SCHEME

&

SYLLABUS

M.Tech. in Electronics & Communication Engineering
Effective from 2018-19

Department of Electronics & Communication Engineering
Deenbandhu Chhotu Ram University of Science &
TechnologyMurthal (Sonipat), Haryana, 131039

Approved in the 13th meeting of academic council held on 18/6/2018.

Mission

To facilitate and promote studies and research in emerging areas of Electronics and Communication Engineering with focus on new frontiers of upcoming technologies evolution of enlightened technocrats, innovators and entrepreneurs who will contribute to national growth in particular and to the international community as a whole.

Vision

To achieve excellence in education and research in main & related areas of Electronics and communication technologies, Sustainable growth of the students not only locally but globally and to occupy a place of pride amongst the most eminent organizations of the world.

Approved in the 13th meeting of academic council held on 18/6/2018.

Programme Educational Objectives:

1. **Core Competence:**

- Post Graduating engineers should understand the basic concepts of Electronics and Communication engineering fundamentals required to solve engineering problems and also to pursue higher studies & Research.

2. **Preparations:**

- To prepare students for various competitive exams like NET, GRE, the entrance exam for research organisations like DRDO, ISRO etc, for the purpose of higher studies and research and getting better placements in PSU, MNC's along with research organisations.

3. **Application and Synthesis**:

- To give more emphasis on application and synthesis in courses related to Design of Electronic Circuits and their Simulation along with optimization. It helps in developing practical skills to design experimentation and develop confidence for tackling a problem and initiating its solution.
- To train students with good scientific and engineering knowledge, so as to comprehend, analyse, design, and create novel products and solutions for the real life problems/systems.

4. **Professionalism:**

- To inculcate in students professional and ethical attitude, effective communication skills teamwork skills, multidisciplinary approach, social engineering, and an ability to relate engineering issues to broader social context.

5. **Learning Environment:**

- To provide students with and academic environment aware of excellence, leadership, written ethical codes and guidelines, and the lifelong learning needed for a successful career.

Programme Outcomes:

Following are the programme outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering,
b. an ability to design and conduct experiments, as well as to analyze and interpret data,
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,
d. an ability to function on multidisciplinary teams,
e. an ability to identify, formulate, and solve engineering problems,
f. an understanding of professional and ethical responsibility,
g. an ability to communicate effectively,
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. To indulge in Research and development activities that will be helpful to further technological development.
i. a recognition of the need for, and an ability to engage in life-long learning,
j. a knowledge of contemporary issues.
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)

SCHEME OF STUDIES & EXAMINATION FOR MASTER OF TECHNOLOGY DEGREE COURSE IN

ELECTRONICS & COMMUNICATION ENGINEERING

(Choice Based Credit System w.e.f 2018-19)

SEMESTER I

Sr. No	Course No.	Course Title	Teaching Schedule		Marks of Class Work	Exam. Marks		Total Marks	Credit	Duration of Exam.
			L	P		Theory	Practical			
1	MTEC501C	Digital Signal & Image Processing	3	-	25	75	-	100	3	3
2	MTEC503C	Analog & Digital CMOS Design	3	-	25	75	-	100	3	3
3	PE-I	Elective – I	3	-	25	75	-	100	3	3
4	PE-II	Elective – II	3	-	25	75	-	100	3	3
5	MTEC581C	Digital Signal & Image Processing Lab	-	4	25		75	100	2	3
6	MTEC583C	Analog & Digital CMOS Design Lab	-	4	25		75	100	2	3
7	MTEC557C	Research Methodology and IPR	2	-	25	75		100	2	3
8	Aud 1	Audit course 1	2	-	25	75		100		3
Total			**16**	**8**	**200**	**450**	**150**	**800**	**18**	**24**

LIST OF PROGRAM SPECIFIC ELECTIVE I & II				**AUDIT COURSE 1 & 2**	
MTEC521C	Wireless Sensor Networks	MTEC533C	Advanced Satellite Communication	AUD531C	English for Research Paper Writing
MTEC523C	Cognitive Radio	MTEC535C	RF and Microwave Circuit Design	AUD533C	Disaster Management
				AUD535C	Sanskrit for Technical Knowledge
MTEC525C	Statistical Information Processing	MTEC537C	Optimization Techniques	AUD537C	Value Education
				AUD539C	Constitution of India
MTEC527C	Markov Chain and Queuing System	MTEC539C	Information and Communication Theory	AUD541C	Pedagogical Studies
				AUD543C	Stress Management by Yoga
MTEC529C	Advanced Wireless and Mobile Communication	MTEC541C	Advanced Microprocessor & Applications	AUD545C	Personality Development through Life Enlightenment Skills.
MTEC531C	Advanced Communication Networks	MTEC543C	Radio Over Fiber		

NOTE:

1. Student can opt any two subjects for electives I & II from given list respectively and one audit course from given list of audit course 1&2.
2. The choice of students for any elective shall not be binding on the department to offer, if the department does not have expertise. The minimum strength of the students opting for the particular subject shall not be less than 8.
3. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/exchange of calculator is prohibited in the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL (SONEPAT)

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ELECTRONICS & COMMUNICATION ENGINEERING

(Choice Based Credit System w.e.f 2018-19)

SEMESTER II

Sr. No	Course No.	Course Title	Teaching Schedule		Marks of Class Work	Exam. Marks		Total Marks	Credit	Duration of Exam.
			L	P		Theory	Practical			
1	MTEC502C	Internet of Things	3	-	25	75	-	100	3	3
2	MTEC504C	Advanced Optical Communication & Networks	3	-	25	75	-	100	3	3
3	PE-III	Elective-III	3	-	25	75	-	100	3	3
4	PE-IV	Elective-IV	3	-	25	75	-	100	3	3
5	MTEC580C	Internet of Things lab	-	4	25		75	100	2	3
6	MTEC582C	Advanced Optical Communication & Networks Lab	-	4	25		75	100	2	3
7	MTEC584C	Mini Project	-	4	25		75	100	2	3
8	Aud 2	Audit course 2	2	-	25	75		100		3
Total			**14**	**12**	**200**	**375**	**225**	**800**	**18**	**24**

LIST OF PROGRAM SPECIFIC ELECTIVE III & IV				**AUDIT COURSE 1 & 2**	
MTEC520C	Advanced Digital Image Processing	MTEC532C	DSP Processors	AUD531C	English for Research Paper Writing
MTEC522C	Antenna & Radiating System	MTEC534C	Biomedical Signal Processing	AUD533C	Disaster Management
				AUD535C	Sanskrit for Technical Knowledge
MTEC524C	Voice and data networks	MTEC536C	Programmable Networks – SDN, NFV	AUD537C	Value Education
				AUD539C	Constitution of India
MTEC526C	MEMS and IC Integration	MTEC538C	Device Modeling	AUD541C	Pedagogical Studies
				AUD543C	Stress Management by Yoga
MTEC528C	Multimedia Communication	MTEC540C	Free Space Optical Communication	AUD545C	Personality Development through Life Enlightenment Skills.
MTEC530C	Cyber Security	MTEC542C	Audio Processing		

NOTE:

1. Student can opt any two subjects for electives III & IV from given list respectively and one audit course from given list of audit course 1&2.
2. The choice of students for any elective shall not be binding on the department to offer, if the department does not have expertise. The minimum strength of the students opting for the particular subject shall not be less than 8.
3. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/exchange of calculator is prohibited in the examination.

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ELECTRONICS & COMMUNICATION ENGINEERING

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SEMESTER III

Sr. No	Course No.	Course Title	Teaching Schedule		Marks of Class Work	Exam. Marks		Total Marks	Credit	Duration of Exam.
			L	P		Theory	Practical			
1	PE-V	Elective-V	3	-	25	75	-	100	3	3
2	OE	Open Elective	3	-	25	75	-	100	3	3
3	MTEC585C	Dissertation Phase – I	-	20	50	-	100	150	10	3
Total			**6**	**20**	**100**	**150**	**100**	**350**	**16**	**9**

LIST OF PROGRAM SPECIFIC ELECTIVE V		LIST OF OPEN ELECTIVE	
MTEC545C	High Performance Networks	MTOE651C	Business Analytics
MTEC547C	Pattern Recognition and Machine learning	MTOE653C	Industrial Safety
MTEC549C	Detection & Estimation Theory	MTOE655C	Operations Research
MTEC551C	Advanced Digital Signal Processing	MTOE657C	Cost Management of Engineering Projects
MTEC553C	Laser Communication	MTOE659C	Composite Materials
MTEC555C	Reliability Engineering	MTOE661C	Waste to Energy

NOTE:

1. Student can opt any one subject for electives (V) and one subject for open elective from given list.
2. The choice of students for any elective shall not be binding on the department to offer, if the department does not have expertise. The minimum strength of the students opting for the particular subject shall not be less than 8.
3. The students will be allowed to use non-Programmable Scientific Calculator. However, sharing/exchange of calculator is prohibited in the examination.
4. Dissertation(Phase-II) being an extension of Dissertation (Phase-I), for progression to Dissertation(Phase-II), it is necessary that the candidate must have passed Dissertation(Phase-I)

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ELECTRONICS & COMMUNICATION ENGINEERING

(Choice Based Credit System w.e.f 2018-19)

SEMESTER IV

Sr. No	Course No.	Course Title	Teaching Schedule		Marks of Class Work	Exam. Marks		Total Marks	Credit
			L	P		Theory	Practical		
1	MTEC586C	Dissertation Phase – II	-	32	100	-	200	300	16
Total				**32**	**100**	**-**	**200**	**300**	**16**

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC501C **DIGITAL SIGNAL AND IMAGE PROCESSING**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits			
3	-	-	3	Class Work	:	25 Marks
				Theory	:	75 Marks
				Total	:	100 Marks
				Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand discrete –time signals and systems in time and frequency domains and computing transforms using efficient algorithms.
2. To design and Realization of digital FIR and IIR filters.
3. To understand Image representation and fundamental image processing steps.
4. To understand image filtering in spatial and frequency domains for different applications.

UNIT I

Review of Discrete Time signals and systems, Characterization in time and frequency domain, Fast Fourier Transform algorithms – In-place computations, Butterfly computations, bit reversal's, Digital Filter design: FIR – Windowing, and IIR – Impulse invariance, bilinear Transformation.

UNIT II

Basic structures for IIR systems: Direct Form I and II, cascade and parallel realization, transposed direct form I and II; Basic structures for FIR systems, computationally efficient structures, and comparison of different structures in terms of sensitivity towards finite word length effects.

UNIT III

Understanding Digital Images, Fundamental image processing steps, Image sampling and Quantization, Representation of digital images, spatial and Gray-level resolution, pixels and neighbors of pixel, Image operations on a pixel basis. Intensity Transformation Functions: Image negatives, log transformations, Power-Law (Gamma) transformations, piecewise –Linear Transformation functions; Histogram Processing: Histogram Equalization, Histogram Matching (Specifications), Local Histogram Processing.

UNIT IV

Spatial filtering: Spatial Correlation and Convolution, Generating Spatial Filter Masks, Smoothing Spatial Filters: Smoothing Linear Filters, Order Statistics (Nonlinear) Filters; Sharpening Spatial Filters: Using the second derivative for Image Sharpening-The Laplacian; Unsharp Masking and Highboost Filtering. Filtering in Frequency Domain: Relationship between the sampling and Frequency intervals, 2-D Impulse and shifting Properties, 2-D Sampling Theorem, Aliasing in Images, 2-D Discrete-Fourier Transform and its Inverse, Properties of 2-D DFT, Additional Characteristics & Filtering Fundamentals in the frequency domain, correspondence between filtering in the spatial and frequency domains; Smoothing frequency domain filters: Ideal Lowpass Filters, Butterworth Lowpass Filters, Gaussian Lowpass Filters; sharpening frequency domain filters: Ideal Highpass Filters, Butterworth Highpass Filters, Gaussian Highpass Filters, Lapalacian in Frequency Domain; Unsharp Masking, Highboost Filtering, and High Frequency Emphasis Filtering, Implementation of DFT: computing 2-D DFT using 1-D DFT Algorithm, Computing IDFT using DFT Algorithm.

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

1. Analyze discrete-time signals and systems in time and frequency domains.
2. Design and realize digital FIR and IIR filters.
3. Various image processing steps and analyzing processed images.
4. Filtering images in both spatial and frequency domains and interpreting results.

Text/ Reference Books:

1. J.G. Proakis, Manolakis "Digital Signal Processing", Pearson, 4th Edition
2. S. K. Mitra. "Digital Signal Processing – A Computer based Approach", TMH, 3rd Edition, 2006
3. S. Salivahanan, Gnanapriya, "Digital Signal Processing", Mc Graw Hill, 2nd Edition.
4. Gonzalez and Woods, "Digital Image Processing", PHI, 3rd Edition
5. A. K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination is not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC503C **ANALOG & DIGITAL CMOS DESIGN**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To give brief operation of MOS transistors.
2. To design CMOS analog and digital signal circuits to achieve performance specifications.
3. To deals with Basic theory of Analog Circuits, Design principles and techniques for analog IC's blocks implemented in CMOS technology

UNIT I

Introduction of MOSFET: Basic principle of MOS transistor, MOS device structure and physical operation. Current- Voltage characteristics, MOSFET at DC, Body effects and Velocity saturation, Introduction to large signal and small signal MOS models for digital design.

