC-118	Antennas and Radiating Systems Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	Determine specifications, design, construct and test antenna.						
CO2	Explore and use tools for designing, analyzing and testing antennas. These tools include Antenna design and analysis software, network analyzers, spectrum analyzers, and antenna pattern measurement techniques.						

List of Experiments:

1. Simulation of half wave dipole antenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.
3. Simulation of quarter wave, full wave antenna and comparison of their parameters.
4. Simulation of monopole antenna with and without ground plane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.
6. Simulation of a half wave dipole antenna array.
7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.
8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.
9. Simulation of Microstrip Antenna.
10. Case study.

MTEC-120	Advanced Digital Signal Processing Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
0	**0**	**4**	**2**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Design different digital filters in software*						
CO2	*Apply various transforms in time and frequency Perform decimation and interpolation*						

List ofExperiments:

1. Write a program for cascade and parallel realization of an FIR transfer function.
2. Write a program for cascade and parallel realization of an IIR transfer function.
3. Write a program to design a Butterworth IIR Band Pass Filter.
4. Write a program to design an FIR filter using various window functions.
5. Write a program to implement the interpolation and decimation.
6. Write a program to design two channels QMF Bank.
7. Write a program to compute the CWT.
8. Write a program to compute the DWT.
9. Write a program to design a wavelet filter.
10. Write a program to find the magnitude response of a wavelet.

MTEC-201	Adaptive Filter Theory						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	To understand the concepts of estimation, normal equations and linear models.						
CO2	To understand Stochastic-Gradient Algorithms and Steady-State Performance of Adaptive Filters.						
CO3	To analyze the tracking and transient performance od adaptive filters.						
CO4	Understanding of RLS and various QR Algorithms.						

Unit-1

Introduction:-Variance of a random variable, Estimation: Given No Observations, Given Dependent Observations, Complex and Vector Cases, Normal Equations, Design Examples, Linear Models and applications. Minimum-Variance Unbiased Estimation and applications.

Steepest-Descent Algorithms:- Steepest-Descent Method, Transient Behavior, Iteration-Dependent Step-Sizes, Newton's Method.

Unit-2

Stochastic-Gradient Algorithms:- LMS Algorithm and applications, Normalized LMS Algorithm, Non-Blind Algorithms, Blind Algorithms and properties, Affine Projection Algorithms, Ensemble-Average Learning Curves.

Steady-State Performance of Adaptive Filters:- Performance Measures, Stationary Data Model, Fundamental Energy-Conservation Relation, Fundamental Variance Relation, Mean-Square Performance of LMS and ε-NLMS.

Unit-3

Tracking Performance of Adaptive Filters:-Non-stationary Data Model, Fundamental Energy-Conservation Relation, Fundamental Variance Relation, Tracking Performance of LMS and ε-NLMS.

Transient Performance of Adaptive Filters:-Data Model, Data-Normalized Adaptive Filters, Weighted Energy-Conservation Relation, Weighted Variance Relation, Transient Performance of LMS and ε-NLMS.

Unit-4

Recursive Least-Squares:-RLS Algorithm, Exponentially-Weighted RLS Algorithm, RLS Array Algorithms: Square-Root Factors, Norm and Angle Preservation, Motivation for Array Methods, RLS Algorithm, Inverse QR Algorithm, QR Algorithm, Extended QR Algorithm.

Text Books

1) "Fundamentals of Adaptive Filtering" by Ali H. Sayed, John Wiley and Sons.
2) "Adaptive Filter Theory" by S. Haykin, Pearson India.

Reference Books

1) "Adaptive Filters Theory and Applications", by B. Farhang-Boroujeny, John Wiley and Sons.
2) "Linear Estimation" by Kailath&Sayed, PHI
3) "Adaptive Filters" by Ali H. Sayed, John Wiley and Sons.