The MOS Inverter: Inverter principle, Depletion and enhancement load inverters, the basic CMOS inverter, Bi-CMOS Inverter, transfer characteristics, logic threshold, Noise margins, and Dynamic behavior, Propagation Delay and transistor sizing.

UNIT II

Combinational & Sequential Logic Structures: CMOS Logic Families - static, dynamic and differential logic families, CMOS Complimentary logic, Pseudo NMOS logic, Dynamic Logic Circuits: Basic principle, non ideal effects, domino CMOS Logic, high performance dynamic CMOS Circuits, Clocking Issues, Two phase clocking, pass Transistor logic, transmission gates logic circuits, complimentary switch logic, SR latches, Flip flops: JK, D, Master- Slave & Edge triggered. Registers, CMOS Schmitt trigger.

UNIT III

Current Mirrors: Simple current mirror, Cascode current Mirror, Widlar current mirror, Wilson Current Mirror

CMOS Amplifier: Miller Effect, Association of Poles with nodes, Frequency Response of all single stage amplifiers. Single transistor Amplifiers stages: Common Drain, Common Gate & Common Source Amplifiers. MOS differential pair with resistive load and current- mirror load.

UNIT IV

Operational Amplifier: Differential Amplifiers, Output Amplifiers, Applications of operational Amplifier, theory and Design; Definition of Performance Characteristics; Design of two stage MOS Operational Amplifier.

Advancement in MOS models: Introduction to Recent developments in MOS device models i.e Fin FET, Single electron Transistor, Junction less transistor, Organic transistors.

Course Outcome: At the completion of this course, each student will have demonstrated proficiency in:

1. Demonstrate a clear understanding of important concepts in MOS Device Models.
2. Designing CMOS analog and digital circuits to achieve performance specifications.
3. Studying advanced concepts of Analog Circuits, Design principles and techniques for analog IC's blocks implemented in CMOS technology

Text/ Reference Books:

1. Adel S. Sedra and Kenneth C. Smith " Microelectronics Circuits" Oxfort university press, 7th edition , 2017
2. J. M. Rabaey, A. P. Chandrakasan and B. Nikolic, "Digital Integrated Circuits" Second Edition, PH/Pearson, 2003.
3. D. A. Pucknell and K. Eshraghian, "Basic VLSI Design", Third Edition, PHI, 1994.
4. BehzadRazavi, " Design of Analog CMOS Integrated Circuit", Mc Graw-Hill.
5. S. M. Kang and Y. Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", Third Edition, MH, 2002.
6. D. A. Johns and Martin, "Analog Integrated Circuit Design", John Wiley, 1997.
7. Gregorian and G C Temes, "Analog MOS Integrated Circuits for Signal Processing", John Wiley, 1986.

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination is not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

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Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC521C **WIRELESS SENSOR NETWORKS**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To design wireless sensor network system for different applications under consideration.
2. To understand the hardware details of different types of sensors and select right type of sensorfor various applications.
3. To understand radio standards and communication protocols to be used for wireless sensor network based systems and application.
4. To use operating systems and programming languages for wireless sensor nodes, performanceof wireless sensor networks systems and platforms.

UNIT I

Introduction to Wireless Communication, Introduction and overview of sensor network architecture and its applications, Unique constraints and challenges, Advantage of Sensor Networks sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

UNIT II

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. Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

UNIT III

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.

UNIT IV

Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and SunSPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS. Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

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

1. Design wireless sensor network system for different applications under consideration.
2. Understand the hardware details of different types of sensors and select right type of sensor for various applications.
3. Understand radio standards and communication protocols to be used for wireless sensor network based systems and application.
4. Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.
5. Handle special issues related to sensors like energy conservation and security challenges.

Text/Reference Books:

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.
5. WaltenegusDargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
6. SabrieSoloman, “Sensors Handbook" by McGraw Hill publication. 2009
7. KazemSohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination is not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC523C **COGNITIVE RADIO**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand the fundamental concepts of cognitive radio networks.
2. To develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
3. To understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.
4. To understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation.

UNIT I

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 II

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

UNIT III

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming. Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

UNIT IV

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, crosslayer design for cognitive radio networks.

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

1. Understand the fundamental concepts of cognitive radio networks.
2. Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
3. Understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.
4. Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation.

Text/ Reference Books:

1. Ekram Hossain, DusitNiyato, Zhu Han, “Dynamic Spectrum Access and Management inCognitive Radio Networks”, Cambridge University Press, 2009.
2. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive radio networks”, John Wiley & SonsLtd., 2009.
3. Bruce Fette, “Cognitive radio technology”, Elsevier, 2nd edition, 2009.
4. Huseyin Arslan, “Cognitive Radio, Software Defined Radio, and Adaptive WirelessSystems”, Springer, 2007.
5. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, “Optimizing WirelessCommunication Systems” Springer, 2009.
6. Linda Doyle, “Essentials of Cognitive Radio”, Cambridge University Press, 2009.

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination is not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC525C STATISTICAL INFORMATION PROCESSING
M. Tech. Electronics and Comm Engg
Semester –I

L	T	P	Credits				
3	-	-	3	Class Work	:	25 Marks
				Theory	:	75 Marks
				Total	:	100 Marks
				Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.
2. To demonstrate mathematical modeling and problem solving using such models.
3. To comparatively evolve key results developed in this course for applications to signal processing, communications systems.
4. To develop frameworks based in probabilistic and stochastic themes for modeling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

UNIT I

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 II

Random signal modeling: 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-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing.

UNIT III

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. Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.

Information Theory and Source Coding: Introduction, Uncertainty, Information and Entropy, Source coding theorem, Huffman, Shanon Fano , 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 IV

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.

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

1. Characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.
2. Demonstrate mathematical modeling and problem solving using such models.
3. Comparatively evolve key results developed in this course for applications to signal processing, communications systems.
4. Develop frameworks based in probabilistic and stochastic themes for modeling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

Text/ Reference Books:

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 SignalProcessing", McGraw Hill, 2000.
3. Mourad Barkat , "Signal Detection and Estimation", Artech House, 2nd Edition, 2005.
4. R G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968.
5. F. J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", NewYork, North-Holland, 1977.
6. Rosen K.H, "Elementary Number Theory", Addison-Wesley, 6th edition, 2010.

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC527C **MARKOV CHAIN & QUEUING SYSTEM**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand Markov Chains and regenerative processes used in modeling a wide variety of systems and phenomena.
2. To model a system as queuing system with some aspect of the queue governed by a random process.
3. To understand telecommunication systems modeling using Markov chains with special emphasis on developing queuing models.

UNIT I

Introduction: Review of basic probability, properties of nonnegative random variables, laws of large numbers and the Central Limit Theorem.

UNIT II

Renewal Processes: Basic definitions, recurrence times, rewards and renewal reward theorem, point processes, Poisson process, Walds equation, Blackwell's theorem.

Discrete time Markov chains: definitions and properties, matrix representation, PerronFrobenius theory.

UNIT III

Continuous time Markov chains: basic definitions, Q-matrix, birth-death processes, quasi birth death processes; Embedded Markov processes, semi Markov processes, reversible Markov chains, Random walks.

UNIT IV

Fundamental queuing results: Little's theorem, invariance of the mean delay, Conservation law. Markovian queues: Jackson and BCMP networks, numerical Algorithms. M/G/1 & G/M/1 queues and G/G/1 queues.

Advanced queuing models: priority, vacation and retrials in queues.

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

1. Understand Markov Chains and regenerative processes used in modelling a wide variety of systems and phenomena.
2. Model a system as queuing system with some aspect of the queue governed by a random process.
3. Understand telecommunication systems modelling using Markov chains with special emphasis on developing queuing models.

Text/Reference Books:

1. Cliffs, “Stochastic Modelling and the Theory Queues”, Prentice Hall, 1989.
2. P.Bremaud, “Markov Chains”, Springer-Verlag, 1999.
3. E.Seneta, “Non Negative Matrices and Markov Chains”, Springer Series in Statistics, Springer,1981.
4. R.Gallager, “Discrete Stochastic Processes”, Kluwer Academic Press, 1996.
5. L.Kleinrock, “Queuing Systems”, vols I and II, John Wiley and Sons 1976.

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC529C ADVANCED WIRELESSES AND MOBILE COMMUNICATION

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To design appropriate mobile communication systems.
2. To be able to apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques
3. Students should be able to distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages.
4. To analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology.

UNIT I

Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co-channel and adjacent channel interference, interference reduction techniques 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 II

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 adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

UNIT III

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 IV

Code Division Multiple Access: Introduction to CDMA technology, IS 95 system Architecture, 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 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G

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

1. Design appropriate mobile communication systems.
2. Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques
3. Distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages.
4. Analyze path loss and interference for wireless telephony and their influences on a mobile communication system's performance.
5. Analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology
6. Understanding upcoming technologies like 3G, 4G etc.

Text/Reference Books:

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

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC531C **ADVANCED COMMUNICATION NETWORK**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand advanced concepts in Communication Networking.
2. To design and develop protocols for Communication Networks.
3. To understand the mechanisms in Quality of Service in networking.
4. To optimize the Network Design.

UNIT I

Overview of Internet-Concepts, challenges and history. Overview of -ATM. TCP/IP Congestion 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 throughput issues. 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 II

Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms. High speed scheduler design. Theory of 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 active queue management.

UNIT III

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 based admission control. Differentiated Services in Internet (DiffServ). DiffServ architecture and framework.

UNIT IV

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

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

1. Understand advanced concepts in Communication Networking.
2. Design and develop protocols for Communication Networks.
3. Understand the mechanisms in Quality of Service in networking.
4. Optimize the Network Design.

Text/Reference Books:

1. Jean Wairand and Pravin Varaiya, "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.

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
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Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC533C ADVANCED SATELLITE COMMUNICATION

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits			
3	-	-	3	Class Work	:	25 Marks
				Theory	:	75 Marks
				Total	:	100 Marks
				Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To give the idea and basic knowledge of satellite Communication Systems.
2. To familiarize the students with the Earth Station Technology i.e design of Earth Station, antennas, Tracking, satellite Packet Communications.
3. To give the idea about the GPS orbits and satellite position determination and to teach the students about the Very small Aperture Terminal Networks.

UNIT I

FUNDAMENTALS OF SATELLITE COMMUNICATION: Introduction to Satellite Communications, Requirements of Satellite Communication, Evolution & Growth of Satellite Communication, Satellite frequency band Allocation, Elements of satellite Communication systems, Types of satellites: Analog/Digital, Active/Passive, LEO/MEO/GEO/ICO, Advantages & Disadvantages of Satellite Communication, Satellite Applications.

SATELLITE LINK DESIGN: Introduction, General link Design Equation, System Noise Temperature, EIRP, C/N, G/T Ratio, Uplink Design, Downlink Design, Combined Link Design, Atmospheric & Ionospheric Effects on Link Design, Interference Effect on Complete Link Design, Error Control for Digital Satellite Links: Error Detection and Correction, Channel Capacity, Error Control Coding.

UNIT II

SATELLITE ORBITAL ASPECTS: Introduction, Orbital Mechanism, Types of Orbit, Kepler's Law, Equation of Orbit, Solar &Sideral Day, Orbital Parameters, Satellite Location with Respect to Earth, Earth Coverage & Slant Range, Mechanism of Launching a Satellite, Satellite Stabilization & Station Keeping, Geostationary Satellite-Hohmann transfer-effects of earth's shape-other heavenly bodies-atmospheric drag & Radiation pressure on the Satellite's Orbit.

MULTIPLE ACCESS & MODULATION TECHNIQUES: Introduction, FDMA, TDMA, Hybrid Access Techniques, Analog & Digital Modulation & Demodulation Techniques, FM, Pre-emphasis & De-emphasis, Multiple Access with On-Board Processing, Practical Demand Access System.

UNIT III

SPACECRAFT & ITS SUBSYSTEMS: Introduction, Communication satellite Subsystems, Their functions & Parameter of Importance, Attitude & Orbit Control System (AOCS), Telemetry, Tracking, Command & Monitory (TTC&M), Power Supply Systems, Space Craft Antennas, Equipment Reliability & Space Qualification, Power Subsystem.

SATELLITE EARTH STATION TECHNOLOGY: Introduction, Earth Station Design, Classification of Earth Station, Earth Station Design Requirements, Earth Station Parameters, Earth Station Subsystem Transmitter, Receiver, Low Noise Amplifier, High Power Amplifier, Antenna System, Tracking Subsystem, Terrestrial Interface, Fixed & Mobile Satellite Service Earth Stations.

UNIT IV

SPECIAL PURPOSE COMMUNICATION SATELLITES: Satellite for Earth Observation, Satellite For Weather Forecast, Scientific Studies, Military Operations and Television, Telephone Service Via Satellite, Data Communication Services, Very Small Aperture Terminal(VSAT), RADARSET, Mobile Satellite Communication System(MSAT), Remote Sensing Satellites.

OVERVIEW OF GPS: Introduction, Basic Concepts, System Architecture, Space Segment, User Segment, GPS Aided GEO-Augmented Navigation (GAGAN) Architecture, GPS Signals: Signal Structure, Anti-Spoofing(AS), Selective Availability, Difference Between GPS & GALILEO Satellite Construction, GPS Orbital Parameters, Observation Data & Navigation Message Data Parameters, GPS Position Determination, GPS Errors; GPS Error Sources-Clock Error, Ionospheric Error, Tropospheric Error, Multipath, Ionospheric Error Estimation Using Dual Frequency GPS Receiver.

Course Outcomes:

1. After reading the course, students will be able to understand the basics of satellite communication systems, earth Station Technology, GPS, VSAT.
2. Students may utilize their knowledge of the subject for the research and development in future.
3. Knowledge of latest concepts is imparted.
4. Students will feel confident to appear in competitive exams like for ISRO.

Text Books:

1. T. Pratt and C.W., ―Bostian Satellite Communications‖.
2. Tri T. Ha, ―Digital Satellite Communication‖ (2 ed) 3 Robert J. Mailloux
3. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, ―GPS – Theory and Practice‖, Springer – Wien, New York(2001).

Reference Books:

1. James Ba – Yen Tsui, ―Fundamentals of GPS receivers – A software approach‖, John Wiley & Sons (2001).
2. Phased Array Antenna Hand Book‖ , Artech House, Boston, London, 1994. 4.
3. Dr. D.C. Agarwal, ―Satellite Communications‖ .

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
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Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC535C **RF AND MICROWAVE CIRCUIT DESIGN**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits			
3	-	-	3			

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand the behavior of RF passive components and model active components.
2. To perform transmission line analysis.
3. To demonstrate use of Smith Chart for high frequency circuit design.
4. To justify the choice/selection of components from the design aspects.

UNIT I

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 II

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 III

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

UNIT IV

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

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

1. Understand the behavior of RF passive components and model active components.
2. Perform transmission line analysis.
3. Demonstrate use of Smith Chart for high frequency circuit design.
4. Justify the choice/selection of components from the design aspects.
5. Contribute in the areas of RF circuit design.

Text/Reference Books:

1. Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The UltimateGuide to Superior Design", AuthorHouse, 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 AndNon Linear Techniques", John Wiley 1990.
5. S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.
6. Radmanesh, "RF and Microwave Electronics Illustrated" , Pearson Education, 2004.

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
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Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC537C **OPTIMIZATION TECHNIQUES**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits			
3	-	-	3	Class Work	:	25 Marks
				Theory	:	75 Marks
				Total	:	100 Marks
				Duration of Exam.	:	3 Hrs.

Course Objectives:

1. The prime objective is to provide training to the students for realizing the importance of optimization. Also it is important to understand the system modeling.
2. It is desirable to cover all the aspects related to problem in the designed model.
3. There are various ways to model different systems in different environments which are to be known.
4. Various Soft computing skills for simulation and optimization are to be studied and implemented.

UNIT I

Introduction: Operation Research Models, OR Model, Queuing & Simulation Models, Two Variable LP Model, Graphical LP solution, Computer Solution with solver & AMPL, Linear Programming Applications.

Sensitivity & Post Optimal Analysis: LP Model in Equation Form, Algebraic Solution, Simplex Method, Artificial Starting Solution, Sensitivity Analysis, Dual Problem, Primal-Dual Relationships, Economic Interpretation of Duality, Additional Simplex Algorithms, Post Optimal Analysis.

UNIT II

Models: Transportation Models and its variants, Transportation Algorithms, Assignment Models, Shortest Route Problem and its Algorithms, Maximal Flow Model, CPM & PERT.

Programming: Heuristic Programming, Greedy Heuristics, Meta Heuristics, TSP Algorithms (B&B, Cutting Plain, Nearest Neighbor, Reversal Heuristic, Tabu, Simulated Annealing), Deterministic & Dynamic Programming.

UNIT III

Simulation Modeling: Monte Carlo Simulation, Type of Simulations, Unconstrained Problems, Constrained Problems, Direct Search Method, Gradient Method, Separable, Quadratic.

UNIT IV

Soft Computing Techniques: GA, ACO, PSO with their modeling and programming.

Course Outcomes:

1. Students are able to contribute in solving different research problem.
2. Further they are able to design their problems for M.Tech as well as Ph.D on their own.
3. They are able to decide the method, ways and means to be used for the research methodology.
4. Use of different simulation techniques and soft computing skills on the existing and bench mark problems for authenticating them or suggesting new solution in addition to the existing solutions will add value to the research.

Text Books:

1. Operation Research By Taha – Pearson
2. Probability & Statistics with Reliability, Queuing & Computer Serine Application- Kishor S. Trivedi – Willey

Reference Books:

1. Mathematical Modeling Principles & Applications:- CENGAGE Learning, Frank R. Giordano, William P. Fox.
2. Operation Research, K. Rajagopal – PHI
3. Operation Research Algorithms and Applications by Rathindra P.Sen, PHI

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC539C INFORMATION AND COMMUNICATION THEORY
M. Tech. Electronics and Comm Engg
Semester –I

L	T	P	Credits			
3	-	-	3	Class Work	:	25 Marks
				Theory	:	75 Marks
				Total	:	100 Marks
				Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To make students able to use concepts of ICT and introduce them with practical aspects of information theory.
2. To make them aware about field algebra and advanced coding techniques used in systems& also provide concepts related to modulation and coding tradeoffs.
3. Estimation and Hypothesis Testing are introduced for practical aspects.
4. Performance of codes and Properties of Estimators and filtering are covered to a great extent.

UNIT 1

Field Algebra: Introduction, Binary operations, Groups, Characteristics of the field, Binary field arithmetic, Galois field, vector spaces, matrices.

Information theory and channel capacity: information sources, Entropy , information rate, mutual information**,** channels models , redundancy ,efficiency of channel , channel capacity, channel capacity for MIMO system, capacity region for multiple access channel ,Random selection of codes

UNIT I1

Codes: Linear block codes , Hamming codes, BCH codes , Reed Solomon codes, Justeen codes, Golay code, MDS code, Reed Muller Code ,cyclic codes ,convolution code , space time codes , turbo codes.

Properties of Estimators and filtering: Unbiasedness, efficiency, C-R bound, asymptotic properties, Wiener filter, Kalman filter.

UNIT III

Channel Coding: Waveform Coding, types of error control, structured sequences, error detecting and correcting capability, usefulness of standard array, , interleaving and concatenated codes, coding and interleaving applied to the compact disc.

Source Coding: Sources, amplitude quantizing, adaptive prediction, transform coding, source coding for digital data, examples of source coding.

UNIT IV

Modulation and coding tradeoffs : Goals of communication system designer, error probability plane, Nyquist minimum bandwidth, Shannon Hartley capacity theorem, bandwidth efficiency plane, modulation and coding tradeoffs, designing and evaluating digital communication systems, bandwidth efficient modulation, modulation and coding for band limited channels, trellis coded modulation

Performance of codes: Performance of linear block codes & convolution codes, Bounds on code performance, Bounds on error performance.

Course Outcomes:

1. Students will be able to understand the field algebra and they will know the significance of block codes.
2. They can compare different methods used channel coding and source coding.
3. They will understand the concept of modulation and coding tradeoffs for evaluation of the system .Also aware of finding out the performance of codes for any specific application.
4. Different methods for doing the estimation will be understandable by the students and able to understand the hypothesis testing after this advanced course.

Text Books:

1. Bernard Skylark & Pabitra Kumar Ray, Digital communications Fundamentals and Applications, Pearson
2. J. Das., S.K. Mullik& P.K. Chatterjee, Principles of digitals communication, New Age International Publishers
3. Papoulis, Athanasios, Probability Random Variables and Stochastic Processes, McGraw-Hill (2008).
4. Taub Schilling, Principles of Communication Systems
5. Harry L Vantrees, Detection ,Estimation and modulation Theory A Willey Interscience Publication.
6. Ranjan Bose, information theory ,coding and cryptography third edition , Mc Graw Hill .

Reference Books:

1. Statistical Signal Processing – Detection, Estimation and Time-Series Analysis, Louis L. Scharf, Addison-Wesley 1991, ISBN 0-201-19038-9.
2. Probability, Random Processes, & Estimation Theory for Engineers, 3rd Edition, H. Stark & J. W. Woods, 2002.
3. An Introduction to Signal Detection and Estimation, Vincent Poor, 2nd ed., 1991
4. L. Scharf, Statistical Signal Processing - Detection, Estimation and Time Series Analysis, Addison-Wesley, 1991.

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC541C ADVANCED MICROPROCESSORS & APPLICATIONS
M. Tech. Electronics and Comm Engg
Semester –I

L	T	P	Credits			
3	-	-	3	Class Work	:	25 Marks
				Theory	:	75 Marks
				Total	:	100 Marks
				Duration of Exam.	:	3 Hrs.

Course Objectives:

1. This course is intended to keep the student abreast of the hardware & software details of microprocessors.
2. This course introduces the primitive microprocessor, i.e., Intel 8086, and then all the processor of X86 family microprocessors.
3. This introduces the software model & functional description of Pentium.
4. This course also opens the door for making strides into the peripheral chips and designing of applications based on Pentium processor.

UNIT I

DESIGN OF MICROPROCESSOR: Design of basic microprocessor architectural Concepts: Microprocessor architecture, word Lengths, addressable memory, and Microprocessor's speed architectural characteristics, registers, instruction, memory addressing architecture, ALU, GPR's Control logic & internal data bus.

MICROPROCESSOR INSTRUCTIONS & COMMUNICATION: Instruction Set, Mnemonics, Basic Instruction Types, Addressing modes, Microprocessor I/O connecting I/O put to Microprocessor, Polling and Interrupts, Interrupt and DM. Controllers.

UNIT II

ADVANCED MICROPROCESSOR: Advanced microprocessors: Intel X86 family of advanced Microprocessor, programming model of 86 families, X86 addressing modes, instruction set, hardware.

HIGH PERFORMANCE CISC ARCHITECTURE (PENTIUM): The software model, functional description, CPU pin descriptions, RISC concepts, bus operations, super scalar architecture, pipe-lining, Branch prediction.

UNIT III

PENTIUM PROCESSOR: The instruction and caches, Floating point unit, protected mode operation, Segmentation, paging, multitasking, Exception and interrupts, Input / Output, Virtual 8086 model, Interrupt processing,

INSTRUCTIONS & PROGRAMMING WITH PENTIUM PROCESSOR: Instruction types, Addressing modes, Processor flags, Instruction set, Basic programming the Pentium Processor.

UNIT IV

PENTIUM PROCESSOR I/O: Data Communication, parallel I/O serial communication, Serial interface and UART modems, I/O devices, D/A, A/D interface, special I/O devices.

DEVELOPING PENTIUM PROCESSOR BASED APPLICATIONS: Introduction to the Design Process, Preparing the specifications, Developing a design, Implementing and Testing and design, Regulatory Compliance Testing, design tool for Development.

Course Outcomes:

1. The students will be acquainted with the knowledge of architecture and programming of X86 family microprocessors.
2. Moreover, students will also have a first-hand exposure of designing of applications based on Pentium processor.
3. Knowledge of peripheral chips is attained.
4. Knowledge of design process and tool for development of Pentium processor based product will help them in placements.

Text/ Reference Books:

1. "The Intel Microprocessors 8086- Pentium Processor", Brey, 4th Edition, 2005.
2. "Microprocessors and Interfacing", D.V. Hall, TMH, 2nd Edition, 2006.
3. "Microcomputer Systems: The 8086/8088 Family: Architecture, Programming and Design", Liu Yu-Chang and Gibson Glenn A., PHI, 2003.
4. "Advanced Microprocessors and Peripherals Architectutes, Programming and Interfacing", Ray A.K. and Bhurchandi, TMH, 2002.
5. "Microprocessor based system design UBS", Rafiquzzman, Wiley-Interscience, 5th Edition, 2005.
6. "The X86 PC: Assembly Language, Design and Interfacing", M.A. Mazidi, J.P. Mazidi and Danny Causey, Peason, 5th Edition, 2011.
7. "The X86 Microprocessor(Architecture, Programming and Interfacing)", L.B. Das, Pearson, 2010.
8. "Advanced Microprocessor", Daniel Tabak, TMH, 2nd Edition, 2012.
9. "Fundamentals of Microprocessor and Microcomputers", B.Ram, Dhanpat Rai Publications, 5th Edition, 2008.

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC543C **RADIO OVER FIBER TECHNOLOGIES**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits			
3	-	-	3			

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objective:

1. To impart the concepts of Radio over Fiber Technology for Cellular applications.
2. To understand ROF Links.
3. To learn about the Components used in ROF Technology.
4. To know different Modulation schemes in ROF.

UNIT I

INTRODUCTION TO RADIO OVER FIBER: Radio Over Fiber – applications, advantages, limitations, Microwave properties of optical links, Direct modulated optical links, external modulators, types, modulation transfer in microwave fiber optic links.

UNIT II

A**NALOG FIBER OPTIC LINKS**: Sub carrier Optical fiber transmission systems, Fiber optic transmission of 64-QAM, 256-QAM signals, Capacity of coaxial and fiber optic links, LASER diode and Photodiode nonlinearities, Fiber dispersion and noise.

UNIT III

COMPONENTS FOR ROF SYSTEMS: Analog modulation of LASER diode, LASER diode fundamentals, Rate equation analysis, Intensity modulation, Frequency modulation Low cost LASER diode driver, LASER diode noise and their influence on link performance.