MTEC-203	Optical Networks						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Contribute in the areas of optical network and WDM network design.*						
CO2	*Implement simple optical network and understand further technology developments for future enhanced network.*						
CO3	*Able to understand the importance of Network Survivability in modern age*						
CO4	*Understand the Network access techniques*						

Unit- 1

SONET/SDH: optical transport network, IP, routing and forwarding, multiprotocol labelswitching.

WDM network elements: optical line terminals and amplifiers, optical add/dropmultiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

Unit- 2

Control and management: network management functions, optical layer services andinterfacing, performance and fault management, configuration management, optical safety.

Unit -3

Network Survivability: protection in SONET/SDH & client layer, optical layer protectionschemes, WDM network design: LTD and RWA problems, dimensioning wavelength routingnetworks, statistical dimensioning models.

Unit- 4

Access networks: Optical time division multiplexing, synchronization, header processing,buffering, burst switching, test beds, Introduction to PON, GPON, AON.

References:

1) Rajiv Ramaswami, Sivarajan, Sasaki, “Optical Networks: A Practical Perspective”, MK, Elsevier, 3 rd edition, 2010.

2) C. Siva Ram Murthy and Mohan Gurusamy, “WDM Optical Networks: Concepts Design, and Algorithms”, PHI, EEE, 2001.

MTEC-205	Remote Sensing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	*Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles;*						
CO2	*Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.*						
CO3	*Understand Microwave Scattering and Imaging System*						
CO4	*Understand Concepts of Thermal and Hyper Spectral Remote Sensing*						

Unit 1

Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmannedspacecrafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT,SPOT,IRS,INSAT,IKONOS,QUICKBIRD etc.

Unit 2

Photographic products, B/W, color, color IR film and their characteristics –resolvingpower of lens and film -Opto mechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery -calibration of thermal scanners.

Unit 3

Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution –range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT - Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

Unit 4

Thermal and Hyper Spectral Remote Sensing: Sensors characteristics-principle ofspectroscopy-imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing – thermal sensors, principles, thermal data processing, applications.Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signalto noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –Radiometric correction–Image enhancement–Image classification– Principles of LiDAR, Aerial Laser Terrain Mapping.

References:

1) Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, John Wiley & Sons-2000, 6thEdition
2) John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 2nd Edition, 1995.
3) John A.Richards, Springer –Verlag, Remote Sensing Digital Image Analysis,1999.
   Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.
4) Charles Elachi and Jakob J. van Zyl , Introduction To The Physics and Techniques of Remote Sensing , Wiley Series in Remote Sensing and Image Processing, 2006.
5) Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman& Co, 1978.

MTOE-201	Business Analytics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	The main objective of this course is to give the student a comprehensive understanding of business analytics methods.						
Course Outcomes (CO)							
CO1	*Able to have knowledge of various business analysis techniques.*						
CO2	*Learn the requirement specification and transforming the requirement into different models.*						
CO3	*Learn the requirement representation and managing requirement assests.*						
CO4	*Learn the Recent Trends in Embedded and collaborative business*						

Unit 1

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst. Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.
Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Unit 2

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.
Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit 3

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.
Managing Requirements Assets: Change Control, Requirements Tools

Unit 4

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

References:

1. Business Analysis by James Cadle et al.
2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

MTOE-203	Industrial Safety						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the industrial safety.*						
Course Outcomes (CO)							
CO1	*Understand the industrial safety.*						
CO2	*Analyze fundamental of maintenance engineering.*						
CO3	*Understand the wear and corrosion and fault tracing.*						
CO4	*Understanding that when to do periodic inceptions and apply the preventing maintenance.*						

Unit-1

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-2

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-3

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-4

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MTOE-205	Operations Research						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it.						
Course Outcomes (CO)							
CO1	*Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.*						
CO2	*Students should able to apply the concept of non-linear programming*						
CO3	*Students should able to carry out sensitivity analysis*						
CO4	*Student should able to model the real world problem and simulate it.*						

Unit -1

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit -2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit- 3