UNIT IV

ROF TECHNOLOGY FOR THE CELLULAR APPLICATIONS: 3G cellular systems, cellular architecture, UMTS architecture, WCDMA ROF systems, Micro diversity, Macro diversity, Traffic estimation, Spectral efficiency, power level, multiple user interference.ROF for Hiper LAN2, Micro cellular communication networks. Peak-to-Average Power Ratio Reduction Techniques, OFDM ROF System Improvement, Combinations of OFDMA and CDMA

Course Outcomes:

1. Students understand the potential of RoF technology along with the combination of multiple access techniques
2. They can combine the radio and Fiber technology.
3. They can improve the efficiency of their ROF links.
4. The students can implement ROF in Matlab.

Text Books:

1. Hameed Al-Raweshidy, Shozo Komaki, “Radio Over fiber technologies for mobile communication networks” Artech House publications, London. 2002.

Reference Books:

1. William S.C.Chang, “RF Photonic technology in optical fiber links” Cambridge university press. 2002
2. Xavier N Fernando,“Radio over Fiber for Wireless Communications: From Fundamentals to Advanced Topics” Wiley Publications,2014.

NOTE:

1. In the Semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all, atleast one from each unit. All questions carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC581C **DIGITAL SIGNAL AND IMAGE PROCESSING LAB**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits
-	-	4	2

Class Work	:	25Marks
Exam	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand and visualize signals and Images and their representation as data
2. To analyze and process signals and Images for different applications
3. To implement signal and image processing in software.

List of Assignments:

1. Basic Signal Representation
2. Convolution and correlation
3. Butterworth Low pass And High pass Filter Design
4. Chebychev Type I,II Filter
5. Realization of direct form I, II IIR Filters.
6. Realization of cascade FIR Filters
7. Realization of direct form I, II FIR Filters
8. State Space Matrix from Differential Equation
9. Normal Equation Using Levinson Durbin
10. Cascade Digital IIR Filter Realization
11. Estimation Of PSD
12. Inverse Z Transform
13. Parallel Realization of IIR filter
14. Performing basic arithmetic and logical operations on images like addition, subtraction, AND, OR etc.
15. Plot the histogram of an image and perform histogram equalization
16. Implement segmentation algorithms
17. Perform image compression using lossy technique
18. Perform image compression using lossless technique
19. Convert a Colour model into another

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

1. Design different digital filters in software
2. Apply various transforms in time and frequency
3. Implement image processing algorithms
4. Perform Image enhancement
5. Perform Image Segmentation

NOTE:

1. Each Laboratory Class/Section shall not be of more than about 20 students.
2. To allow fair opportunity of practical hands-on experience to each student, each experiment may either be done by each student individually or in a group of not more than 3-4 students. Larger groups be strictly discouraged / disallowed.
3. Pre-experimental & post experimental quiz / questions may be offered for each Lab experiment to reinforce & aid comprehension of the experiment.

MTEC583C **ANALOG & DIGITAL CMOS DESIGN LAB**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits			
-	-	4	2			

Class Work	:	25 Marks
Exam	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objective:

1. To Design digital and analog Circuit using CMOS technology
2. To use EDA tools like Cadence, Mentor Graphics and other open source software tools like microwind, ng spice.

List of Experiments:

1) Use VDD=1.8V for 0.18um CMOS process, VDD=1.3V for 0.13um CMOS Process and VDD=1V for 0.09um CMOS Process.
   a) Plot ID vs. VGS at different drain voltages for NMOS, PMOS.
   b) Plot ID vs. VGS at particular drain voltage (low) for NMOS, PMOS and determine Vt.
   c) Plot log ID vs. VGS at particular gate voltage (high) for NMOS, PMOS and determine IOFF and sub-threshold slope.
   d) Plot ID vs. VDS at different gate voltages for NMOS, PMOS and determine Channel length modulation factor.
   e) Extract Vth of NMOS/PMOS transistors (short channel and long channel). Use VDS =30mV

   To extract Vth use the following procedure.
   a) Plot gm vs VGS using NGSPICE and obtain peak gm point.
   b) Plot ID vs. VDS at different drain voltages for NMOS, PMOS, plot DC load line and calculate gm, gds, gm/gds, and unity gain frequency.

   Tabulate your result according to technologies and comment on it.
2) Use VDD=1.8V for 0.18um CMOS process, VDD=1.2V for 0.13um CMOS Process and VDD=1V for 0.09um CMOS Process.
   a) Perform the following.
      i. Plot VTC curve for CMOS inverter and thereon plot dVout vs. dVin and determine transition voltage and gain gm. Calculate VIL, VIH, NMH, NML for the inverter.
      ii. Plot VTC for CMOS inverter with varying VDD.
      iii. Plot VTC for CMOS inverter with varying device ratio.
   b) Perform transient analysis of CMOS inverter with no load and with load and determine tpHL, tpLH, 20%-to-80% tr and 80%-to-20% tf. (use VPULSE = 2V, Cload = 50fF).
   c) Perform AC analysis of CMOS inverter with fanout 0 and fanout 1. (Use Cin= 0.012pF,Cload = 4pF, Rload = k)
3) Build a three stage and five stage ring oscillator circuit in 0.18um and 0.13um technology and compare its frequencies and time period.
4) Perform the following:
   a) Draw small signal voltage gain of the minimum-size inverter in 0.18um and 0.13um technology as a function of input DC voltage. Determine the small signal voltage gain at the switching point and compare the values for 0.18um and 0.13um process.
   b) Consider a simple CS amplifier with active load, as explained in the lecture, with NMOS transistor MN as driver and PMOS transistor MP as load, in 0.18um technology. (W/L)MN=5, (W/L)MP=10 and L=0.5um for both transistors.
      i. Establish a test bench, as explained in the lecture, to achieve VDSQ=VDD/2.
      ii. Calculate input bias voltage if bias current=50uA.
      iii. obtain the bias current. Compare its value with 50uA.
      iv. Determine small signal voltage gain, -3dB BW and GBW of the amplifier using small signal analysis (consider 30fF load capacitance).
      v. Plot step response of the amplifier for input pulse amplitude of 0.1V. Derive time constant of the output and compare it with the time constant resulted from -3dB BW.
      vi. To determine input voltage range of the amplifier

5) Two stage OPAMP Vdd=1.8V Vss=0V Note: Adjust accuracy options of the simulator (setup->options in GUI). Use proper values of resistors to get a Two stage OPAMP with differential-mode voltage gain=10.
   Consider voltage gain=2 for the first stage and voltage gain=5 for the second stage.
   i. Draw the schematic of op-amp macro model.
   ii. Determine parameters of the op-amp macro model such that
   a) Low-frequency voltage gain b)Unity gain BW c)CMRR
   iii. Draw schematic diagram of CMRR simulation setup.
6) Technology: UMC 0.18um, VDD=1.8V. Use MAGIC or Microwind.
   a) Draw layout of a minimum size inverter in UMC 0.18um technology using MAGIC Station layout editor. Use that inverter as a cell and lay out three cascaded minimum-sized inverters. Use M1 as interconnect line between inverters.
   b) Run DRC, LVS and RC extraction. Make sure there is no DRC error. Extract the netlist.
   c) Use extracted netlist and obtain tPHL&tPLH for the middle inverter.
   d) values of delay times with corresponding values obtained in part 'c'.

Course Outcomes: At the end of the laboratory work, students will be able to:

1. Design digital and analog Circuit using CMOS.
2. Use EDA tools like Cadence, Mentor Graphics and other open source software tools like microwind, Ng spice.

NOTE:

1. Each Laboratory Class/Section shall not be of more than about 20 students.
2. To allow fair opportunity of practical hands-on experience to each student, each experiment may either be done by each student individually or in a group of not more than 3-4 students. Larger groups be strictly discouraged / disallowed.
3. Pre-experimental & post experimental quiz / questions may be offered for each Lab experiment to reinforce & aid comprehension of the experiment.

MTEC557C **RESEARCH METHODOLOGY AND IPR**

M. Tech. Electronics and Comm Engg

Semester –I

L	T	P	Credits
2	-	-	2

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand research problem formulation.
2. To analyze research related information
3. To understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. To 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.
5. To understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT II

Effective literature studies approaches, analysis Plagiarism , Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT III

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

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

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. 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.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Text/Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science& engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 nd Edition , "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 NewTechnological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Approved in the 13th meeting of academic council held on 18/6/2018.

M.Tech. Programme (Audit Course)

AUD531C: ENGLISH FOR RESEARCH PAPER WRITING
M. Tech. Semester – I/II (Common to all Branches)

L	P	Credits		Class Work	:	25Marks
2	--	--		Examination	:	75 Marks
				Total	:	100 Marks
				Duration of Examination	:	3 Hours

Course Objectives: Students will be able to:

1. Understand that how to improve your writing skills and level of readability,
2. Learn about what to write in each section,
3. Understand the skills needed when writing a Title, and
4. Ensure the good quality of paper at very first-time submission

Course Outcomes:

The Students will become conscious citizens of India aware of their duties, rights and functions of various bodies of governance and welfare; thereby well equipped to contribute to India.

UNIT I: **Basics of Writing Skills:**
Subject Verb Agreements; Parallelism; Structuring Paragraphs and Sentences; Being Concise and Removing Redundancy; Avoiding Ambiguity and Vagueness; Dangling Modifiers

UNIT II: **Reviewing and Citation:**
Clarifying Who Did What; Highlighting Your Findings from Literature; Hedging and Critiquing; Paraphrasing; Avoiding Plagiarism; Formatting and Citation (Publication Manual of the American Psychological Association)

UNIT III: **Sections of a Research Paper:**
Writing Effective and Impressive Abstract; Writing Introduction; Review of Literature; Defining Objectives of the Study; Methodology Adopted; Results Obtained; Discussion and Conclusion; Editing and Proof Reading to Ensure Quality of paper

UNIT IV: **Oral Presentation for Academic Purposes:**
Oral Presentation for Seminars, Conferences and Symposiums; Poster Presentation; Choosing AppropriateMedium; Interaction and Persuasion

TEXT / REFERENCE BOOKS:

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
5. Mc Murrey,David A. and Joanne Buckley. Handbook for Technical Writing. New Delhi: Cengage Learning, 2008.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

AUD533C: DISASTER MANAGEMENT
M. Tech. Semester – I/II (Common for all Branches)

L	P	Credits			
2	--	--	Class Work	:	25Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Course Objectives:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
4. Critically understand different aspects of disaster management

Course Outcomes: A student will be able to:

1. Know the significance of disaster management,
2. Study the occurrences, reasons and mechanism of various types of disaster
3. Learn the preventive measures as Civil Engineer with latest codal provisions
4. Apply the latest technology in mitigation of disasters

UNIT I: **Introduction to Disaster Management:** Definitions: Disaster, Emergency, Hazard, Mitigation, Disaster Prevention, Preparedness and Rehabilitation, Risk and Vulnerability, Classification of Disaster, Natural and Man made Disasters, Disaster Management Act 2005, Role of NDMA, NDRF, NIDM

Risk and Vulnerability to disaster mitigation and management options: Concept and Elements, Risk Assessment, Vulnerability, Warning and Forecasting.

UNIT II: **Hydro-meteorological based disasters I:** Tropical Cyclones, Floods, droughts, mechanism, Causes, role of Indian Metrological Department, Central Water Commission, structure and their impacts, classifications, vulnerability, Early Warning System, Forecasting, Flood Warning System, Drought Indicators, recurrence and declaration, Structural and Non-structural Measures.

Hydro-meteorological based disasters II: Desertification Zones, causes and impacts of desertification, Characteristics, Vulnerability to India and Steps taken to combat desertification, Prevention.

UNIT III: **Geological based disasters**: Earthquake, Reasons, Direct and Indirect Impact of Earthquake; Seismic Zones in India, Factors, Prevention and Preparedness for Earthquake, Tsunamis, Landslides and avalanches: Definition, causes and structure; past lesson learnt and measures taken; their Characteristic features, Impact and prevention, structural and non-structural measures.

UNIT IV: **Manmade Disasters I:** Chemical Industrial hazards; causes and factors, pre- and post disaster measures; control ; Indian Standard Guidelines and Compliance; Oil Slicks and Spills, Outbreak of Disease and Epidemics, Traffic accidents; classification and impact, War and Conflicts; Fire risk assessment; Escape routes; fire fighting equipment;

Use of remote sensing and GIS in disaster mitigation and management.

TEXT / REFERENCE BOOKS:

1. Thomas D. Schneid., Disaster Management and Preparedness, CRC Publication, USA, 2001
2. Patrick Leon Abbott, Natural Disasters, Amazon Publications, 2002
3. Ben Wisner., At Risk: Natural Hazards, People vulnerability and Disaster, Amazon Publications, 2001
4. Oosterom, Petervan, Zlatanova, Siyka, Fendel, Elfriede M., "Geo-information for Disaster Management", Springer Publications, 2005
5. Savindra Singh and Jeetendra Singh, Disaster Management, Pravalika Publications, Allahabad

Approved in the 13th meeting of academic council held on 18/6/2018.

6. Nidhi GaubaDhawan and AmbrinaSardar Khan, Disaster Management and Preparedness, CBS Publishers & Distribution
7. Selected Resources Published by the National Disaster Management Institute of Home Affairs, Govt. of India, New Delhi.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

AUD535C: SANSKRIT FOR TECHNICAL KNOWLEDGE

M. Tech. Semester – I/II (Common for all Branches Engineering)

L	P	Credits			
2	--	--	Class Work	:	25Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Course Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in Mathematics, Science & other subjects
4. Enhancing the memory power

Course Outcomes: Students will be able to

1. Understand basic Sanskrit language
2. Understand Ancient Sanskrit literature about science and technology
3. Get equipped with Sanskrit and explore the huge knowledge from ancient literature

	Audit 1 and 2: Sanskrit for Technical Knowledge	
Unit	Content	
I.	Nominative Forms of Pronouns– अस्मद्,युस्मद् एतत् एवं तत् के रूप– पुल्लिग,नपुंसकलिंग एवं स्त्रीलिंग अकारान्त षब्दरूप पुल्लिग एवं नपुंसकलिंग में धातुएं– पठ्,खाद्,लिख,गम् (पांच लकारों में) सामान्य वाक्य बनाना	06
II.	आकरान्त (यथा–रमा) ईकरान्त (यथा – नदी) षब्दों का प्रायोग तत्,एतत्,यत्,किम्– षब्दों का सभी कारकों में वाक्य में प्रयोग,	06
III.	विसर्ग सन्धि,स्वर सन्धि,अयादि सन्धि,	06
IV.	प्रत्ययों का प्रयोग – षतृ,षानच्,क्तवतु, कत,कतृवाच्य से कर्मवाच्य में परिवर्तन – (क्त एवं क्तवतु) केवल प्रथम पुरूष का वाच्य परिवर्तन	06

TEXT / REFERENCE BOOKS:

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

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

AUD537C: VALUE EDUCATION

M. Tech. Semester – I/II (Common for all Branches)

L	P	Credits			
2	--	--	**Class Work**	**:**	**25Marks**
			Examination	**:**	**75 Marks**
			Total	**:**	**100 Marks**
			Duration of Examination	**:**	**3 Hours**

Course Objectives: The students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Course Outcomes: The students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality
4. Strengthen the "EQ"

Unit I: Hierarchy and Classification of values,
Values and Belief Systems, Competence in professional ethics,
Value judgment based on cultural, tradition and interdependence.

Unit II: Need for value education
Sense of duty.Devotion, Self-reliance.
Honesty, Humanity, trust.Patriotism and national Unity.
Harmony in the nature and realization of coexistence
Vision of better India

Unit III: Understanding the meaning and realizing the effect of the following:
Aware of self- destructive habits, Knowledge, Acceptance, Love, Situations, happiness, Bliss, Peace,Power, Purity , Realization, Assertiveness, Regard, Respect, Sensitive, Divinity, emotions, Repentance, hurt, Ego, Attachment, worry, Resentment, Fear, Anxiety, Greed, Criticism, Tension, Frustration, Expectation, Irritation, Anger, Guilt, Jealous, Pear Pressure, True Friendship, Cooperation -Coordination- competition.
Enhancing self esteem and personality.

Unit IV: Hinduism, Jainism, Buddhism, Christianity, Islam, Sikhism.
Self-management and Good health (Role, Responsibility, Relation, Routine, Requirements, Resources)
My True self and Original qualities.Supreme-soul- source of values.
What Scientists say about super power?

TEXT / REFERENCE BOOKS:

1. Chakroborty, S.K. Values and Ethics for organizations Theory and practice. Oxford University Press, New Delhi.
2. R R Gaur, R Sangal, G P Singh.Human Values and Professional Ethics. Excell Books, New Delhi.
3. Value Education in Spirituality- Course-I, course -II by Brahma Kumaris Education Wing, RajyogaEducation & Research Foundation, Mount Abu, Rajasthan.
4. True Management: I K International Publication 2018.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

AUD539C: CONSTITUTION OF INDIA
M. Tech. Semester – I/II (Common for all Branches)

L	P	Credits			
2	--	--	**Class Work**	**:**	**25Marks**
			Examination	**:**	**75 Marks**
			Total	**:**	**100 Marks**
			Duration of Examination	**:**	**3 Hours**

Course Objectives: Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. 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.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes:

The Students will become conscious citizens of India aware of their duties, rights and functions of various bodies of governance and welfare; thereby well equipped to contribute to India.

Unit I: **Making of the Indian Constitution and its Philosophy**

Sources of Indian Constitution, its Preamble and Salient Features.

Unit II: **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
Fundamental Duties

Unit III: **Organs of Governance**

Legislature: Parliament and its Composition; Qualifications and Disqualifications of Its members
Executive: President, Governor and Council of Ministers
Judiciary: Appointments, Qualifications, Powers and Functions of judges

Unit IV: **Local Administration and institutes for welfare**

District Administration Head: Role and Importance; Municipalities: Introduction, Mayor and role of Elected Representative
Panchayati Raj Institutions: Introduction, Gram Panchayat, Panchayat Samiti and Zila Panchayat
Institutes and Bodies for the welfare of SC/ST/OBC and women

TEXT / REFERENCE BOOKS:

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 Ed., Lexis Nexis, 2014

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

AUD541C: PEDAGOGICAL STUDIES

M. Tech. Semester – I/II (Common for all Branches)

L	P	Credits			
2	--	--	**Class Work**	**:**	**25Marks**
			Examination	**:**	**75 Marks**
			Total	**:**	**100 Marks**
			Duration of Examination	**:**	**3 Hours**

Course Objectives: The course will enable the student teachers:

1. To understand the concept of pedagogy and conceptual framework.
2. To gain insight on the meaning and nature of different pedagogies.
3. To determine aims and strategies of teaching- learning.
4. To understand the principals, maxims of successful teaching and the different methods of teaching.
5. Comprehend the need and importance of various devices of teaching and learning and their relationship between the two.
6. Point out and illustrate the difference between teaching and learning and their relationship between the two.
7. To appreciate that science/ engineering is a dynamic and expanding body of knowledge.

Course Outcomes: Students will be able to understand:

1. It will improve teaching effectiveness of prospective teachers.
2. A prospective teacher will be able to design curriculum and assess the curriculum of their discipline in an effective way by understating the needs of the learners.
3. How can teacher education, school curriculum and guidance support effective pedagogy?
4. It will be functional for professional development among teachers.

Unit I: **Introduction and Methodology**

- Aims and Rationale, Conceptual Framework, Terminology related to Pedagogy
- Contexts, Research Questions
- Theories of Learning, Curriculum, Scope of Pedagogy

Unit II: **Teaching**

- Meaning and importance of Behavioral Objectives
- Writing of Objectives in Behavioral Terms
- Phases and Variables of Teaching
- Principles, levels and maxims off teaching
- Relationship between Teaching and Learning

Unit III: **Methods of Teaching**

- Methods: Inductive, Deductive, Project, Analytic, Synthetic, Brain Storming, Case Discussion
- Concept and Significance of Individualized and Cooperative Teaching-Language Laboratory, Tutorials, Keller's Plan (PSI), Computer Supporting Collaborative Learning
- Mastery Learning: Concept, Basic Elements, Components and Types of Mastery Learning Strategies

Unit IV: **Evaluation Strategies**

- Evaluation in Teaching: Concept of Evaluation, Relationship between Teaching and Evaluation, Types of Evaluation (Formative and Summative)
- Methods of Evaluation through Essay Type. Objective Type and Oral Method, Comparative merits and demerits of evaluation methods
- Latest Trends in Evaluation

TEXT / REFERENCE BOOKS:

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.

Approved in the 13th meeting of academic council held on 18/6/2018.

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.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.
8. Dyer C (2008) Early years literacy in Indian urban schools: Structural, social and pedagogical issues, Language and Education, 22 (5): 237-253.
9. Sharma N (2013) An exploration of teachers' beliefs and understanding of their pedagogy, MPhil thesis, Mumbai: TATA Institute of Social Sciences.
10. Zeichner K, Liston D (1987) Teaching student teachers to reflect, Harvard Educational Review, 56 (1): 23-48.
11. Watkins C, Mortimore P (1999) Pedagogy: What do we know? In Mortimore P (ed.) Understanding pedagogy and its impact on learning. London: Paul Chapman Publishing.
12. Tyler R (1949) Basic principles of curriculum and instruction. Chicago: Chicago University Press.
13. Arends, R.1. (1 994) Learning to Teach, New York: McGraw-Hill.
14. Lunenberg M, Korthagen F, Swennen A (2007) The teacher educator as a role model, Teaching and Teacher Education, 23: 586-601.
15. Meena . Wilberforce E. Curriculum Innovation in Teacher Education: Exploring Conceptions among Tanzanian Teacher Educators. ÅBO AKADEMI UNIVERSITY PRESS, 2009.
16. Cooley, W. W., and Lohnes, P. R. (1976). Evaluation research in education. New York: Irvington.
17. Hassard, Jack, 2004, The Art of Teaching Science, Oxford Univesity Press.
18. Joyce, B., Weil, M., Calhoun, E. : (2000). Models of teaching, 6th edition, Allyn & Bacon.
19. Kyriacou, C. (2007) Effective teaching in schools – theory and practice. Cheltenham: Nelson Thornes.
20. Nye, B., Konstantopoulos, S. & Hedges, L.V. (2004) 'How large are teacher effects?' Educational evaluation and policy analysis, 26(3), 237-257.
21. National Staff Development Council. (2001). NSDC's standards for staff development. Oxford, OH: Author.
22. Serpell, Z. & Bozeman, L. (1999). Beginning teacher induction: A report on beginning teacher effectiveness and retention. Washington, DC: National Partnership for Excellence and Accountability in Teaching.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

AUD543C: STRESS MANAGEMENT BY YOGA
M. Tech. Semester – I/II (Common for all Branches)

L	P	Credits			
2	--	--	**Class Work**	**:**	**25Marks**
			Examination	**:**	**75 Marks**
			Total	**:**	**100 Marks**
			Duration of Examination	**:**	**3 Hours**

Course Objectives:

1. To achieve overall health of body and mind
2. To overcome stress

Course Outcomes: Students will be able to:

1. Develop healthy mind and healthy body thus improving social health also
2. Improve efficiency
3. Improving "SQ"

Unit I:

1. Causes of stress, consequences of stress, diagnosis of stress, solution of reducing Stress.
2. Difference and relation b/w Yog and Yoga,
3. benefits of meditation and Yoga,
4. Rules and Regulation of Yog and Yoga.
5. Empowerment of Soul and fitness of body.

Unit II:

1. Do`s and Don't's in life.
2. How to be and not to be?
3. Understanding spirituality and materials.
4. Impact of: Truth at mouth/ Truth in thoughts
   Non Violence outside / Compassion in thoughts, Celibacy (kamnayn- desire), purity of mind , non-covetousness, Cleanliness, satisfaction, self study and surrender to almighty, Austerity, Penance

Unit III: Role of Meditation in reducing Stress.
Role of Yoga in reducing Stress.
Pranyama: AnulomVilom ,Ujjai, Costal Breathing, Abdominal Breathing, Sunyak, Kumbhak

Unit IV: **Asan:**Sukhasana, Vajrasana, Padmasana, Swastik Asana, Ling Mudra, Gorakshasana, Talasana, Konasana, Trikonasana, Chakrasana, Utkatasana, Dhurva Asana, Garuda Asana, Bhadrasana, Parvatasana, Yoga Mudra, Paschimottasana, Vakrasana, Gomukhasana, Bakasana, Tulasana, Matsyasana, Mayuri Asana, Bhujagasana, DhanurVakrasana, PavanMuktasana, Viprtkarani, Makarasana, Shavasana, Dridasana, Yonimudra, Nauli, Dhenu Mudra.

TEXT / REFERENCE BOOKS:

1. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama, (Publication Department), Kolkata
3. "Value Education in Spirituality- Course-IV" by Brahma Kumaries Education Wing, Rajyoga Education Research Foundation, Mount Abu, Rajasthan.
4. "Stress Management for Dummies" by Allen Elkin, IDG Books India (P) Ltd.
5. "Yoga Courses for All" by Dr Hansraj Yadav, BhartyaVidyaBhawan, Mumbai

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

AUD545C: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

M. Tech. Semester – I/II (Common for all Branches)

L	P	Credits			
2	--	--	**Class Work**	**:**	**25Marks**
			Examination	**:**	**75 Marks**
			Total	**:**	**100 Marks**
			Duration of Examination	**:**	**3 Hours**

Course Objectives: Students will be able to:

1. To learn and achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Course Outcomes:

1. The study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity.
3. Study of Neetishatakam will help in developing versatile personality of students.

Unit I: **Holistic Development of Personality**

Neetisatakam-Verses-19,20,21,22 (Wisdom), Verses-29, 31 32 (Pride and Heroism) ,Verses-26,28,63,65 (Virtue)

Unit II: **Approach to Day to Day Work and Duties**

Shrimad BhagwadGeeta: Chapter 2 (Verses- 41, 47, 48), Chapter 3 (Verses- 13, 21, 27, 35), Chapter 6 (Verses- 05, 13, 17, 23, 35), Chapter 18 (Verses- 45, 46, 48)

Unit III: **Statements of Basic Knowledge**

Shrimad BhagwadGeeta: Chapter 2 (Verses- 56, 62,68), Chapter 12 (Verses- 13, 14, 15, 16, 17, 18)

Unit IV: **Personality of a Role Model**

Shrimad BhagwadGeeta: Chapter 2 (Verses- 17), Chapter 3 (Verses 36, 37, 42), Chapter 4 (Verses 18, 38, 39), Chapter 18 (Verses 37, 38 63)

TEXT / REFERENCE BOOKS:

1. Srimad Bhagavad Gita by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.
3. BhagvadGeeta- Prof. Satyavrata Siddhantalankar, Orient Publishing.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

MTEC502C **INTERNET OF THINGS**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To vision and introduction to IoT.
2. To understand IoT market perspective.
3. To data and knowledge management and use of devices in IoT technology.
4. To understand state of the art – IoT architecture.
5. To real world IoT design constraints, industrial automation and commercial building automation in IoT.