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit -4

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MTOE-207	Cost Management of Engineering Projects						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the strategic cost management process.*						
CO2	*Students should able to types of project and project team types*						
CO3	*Students should able to carry out Cost Behavior and Profit Planning analysis.*						
CO4	*Student should able to learn the quantitative techniques for cost management.*						

Unit-1

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost.Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit-2

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit-3

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit-4

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MTOE-209	Composite Materials						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the composite materials and their properties.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification and characteristics of Composite materials.*						
CO2	*Students should able reinforcements Composite materials.*						
CO3	*Students should able to carry out the preparation of compounds.*						
CO4	*Student should able to do the analysis of the composite materials.*						

UNIT–1:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

UNIT – 2

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostaticpressing.Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–3

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – 4

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.
3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MTOE-211	Waste to Energy						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**0**	**0**	**3**	**60**	**40**	**100**	**3 Hrs.**
Program Objective (PO)	*To enable students to aware about the generation of energy from the waste.*						
Course Outcomes (CO)							
CO1	*Students should able to learn the Classification of waste as a fuel.*						
CO2	*Students should able to learn the Manufacture of charcoal.*						
CO3	*Students should able to carry out the designing of gasifiers and biomass stoves.*						
CO4	*Student should able to learn the Biogas plant technology.*						

Unit-1

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-2

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-3

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-4

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTAD-101	English For Research Paper Writing						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Student will able to understand the basic rules of research paper writing.*						
Course Outcomes (CO)							
CO1	*Understand that how to improve your writing skills and level of readability*						
CO2	*Learn about what to write in each section*						
CO3	*Understand the skills needed when writing a Title*						
CO4	*Ensure the good quality of paper at very first-time submission*						

Unit 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

References:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

MTAD-103	Disaster Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Develop an understanding of disaster risk reduction and management*						
Course Outcomes (CO)							
CO1	*Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*						
CO2	*Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*						
CO3	*Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*						
CO4	*critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in*						

Unit 1

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 4

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment.Strategies for Survival.Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation.Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep&Deep Publication Pvt. Ltd., New Delhi.

MTAD-105	Sanskrit for Technical Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*						
Course Outcomes (CO)							
CO1	*To get a working knowledge in illustrious Sanskrit, the scientific language in the world*						
CO2	*Learning of Sanskrit to improve brain functioning*						
CO3	*Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*						
CO4	*The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*						

Unit –1

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – 2

Order, Introduction of roots,Technical information about Sanskrit Literature

Unit –3

Technical concepts of Engineering: Electrical, Mechanical

Unit –4

Technical concepts of Engineering: Architecture, Mathematics

References

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

MTAD-107	Value Education						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*						
Course Outcomes (CO)							
CO1	*Knowledge of self-development*						
CO2	*Learn the importance of Human values*						
CO3	*Developing the overall personality*						
CO4	*Know about the importance of character*						

Unit 1

Values and self-development –Social values and individual attitudes.Work ethics, Indian vision of humanism.Moral and non- moral valuation.Standards and principles.Value judgements.

Unit 2

Importance of cultivation of values.Sense of duty.Devotion, Self-reliance.Confidence, Concentration.Truthfulness, Cleanliness.Honesty, Humanity.Power of faith, National Unity.Patriotism.Love for nature,Discipline

Unit 3

Personality and Behavior Development - Soul and Scientific attitude.Positive Thinking.Integrity and discipline.Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance.True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits.Association and Cooperation. Doing best for saving nature

Unit 4

Character and Competence –Holy books vs Blind faith.Self-management and Good health.Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References

1.Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

MTAD-102	Constitution of India						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*						
Course Outcomes (CO)							
CO1	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*						
CO2	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*						
CO3	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*						
CO4	*Discuss the passage of the Hindu Code Bill of 1956.*						