UNIT I

Introduction to Internet of Things (IoT): Definition of the Internet of Things (IoT), The Importance of the Internet of Things (IoT) in Society IoT Architecture, History of IoT, M2M Machine to Machine, Web of Things, Overview of IoT Lab Hardware platforms, The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, 6LoWPAN, Understand IoT Market perspective in different segments.

Operating System used for IoT: Linux Operating System introduction, Working with the command line and the Shell, Managing directories and files, Managing user access and security, Setting up a Linux file system, Understanding system initialization, Connecting a system to the network, Installing and Configuring Linux

UNIT II

Shell Scripting Programming for IoT: Introduction, Creating Shell Scripts, Flow control in the Shell, Advanced Shell features Programming Language used in IoT, C Programming, Python

UNIT III

Hardware Interfacing for IoT: Sensors interfacing, Actuators interfacing**,** Communication Protocol study for IoT, UART Communication, RS485 Communication, I2C Protocol device interfacing, SPI Protocol device interfacing, Ethernet configuration, Zigbee interfacing, Wi-Fi AP and Router interfacing

UNIT IV

Case study & advanced IoT Applications with: Smart Agriculture Sensors, Smart Environment Sensors, Smart Industrial Sensors, Smart Water Sensors, Smart Home Automation, Smart Security Solutions

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

1. Understand the vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use of Devices, Gateways and Data Management in IoT.
4. Building state of the art architecture in IoT.
5. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

Text Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC504C ADVANCED OPTICAL COMMUNICATION & NETWORKS

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand the fundamental behaviour of the individual optical components, describes their interactions with other devices in an optical fiber.
2. To study the basic components of Optical fiber Communication systems.
3. To understand the operational principle of WDM, SONET, ATM, DWDM.
4. To understand different optical fiber based systems and networks based on power budget analysis.

UNIT I

Introduction to optical fiber: Introduction to ray theory, theory of optical wave propagation, optical fiber attenuation ,optical fiber absorption ,scattering and band losses ,classification of optical fiber ,dispersion, dispersion shifted fiber ,dispersion modified fibers, dispersion compensated fibers, optical fiber non linear impairments.

Optical amplifier: Types of optical amplifier, Raman optical amplifiers, semiconductor optical amplifier, Erbium doped fiber amplifier.

UNIT II

Optical transmitter and receiver: Introduction, Data pattern, photo detector diodes, classification of optical receiver, optical receiver performance characteristics, LED transreceivers, LASER diode Transreceiver.

UNIT III

Optical modulation: Introduction, The Mach zander interferometer, The Mach zander (LINBO3)Optical modulator.

Multiplexing: Introduction ,WDM, AWG multiplexer/demultiplexer for DWDM system add/drop multiplexer/demultiplexers.

UNIT IV

Optical Network & Photonic switching: WDM-Networking Evolution, SONET/SDH, optical access networks, PON, EPON & FTTC, Wavelength conversion, need for wavelength conversion, wavelength convertors.

Photonic Switching: Introduction, OCS, OBS, Optical Packet switching (OPS)

Course Outcome: By the end of the course, the students shall be able to:

1. Describe and Analyse the optical fiber based systems.
2. Identify and Design optical fiber based networks.
3. Learnt multiplexing concepts for optical communication.
4. Students have thorough knowledge of establishing any optical link which will make them fit to be placed in relevant industry.

Text/ Reference Books:

1. WDM optical Networks by C. Sivaram Murthy, PHI publication.
2. Horal Kolimbris "fiber optical communication "Pearson
3. Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK,Elsevier, 3rd edition, 2010.
4. Gerd Keiser, "Optical Fiber Communication", TMH

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
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Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC520C **ADVANCED DIGITAL IMAGE PROCESSING**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To learn different image transform.
2. To learn multiresolution analysis of images using wavelets.
3. To understand the concept of image restoration and image compressions.
4. To appraise students with image segmentation and color image processing.

UNIT I

Review of spatial and frequency domain processing; Image Transforms, Need for image transforms, DFT, DCT. Multiresolution analysis, Wavelet transforms: Haar Wavelet, Wavelet series expansion, Continuous Wavelet Transform, Discrete Wavelet Transform, Faster implementation of DWT: one -dimensional DWT, two-dimensional DWT, Applications of Wavelet transforms. JPEG 2000 image compression standard.

UNIT II

Image Restoration and Reconstruction

Restoration in presence of Noise only: A model of the image degradation/ restoration process, Noise models: Spatial and frequency properties of noise, some important noise probability density functions, Periodic Noise, Estimation of Noise Parameters; Restoration in the presence of noise only spatial filtering: Mean Filters, Order Statistic Filters, Adaptive Filters; Periodic noise reduction by frequency domain filtering: Bandreject Filters, Bandpass Filters, Notch Filters.

Restoration in presence of Degradations: Linear, Position –Invariant Degradations, Estimating the Degradation Function: Estimation by Image Observation, Estimation by Experimentation, Estimation by Modeling; Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.

UNIT III

Image Compression: Fundamentals: Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information, measuring Image Information, Fidelity Criteria, Image Formats, Containers, and Compression Standards; Basic Compression Methods: Huffman Coding, Arithmetic Coding, Run length Coding, Symbol Based Coding, Bit Plane Coding, Block Transform Coding, Wavelet Coding, Digital Image Watermarking.

Image Segmentation: Detection of Discontinuities: Point, Line, and Edge detection, Boundary detection, Thresholding: Role of Illumination, basic global thresholding, Using Image Smoothing to improve global thresholding, Using Edges to improve global thresholding, Multiple thresholds, Variable Thresholding, Multivariable Thresholding, Regional –Based segmentation: Region growing, region splitting and merging, use of motion in segmentation: Spatial Techniques, Frequency Domain Techniques.

UNIT IV

Colour image Processing

Colour fundamentals, Colour models: The RGB Colour Model, The CMY and CMYK Colour models , The HSI Colour model; Conversion of colour models, Pseudo colour image processing: Intensity Slicing, Intensity to colour Transformations, Basics of Full Colour image processing.

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

1. Learn multiresolution analysis of images using wavelets.
2. Restore the images using different types of filters and techniques as per the image.
3. Compress the image for different application.
4. Segment the image as per requirement and representing images in different color models.

Text/Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, 3rd Edition. Pearson India, 2008.
2. S. Shridhar, “Digital Image Processing”, 2nd Edition, Oxford University Press, 2016.
3. J. W. Woods, “Multidimensional Signal, Image and Video Processing and Coding”,2nd Edition, Academic Press, 2011.
4. Ed. Al Bovik ,”Handbook of Image and Video Processing”, 2nd Edition, Academic Press, 2000.

NOTE:

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Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC522C **ANTENNAS AND RADIATING SYSTEMS**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits			
3	-	-	3			

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To compute the far field distance, radiation pattern and gain of an antenna for given current distribution.
2. To estimate the input impedance, efficiency and ease of match for antennas.
3. To compute the array factor for an array of identical antennas.
4. To design antennas and antenna arrays for various desired radiation pattern characteristics.

UNIT I

Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Array antennas 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, FRISS Transmission equation, Antenna Temperature.

UNIT II

Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects.

Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non uniform current.

UNIT III

Linear Arrays: Two element array, N Element array: Uniform Amplitude and spacing, Broadside and End fire array, Super directivity, Planar array, Design consideration.

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.

UNIT IV

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

Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introduction to MIMO.

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

1. Compute the far field distance, radiation pattern and gain of an antenna for given current distribution.
2. Estimate the input impedance, efficiency and ease of match for antennas.
3. Compute the array factor for an array of identical antennas.
4. Design antennas and antenna arrays for various desired radiation pattern characteristics.

Text/Reference Books:

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", TataMcGraw-Hill, 2002.
3. R.C.Johnson and H.Jasik, "Antenna Engineering hand book", Mc-Graw Hill, 1984.
4. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
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Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC524C **VOICE AND DATA NETWORKS**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To learn protocol, algorithms, trade-offs rationale.
2. To understand routing, transport, DNS resolutions
3. To understand network extensions and next generation architectures.

UNIT I

Network Design Issues, Network Performance Issues, Network Terminology, centralized and 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 II

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

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.

UNIT IV

Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

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

1. Protocol, algorithms, trade-offs rationale.
2. Routing, transport, DNS resolutions
3. Network extensions and next generation architectures.

Text/Reference Books:

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 andSons, 1975.
6. Aaron Kershenbaum, “Telecommunication Network Design Algorithms”, McGraw Hill,1993.
7. Vijay Ahuja, “Design and Analysis of Computer Communication Networks”, McGrawHill, 1987

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC526C **MEMS AND IC INTEGRATION**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course objective:

1. To familiarize students with fundamental basis of MEMS devices, such as microactuators and microsensors, as well as their principles of operation.
2. The course will introduce micromachining techniques and microfabrication techniques.
3. They will learn the applications to the design and manufacturing of an MEMS device.
4. They will study the Microsystems fabrication processes.

UNIT I

MEMS and Microsystems: Overview of CMOS process in IC fabrication, MEMS system-level design methodology, Microfabrication Evolution, Microsystems miniaturization, Microsystem Applications in health care industry, aerospace industry, telecommunications.

Microsensors and Microactuation: Working principles of Microsystems, Microsensors – acoustic wave sensors, biomedical sensors, optical sensors, thermal sensors, Pressure sensors with embedded electronics(Analog/Mixed signal): Accelerometer with transducer, Gyroscope, RF MEMS, optical MEMS, Sensor noise calculation, Bolometer Design, Microactuation overview, Microactuation using thermal forces, electrostatic forces, shaped memory alloys, piezoelectric crystals, Microgrippers, Micromotors, Microvalves, Micropumps, Microaccelerometers, Microfluidics.

UNIT II

Microsystem Design- Mechanics Engineering: Equivalent Circuit representation of MEMS, signal conditioning circuits. Engineering Science and Engineering Mechanics for Microsystem Design

Microsystem Design- Thermofluid Engineering: Thermofluid engineering and microsystem design – fluidmechanics at macro and mesoscale, fluid flow in nanoscale designs.

UNIT III

Scaling laws in Miniaturized Designs: Scaling in electrostatic forces, electromagnetic forces, Scaling in electricity, fluid mechanics and heat transfer.

Microsystems fabrication processes: Materials for MEMS and Microsystems, Photolithography, Ion Implantation, Diffusion, CVD, PVD, Epitaxy, Etching with reference to concers involved in microfabrication.

UNIT IV

Micromanufacturing: Bulk Micromanufacturing, Surface Micromachining, LIGA Process

Micropackaging: Microsystem Packaging, Interfaces in Microsystem Packaging, Packaging Technologies, Three dimensional packaging, Microsystems assembly, Selection of Packaging Materials.

Course Outcomes:

1. After successful completion of the course, students will be able to apply and analyze the concepts of advanced Microsystem fabrication technologies.
2. They have the ability to design different techniques and process for microsensor & microactuators.
3. Understand and design of different packaging techniques and material of MEMS.
4. They have learned the design applications of MEMS in various areas.

Text/ Reference Books:

1. Gregory T.A. Kovacs, Micromachined Transducers Sourecbook, The McGraw-Hill, Inc. 1998
2. Stephen D. Senturia, Microsystem Design, Kluar Publishers, 2001
3. Nadim Maluf, An Introduction to Microelectromechanical Systems Engineering, Artech House, 2000.
4. M.H. Bao, Micro Mechanical Transducers, Volume 8, Handbook of Sensors and Actuators, Elsevier, 2000.
5. H. J. De Los Santos, Introduction to Microelectromechanical (MEM) Microwave Systems, Artech, 1999.
6. Masood Tabib-Azar, Microactuators, Kluwer, 1998.
7. LjubisaRistic, Editor, Sensor Technology and Devices, Artech House, 1994
8. D. S. Ballantine, et. al., Acoustic Wave Sensors, Academic Press, 1997
9. James M.Gere and Stephen P. Timoshenko, Mechanics of Materials, 2nd Edition, Brooks/Cole Engineering Division, 1984

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC528C MULTIMEDIA COMMUNICATION

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits			
3	-	-	3	Class Work	:	25 Marks
				Theory	:	75 Marks
				Total	:	100 Marks
				Duration of Exam.	:	3 Hrs.

Course Objectives:

1. The objectives of a multimedia system are to send information, educate the public and provide entertainment.
2. Multimedia will help to improve computer penetration in various spheres of life.
3. To study about various multimedia networks.
4. To learn about designing for the World Wide Web.

UNIT I

Multimedia & Information Representation

Multimedia Introduction: multimedia networks, Telephone networks, Data Networks, Broadcast television networks, Integrated services digital networks, Broadband multiservice networks, types of Multimedia Applications: Movie on Demand, Near Movie on Demand, communication modes, multipoint conferencing, network QOS, Application QOS.

Multimedia Information Representation: Digitization principles, Encoder Design, Decoder Design, Unformatted Text, Formatted Text, Hypertext, Images: Graphics, Digitized documents, Digitized pictures; Audio: PCM speech, CD-quality audio, Synthesized audio; Video: Broadcast television, Digital video, PC video, video content.

UNIT II

Text and Image Compression

Compression Principles & Text Compression: Compression Principles: Source encoders and Destination decoders, Lossless and lossy compression, Entropy encoding, Source encoding; Text Compression: Static Huffman coding, Dynamic Huffman Coding, Arithmetic Coding.

Image Compression: Graphics Interchange Format, Tagged image file format, digitized documents, digitized pictures.

UNIT III

Audio and Video compression: Audio Compression: Differential Pulse Code Modulation, Adaptive Differential PCM, Adaptive predictive coding, Linear Predictive coding, Code –excited LPC, Perceptual Coding.

Video compression: video compression principles, Motion Pictures Expert Group (MPEG), MPEG1, MPEG2.

UNIT IV

The internet and multimedia: The internet, Internetworking: Internet addresses, connections, The Bandwidth Bottleneck, Internet services, MIME-Types, The world wide web and HTML, Dynamic web pages and XML, multimedia on the web, Tools for the World Wide Web: web browsers, web servers, web page makers and site builders, plug-ins and delivery vehicles.

Designing For The World Wide Web: Developing for the web: HTML is a Markup Language, The Desktop Workspace, The Small Device Workspace, nibbling, Text for the web: making columns of text, flowing text around images; images for the web: GIF and PNG Images, JPEG Images, Using Photoshop, Backgrounds, clickable buttons, Client –side image maps, sound for the web, animation for the web.

Course Outcomes:

1. Students will learn the basic concept of multimedia information representation and multimedia networks.
2. Learn QoS and its applications.
3. Able to understand different multimedia data in digital formats.
4. Learn various compression techniques and standards.

Text Books:

1. Fred Halsall, “Multimedia Communications”, Pearson
2. Tay Vaughan, “Multimedia, making it work” Eighth edition, Tata McGraw-Hill Edition

Reference Books

1. Rao, Bojkovic&Milovanovic, “Multimedia Comm. System: Techniology , Std. & Network”, PHI
2. John F. KoegelBufod, “Multimedia Systems”, Addison Wesley, Edition. 2000

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC530C **CYBER SECURITY**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To make our graduates aware about cyber security.
2. How cyber laws can be used for our safety?
3. How industry uses cyber security issues?
4. What are the cyber security policies of the country?
5. How issues related to cyber security can be resolved?

UNIT I

Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

UNIT II

Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control.

Security Threats: Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e-Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.

UNIT III

Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.

UNIT IV

Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies.

Information Security Standards: ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.

Course Outcomes:

1. The graduates must be able to address their problems related to cyber issues.
2. They will be prepared in better way for facing the cyber world.
3. Graduates will be able to give their suggestions related to cyber security.
4. Graduates can help individuals and industries regarding cyber laws, policies and crimes.

Text Books:

1. Charles P. Pfleeger, Shari LawerancePfleeger, “Analysing Computer Security ”, Pearson Education India.
2. V.K. Pachghare, “Cryptography and information Security”, PHI Learning Private Limited, Delhi India.

References Books:

1. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla ,”Introduction to Information Security and Cyber Law” Willey Dreamtech Press.
2. Schou, Shoemaker, “ Information Assurance for the Enterprise”, Tata McGraw Hill.
3. Chander, Harish,” Cyber Laws And It Protection ” , PHI Learning Private Limited ,Delhi ,India

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC532C **DSP PROCESSORS**

M. Tech. Electronics and Comm Engg
Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. The main objectives of this course are to teach & aware students about D.S.P. processors, their characteristics and applications.
2. They will learn about the internal architecture and Memory architecture.
3. They'll also learn addressing modes and instruction set of D.S.P. processors and their programming using assembly language.
4. In addition, they'll gain knowledge about different D.S.P. processors and their interfacing with peripherals.

UNIT I

Introduction to DSP Processors: Advantages of DSP, characteristics of DSP systems, classes of DSP applications, DSP processor embodiment and alternatives, Fixed Vs Floating point processors, fixed point and Floating point Data Paths.

DSP Architecture: An introduction to Harvard Architecture, Differentiation between Von-Neumann and Harvard Architecture, Quantization and finite word length effects, Bus Structure, Central Processing Unit, ALU, Accumulators, Barrel Shifters, MAC unit, compare, select, and store unit (CSSU), data addressing and program memory addressing

UNIT II

Memory Architecture: Memory structures, features for reducing memory access required, wait states, external memory interfaces, memory mapping, data memory, program memory and I/O memory, memory mapped registers.

Addressing & Instruction set: Various addressing modes - implied addressing, immediate data addressing, memory direct addressing, register direct and indirect addressing, and short addressing modes, Instruction types, various types registers, orthogonality, assembly language and application development.

UNIT III

Execution Control and Pipelining: Hardware looping, interrupts, stacks, pipelining and performance, pipelining depth, interlocking, branching effects, interrupt effects, instruction pipelining.

PERIPHERALS: Serial ports, timers, parallel ports, bit I/O port, host ports, communication ports, on-chip A/D and D/A converters, external interrupts, on chip debugging facilities, power consumption and management.

UNIT IV

Processors: Architecture and instruction set of TMS320C3X, TMS320C5X, TMS320C6X, ADSP 21XX DSP Chips, some example programs.

Recent Trends In DSP System Design: FPGA-based DSP System Design, advanced development tools for FPGA, Development tools for Programmable DSPs, Code Composer Studio.

Course Outcomes:

1. After the completion of the course the students gain knowledge and understanding of the characteristics and applications of D.S.P. processors.
2. They will understand the internal working of D.S.P. processors and their memory architecture.
3. They learn about the addressing modes and instruction set of D.S.P. processors using which they can program D.S.P.s using assembly language.
4. They will be able to connect peripheral devices to D.S.P. processors.

Text Books:

1. Lapsley, P.Bier, J.Shoham, A. and Lee, E.A. DSP Processor Fundamentals: Architecture and Features, IEEE Press Series on Signal Processing, IEEE(2000)

Reference Books:

1. Venkataramani, B. and Bhaskar, M., Digital Signal Processor: Architecture, Programming and Applications, TMH(2003)

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC534C **BIOMEDICAL SIGNAL PROCESSING**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand different types of biomedical signal.
2. To identify and analyze different biomedical signals.
3. To find applications related to biomedical signal processing

UNIT I

Acquisition, Generation of Bio-signals, Origin of bio-signals, Types of bio-signals, Study of diagnostically significant bio-signal parameters.

UNIT II

Electrodes for bio-physiological sensing and conditioning, Electrode-electrolyte interface, polarization, electrode skin interface and motion artefact, biomaterial used for electrode, Types of electrodes (body surface, internal, array of electrodes, microelectrodes), Practical aspects of using electrodes, Acquisition of bio-signals (signal conditioning) and Signal conversion (ADC's DAC's)Processing, Digital filtering

UNIT III

Biomedical signal processing by Fourier analysis, Biomedical signal processing by wavelet (time frequency)analysis, Analysis (Computation of signal parameters that are diagnostically significant), Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals, Coherent treatment of various biomedical signal processing methods and applications.

UNIT IV

Principal component analysis, Correlation and regression, Analysis of chaotic signals Application areas of Bio–Signals analysis Multi resolution analysis(MRA) and wavelets, Principal component analysis(PCA), Independent component analysis(ICA), Pattern classification–supervised and unsupervised classification, Neural networks, Support vector Machines, Hidden Markov models. Examples of biomedical signal classification examples.

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

1. Understand different types of biomedical signal.
2. Identify and analyze different biomedical signals.
3. Find applications related to biomedical signal processing

Text/Reference Books:

1. W. J. Tompkins, "Biomedical Digital Signal Processing", Prentice Hall, 1993.
2. Eugene N Bruce, "Biomedical Signal Processing and Signal Modeling", John Wiley &Son's publication, 2001.
3. Myer Kutz, "Biomedical Engineering and Design Handbook, Volume I", McGraw Hill,2009.
4. D C Reddy, "Biomedical Signal Processing", McGraw Hill, 2005.
5. Katarzyn J. Blinowska, JaroslawZygierewicz, "Practical Biomedical Signal Analysis Using MATLAB", 1st Edition, CRC Press, 2011.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

MTEC536C **PROGRAMMABLE NETWORKS - SDN, NFV**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To understand advanced concepts in Programmable Networks.
2. To understand Software Defined Networking, an emerging Internet architectural framework.
3. To implement the main concepts, architectures, algorithms, protocols and applications in SDN and NFV.

UNIT I

Introduction to Programmable Networks, History and Evolution of Software Defined Networking (SDN), Fundamental Characteristics of SDN, Separation of Control Plane and Data Plane, Active Networking.

Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the basics of Open Flow protocol.

UNIT II

Network Virtualization: Concepts, Applications, Existing Network Virtualization Framework, Mininet A simulation environment for SDN.

Control Plane: Overview, Existing SDN Controllers including Floodlight and Open Daylight projects.

Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts. Data Plane: Software-based and Hardware-based; Programmable Network Hardware.

UNIT III

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

UNIT IV

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

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

1. Understand advanced concepts in Programmable Networks.
2. Understand Software Defined Networking, an emerging Internet architectural framework.
3. Implement the main concepts, architectures, algorithms, protocols and applications in SDN and NFV.

Text/Reference Books:

1. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks, An AuthoritativeReview of Network Programmability Technologies”, O'Reilly Media, August 2013.
2. Paul Goransson, Chuck Black, Timothy Culver. “Software Defined Networks: AComprehensive Approach”, Morgan Kaufmann Publishers, 2016.
3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, CRCPress, 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 IntellectualHistory of Programmable Networks” ACM CCR April 2014.
6. Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015.
7. OpenFlow standards, http://www.openflow.org, 2015.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
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Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC538C **DEVICE MODELLING**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits			
3	-	-	3	Class Work	:	25 Marks
				Theory	:	75 Marks
				Total	:	100 Marks
				Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To familiarize students with the modeling and the physical concepts behind the operation of semiconductor devices.
2. Students will learn about the Metal Semiconductor Junctions.
3. To provide students the insight useful for understanding new semiconductor devices.
4. Also learn the technologies used in VLSI systems.

UNIT I

Basic Semiconductor Physics: Energy Bands and Charge Carriers, Band Model, Bond Model, MOS Capacitor, Hall Effect. MOSFET and Compound Semiconductor FET, MOSFET capacitor, Basic operation, Basic modeling, Advanced MOSFET modeling, RF modeling of MOS transistors, Equivalent circuit representation of MOS transistor, High frequency behavior of MOS transistor and A.C small signal modeling

UNIT II

Metal Semiconductor Junctions: Equilibrium in Electronic Systems, Ideal metal semiconductor junctions, Schottky Barriers, Mott barrier, tunnel contacts and ohmic Contacts.

BJT: Bipolar Junction Transistors, model parameter extraction, modeling parasitic BJT, Resistors, Capacitors, Inductors, Ebers-Moll Model, Hetero Junction Bipolar Transistor

UNIT III

Noise modeling: Noise sources in MOSFET, Flicker noise modeling, Thermal noise modeling, model for accurate distortion analysis, nonlinearities in CMOS devices and modeling, calculation of distortion in analog CMOS circuits

Other MOSFET models : MOSFET Physical Effects , MOSFET High Field Effects, The EKV model, model features, long channel drain current model, modeling second order effects of the drain current, modeling of charge storage effects, Non-quasi-static modeling, noise model temperature effects, MOS model 9, MOSAI model

UNIT IV

Modeling of process variation and quality assurance: Influence of process variation, modeling of device mismatch for Analog/RF Applications, Benchmark circuits for quality assurance, Automation of the tests. Recent developments in Microelectronic Devices.

Course Outcome:

1. After successful completion of course, students will be able to understand and utilize the basic governing equations to analyze semiconductor devices.
2. They will able to implement different models of MOSFET for VLSI circuit.
3. They can design circuits to combat noise in MOSFET.
4. Since they are abreast with the latest concept of microelectronic device, they can be placed in relevant industries like C-DAC, Mentor Graphics.

Text Books:

1. S. M. Sze, *Modern Semiconductor Device Physics*, Wiley, 1998.

Reference Books:

1. R. S. Muller and T. I. Kaminis, *Device Electronics for Integrated Circuits*, Second Edition, Wiley, 1986.
2. Trond Ytterdal, Yuhua Cheng and Tor A. FjeldlyWayne Wolf, "Device Modeling for Analog and RF CMOS Circuit Design", John Wiley & Sons Ltd.
3. Donald A. Neaman, " Semiconductor physics and devices" Third Edition, McGraw –Hill Pvt Ltd,2007

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC540C **FREE SPACE OPTICAL COMMUNICATION**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objective:

1. To introduce wireless Gigabit technology by means of optical wireless communications.
2. To study the indoor and outdoor concepts of FSO.
3. To know how various modulation techniques specific to FSO effect communication.
4. To learn designing of FSO link.

UNIT-I

Introduction: Advantages, Disadvantages & classification of optical wireless system (indoor& outdoor), line of sight system, non line of sight systems, cellular system, indoor IR standard.

Wireless Optical channels: Free space optics outdoor channels, propagation in terrestrial link, beam divergence, atmospheric losses, absorption, scattering, atmospheric factors affecting transmission in FSO links; atmospheric turbulence.

UNIT-II

Modeling of atmospheric turbulence, spatial coherence of optical signals, channel impulse response / probability distribution of turbulence.