Unit I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 2

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

Unit 3

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit 4

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

MTAD-104	Pedagogy Studies						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	*Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development*.						
Course Outcomes (CO)							
CO1	*What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*						
CO2	*What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*						
CO3	*How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*						
CO4	*What is the importance of identifying research gaps?*						

Unit 1

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

Unit 2

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.Strength and nature of the body of evidence for effective pedagogical practices.Pedagogic theory and pedagogical approaches.Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 3

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

Unit 4

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

References

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

MTAD-106	Stress Management by Yoga						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To achieve overall health of body and mind and to overcome stress						
Course Outcomes (CO)							
CO1	*Develop healthy mind in a healthy body thus improving social health.*						
CO2	*Improve efficiency*						
CO3	*Learn the Yogasan*						
CO4	*Learn the pranayama*						

Unit – 1

Definitions of Eight parts of yog (Ashtanga).

Unit- 2

Yam and Niyam, Do`s and Don't's in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Unit- 3

Asan and Pranayam, Various yog poses and their benefits for mind & body,

Unit- 4

Regularization of breathing techniques and its effects-Types of pranayam.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami YogabhyasiMandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

MTAD-108	Personality Development through Life Enlightenment Skills						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**0**	**-**	**100**	**100**	**3 Hrs.**
Program Objective (PO)	To learn to achieve the highest goal happily To become a person with stable mind, pleasing personality and determination To awaken wisdom in students						
Course Outcomes (CO)							
CO1	*Students become aware about leadership.*						
CO2	*Students will learn how to perform his/her duties in day to day work.*						
CO3	*Understand the team building and conflict*						
CO4	*Student will learn how to become role model for the society.*						

Unit – 1

Neetisatakam-Holistic development of personality: Verses: 19, 20, 21, 22 (wisdom); Verses: 29, 31, 32 (pride & heroism); Verses: 26, 28, 63, 65 (virtue); Verses: 52, 53, 59 (don's); Verses: 71, 73, 75, 78 (do's).

Unit – 2

Approach to day to day work and duties; ShrimadBhagwadGeeta: Chapter-2: Verses: 41, 47, 48; Chapter-3: Verses: 13, 21, 27, 35; Chapter-6: Verses: 5, 13, 17, 23, 35; Chapter-18: Verses: 45, 46, 48.

Unit - 3

Statements of basic knowledge; ShrimadBhagwadGeeta: Chapter-2: Verses: 56, 62, 68; Chapter-12: Verses: 13, 14, 15, 16, 17, 18.

Unit – 4

Personality of Role model; ShrimadBhagwadGeeta: Chapter-2: Verses: 17; Chapter-3: Verses: 36, 37, 42: Chapter-4: Verses: 18, 38, 39; Chapter-18: Verses: 37, 38, 63.

References:

1. Srimad Bhagavad Gita, Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Dissertation Part – I and Dissertation Part - II

	Dissertation Part-I (MTEC-207) and Dissertation Part-II (MTEC-202)
Course Outcomes (CO)	
CO1	Ability to synthesize knowledge and skills previously gained and applied to an in depth study and execution of new technical problem.
CO2	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
CO3	Ability to present the findings of their technical solution in a written report.
CO4	Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following:

Relevance to social needs of society
Relevance to value addition to existing facilities in the institute
Relevance to industry need
Problems of national importance
Research and development in various domain

The student should complete the following:

Literature survey Problem Definition
Motivation for study and Objectives
Preliminary design / feasibility / modular approaches
Implementation and Verification
Report and presentation
The dissertation part- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:
Experimental verification / Proof of concept.
The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Part – I and Dissertation Part - II

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two parts i.e. Part– I: July to December and Part– II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives.

The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing Engineering and any other related domain. In case of Industry sponsored projects, the relevant application notes, white papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Part–I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper, proof of concept/functionality, part results, and record of continuous progress.

Part–I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Part-I work.

During Part– II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Part–II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, and record of continuous progress.

Part-II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the Part-I work.