Induced intensity fading: log normal, negative exponential, Gamma Gamma.

UNIT-III

Modulation techniques for wireless optical communication, selection criteria of modulation scheme: on – off keying, M-pulse position modulation (M-PPM), M level pulse amplitude modulation, bandwidth, bit error rate power spectral density of above mentioned modulation scheme.

UNIT-IV

FSO link & system design: link design , link margin , link budget example of a terrestrial optical wireless communication system, optical link reliability, other factors influencing selection of FSO link , beam pointing & tracking , eye safety consideration.

Block diagram of FSO transmitter & receiver

Course Outcomes:

1. Students attain the knowledge of latest concepts of communication.
2. They also learn how to improve communication of data using FSO.
3. They can now design a system based on FSO in software.
4. A complete FSO link can be established as a hardware to study an alternate concept of communication.

Text/ Reference Books:

1. Terrestrial Wireless Optical Communication by Devi Chadha, Tata McGraw Hill.
2. Advanced free space optics by Majumdar, Arun K, Springer Series.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC542C **AUDIO PROCESSING**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objective:

1. To understand different characteristics of Speech.
2. To identify and analyze different speech analysis system.
3. To write algorithms for Recognition of speech.

UNIT-I

Principle Characteristics of Speech: Linguistic information, Speech and Hearing, Speech production mechanism, Acoustic characteristic of speech Statistical Characteristics of speech. Speech production models, Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model.

UNIT-II

Speech Analysis and Synthesis Systems: Digitization, Sampling, Quantization and coding, Spectral Analysis, Spectral structure of speech, Autocorrelation and Short Time Fourier transform, Window function, Sound Spectrogram, Mel frequency Cepstral Coefficients, Filter bank and Zero Crossing Analysis, Analysis –by-Synthesis, Pitch Extraction.

UNIT-III

Linear Predictive Coding Analysis: Principle of LPC analysis, Maximum likelihood spectral estimation, Source parameter estimation from residual signals, LPC Encoder and Decoder, PARCOR analysis and Synthesis, Line Spectral Pairs, LSP analysis and Synthesis. Speech Coding: Reversible coding, Irreversible coding and Information rate distortion theory, coding in time domain: PCM, ADPCM, Adaptive Predictive coding, coding in Frequency domain: Sub band coding, Adaptive transform coding, Vector Quantization, Code Excited Linear Predictive Coding (CELP).

UNIT-IV

Speech Recognition: Principles of speech recognition, Speech period detection, Spectral distance measure, Structure of word recognition system, Dynamic Time Warping (DTW), Theory and implementation of Hidden Markov Model (HMM).

Speaker recognition: Human and Computer speaker recognition Principles Text dependent and Text Independent speaker recognition systems. Applications of speech Processing.

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

1. Understand different characteristics of Speech.
2. Identify and analyze different speech analysis system.
3. Write algorithms for Recognition of speech.

Text/Reference Books:

1. Sadaoki Furui, “Digital Speech Processing, Synthesis and Recognition” 2nd Edition, Taylor& Francis, 2000.
2. Rabiner and Schafer, “Digital Processing of Speech Signals”, Pearson Education, 1979.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC580C **INTERNET OF THINGS LAB**

M. Tech. Electronics and Comm Engg
Semester –II

L	T	P	Credits
-	-	4	2

Class Work	:	25 Marks
Exams	:	75 Marks
Total	:	100 Marks

Course Objectives:

1. To get hands on training on IOT kits.
2. To learn about IOT applications.
3. To learn IOT test beds.
4. To learn Development of IOT lab platform.

List of Experiments:

1. Design full adder with testbench in VHDL
2. Design FFT with testbench
3. Design FIR with testbench
4. Design serial adder with testbench
5. Introduction to CC3300 IoT platform
6. Establish a wifi connection using CC3300 module
7. Design ESP8266 based wireless web server
8. IoT Based Smart Camera monitoring
9. Air Pollution Meter using cc3300 module
10. Windows 10 on Raspberry
11. Communicating with Arduino through Android
12. Alarm Clock using cc3300 wireless module
13. Temperature transmission using Raspberry Pi
14. House monitoring using Arduino and Raspberry Pi
15. Wireless Video Surveillance Robot
16. Humidity And Temperature monitoring using cc300 module
17. Health monitoring using raspberry pi module
18. Facial Recognition Door using android and raspberri pi
19. Baggage Tracker using GSM
20. Smart Trash Collector using IOT

Course Outcomes:

1. Students are able to get hands on IOT kits.
2. Students learn about IOT test beds.
3. Students learn Development of IOT lab platform.
4. They learn advantages and Disadvantages of different IOT concepts.

NOTE:

1. Each Laboratory Class/Section shall not be of more than about 20 students.
2. To allow fair opportunity of practical hands-on experience to each student, each experiment may either be done by each student individually or in a group of not more than 3-4 students. Larger groups be strictly discouraged / disallowed.
3. Pre-experimental & post experimental quiz / questions may be offered for each Lab experiment to reinforce & aid comprehension of the experiment.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC582C ADVANCED OPTICAL COMMUNICATION & NETWORKS LAB

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits			
-	-	4	2	Class Work	:	25 Marks
				Exams	:	75 Marks
				Total	:	100 Marks

Course Objectives– After completing this course, the students should be able to:

1. Align light waves into small optical components with high precision Use hardware/software design tools to develop modern fiber based communication systems.
2. Calculate and simulate the attenuation and signal degradation dispersion.
3. Calculate power coupling losses due to connectors, splices, source output pattern and NA.
4. Understand, compute and simulate the modes in step index fiber and graded index fiber.

(A few experiments may be designed & included in this list depending upon the infrastructure available in the institute)

1. Introduction to various optical devices.
2. Introduction of fiber optical detector.
3. Designing of fiber optical transmitters.
4. Determination of numerical aperture of optical fiber.
5. To plot characteristics of LED.
6. Setting a fiber optic analog link.
7. Setting a fiber optic digital link.
8. Determination of modulation/demodulation of light source by direct amplitude modulation techniques.
9. Forming a PC to PC communication link using optical fiber & RS 232.
10. Setting up a fiber optic voice link.
11. Performing modulation & demodulation of light source by PPM technique.
12. Performing of modulation & demodulation of light source by PWM technique.
13. Finding Propagation loss & bending loss in optical fiber.
14. Simulation of various types of optical networks.

Course Outcomes: By the end of the course, the students shall be able to:

1. Understand the reliability issues of the various optical devices (connectors, SOA and splices) .
2. Design, implement and test WDM communication system using its basic components.
3. Participate in team projects including design, inspection and optimization.
4. Compete in the engineering job market and/or be admitted to Ph. D. programme.

NOTE:

1. Each Laboratory Class/Section shall not be of more than about 20 students.
2. To allow fair opportunity of practical hands-on experience to each student, each experiment may either be done by each student individually or in a group of not more than 3-4 students. Larger groups be strictly discouraged / disallowed.
3. Pre-experimental & post experimental quiz / questions may be offered for each Lab experiment to reinforce & aid comprehension of the experiment.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC584C **MINI PROJECT**

M. Tech. Electronics and Comm Engg

Semester –II

L	T	P	Credits			
-	-	4	2	Class Work	:	25 Marks
				Exams	:	75 Marks
				Total	:	100 Marks

The objective of mini project is to develop in students the professional quality of synthesis employing technical knowledge obtained in the field of Engineering & Technology through a project work involving design / analysis augmented with creativity, innovation and ingenuity.

The student shall take up investigative study on a topic in the broad relevant field of engineering, involving hardware or software or both hardware & software, to be assigned by the department on an individual basis, under the guidance of a supervisor from the department. This is expected to provide a good initiation for the student(s) in R & amp; D work.

The activities under mini project may normally include:
1. Literature survey on an assigned topic.
2. Working out a preliminary approach to the problem relating to the assigned topic.
3. Conducting preliminary analysis/modelling/simulation/experiment/design.
4. Compilation of the work and presenting it in two seminar talks in the semester, before a committee having M.Tech. coordinator and supervisor(s).
5. Submit a written spiral-bound report on the work undertaken to the M.Tech. Coordinator.

Internal evaluation of Mini Project will be done at the end of the semester through a seminar by the committee consisting of the following:
1. Chairperson/Head of Department/ Nominee : Chairperson
2. M.Tech. Coordinator : Member-Secretary
3. Respective Project Supervisor(s) : Member(s)

Final exam. will be conducted by the internal examiner (M.Tech. Coordinator / faculty nominated by Chairperson) and external examiner to be appointed by Controller of Examinations from a Panel of Examiners submitted by the Dept.

M.Tech. coordinator will be assigned a load of 1 hour per week excluding his/ her own guiding load. Project supervisor (guiding teacher) will be assigned a load of 1 hour per week per student subject to a maximum load of 2 hours.

MTEC545C **HIGH PERFORMANCE NETWORKS**

M. Tech. Electronics and Comm Engg

Semester –III

L	T	P	Credits			
3	-	-	3	Class Work	:	25 Marks
				Theory	:	75 Marks
				Total	:	100 Marks
				Duration of Exam.	:	3 Hrs.

Course Objective:

1. To apply knowledge of mathematics, probability, and statistics to model and analyze some networking protocols.
2. To design, implement, and analyze computer networks.
3. To identify, formulate, and solve network engineering problems.
4. To use techniques, skills, and modern networking tools necessary for engineering practice.

UNIT-I

Types of Networks, Network design issues, Data in support of network design. Network design 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-II

VoIP system architecture, protocol hierarchy, Structure of a voice endpoint, Protocols for the transport of voice media over IP networks. Providing IP quality of service for voice, signaling protocols for VoIP, PSTN gateways, VoIP applications.

UNIT-III

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, overlaynetworks-P2P connections. Traffic Modeling: Little's theorem, Need for modeling, Poisson modeling, Non-poisson models, Network performance evaluation.

UNIT-IV

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

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

1. Apply knowledge of mathematics, probability, and statistics to model and analyze some networking protocols.
2. Design, implement, and analyze computer networks.
3. Identify, formulate, and solve network engineering problems.
4. Show knowledge of contemporary issues in high performance computer networks.
5. Use techniques, skills, and modern networking tools necessary for engineering practice.

Text/Reference Books:

1. Kershenbaum A., "Telecommunications Network Design Algorithms", Tata McGraw Hill,1993.
2. Larry Peterson & Bruce David, "Computer Networks: A System Approach", MorganKaufmann, 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", MorganKaufmann, 1996.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC547C PATTERN RECOGNITION AND MACHINE LEARNING

M. Tech. Electronics and Comm Engg

Semester –III

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objective:

1. To study the parametric and linear models for classification
2. To design neural network and SVM for classification
3. To develop machine independent and unsupervised learning techniques.

UNIT-I

Introduction to Pattern Recognition: Problems, applications, design cycle, learning and adaptation, 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 Linear Models for Classification.

UNIT-II

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

UNIT-III

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

UNIT-IV

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

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

1. Study the parametric and linear models for classification
2. Design neural network and SVM for classification
3. Develop machine independent and unsupervised learning techniques.

Text/Reference Books:

1. Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2nd Edition JohnWiley & Sons, 2001.
2. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, “The Elements of Statistical Learning”, 2nd Edition, Springer, 2009.
3. C. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

MTEC549C **DETECTION AND ESTIMATION THEORY**

M. Tech. Electronics and Comm Engg

Semester –III

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objective:

1. To understand the mathematical background of signal detection and estimation.
2. To use classical and Bayesian approaches to formulate.
3. To solve problems for signal detection and parameter estimation from noisy signals.
4. To derive and apply filtering methods for parameter estimation.

UNIT-I

Review of Vector Spaces: Vectors and matrices: notation and properties, orthogonality and linear independence, bases, distance properties, matrix operations, Eigen values and eigenvectors. Properties of Symmetric Matrices: Diagonalization of symmetric matrices, symmetric positive definite and semi definite matrices, principal component analysis (PCA), singular value decomposition.

UNIT-II

Stochastic Processes: Time average and moments, ergodicity, power spectral density, covariance matrices, response of LTI system to random process, cyclostationary process, and spectral factorization.

UNIT-III

Detection Theory: Detection in white Gaussian noise, correlator and matched filter interpretation, Bayes' criterion of signal detection, MAP, LMS, entropy detectors, detection in colored Gaussian noise, Karhunen-Loeve expansions and whitening filters. Estimation Theory: Minimum variance estimators, Cramer-Rao lower bound, examples of linear models, system identification, Markov classification, clustering algorithms.

UNIT-IV

Topics in Kalman and Weiner Filtering: Discrete time Wiener-Hopf equation, error variance computation, causal discrete time Wiener filter, discrete Kalman filter, extended Kalman filter, examples. Specialized Topics in Estimation: Spectral estimation methods like MUSIC, ESPIRIT,DOA Estimation.

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

1. Understand the mathematical background of signal detection and estimation
2. Use classical and Bayesian approaches to formulate
3. Solve problems for signal detection and parameter estimation from noisy signals.
4. Derive and apply filtering methods for parameter estimation.

Text/Reference Books:

1. Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume I: EstimationTheory",Prentice Hall, 1993
2. Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume II: DetectionTheory", 1st Edition, Prentice Hall, 1998
3. Thomas Kailath, BabakHassibi, Ali H. Sayed, "Linear Estimation", Prentice Hall, 2000.
4. H. Vincent Poor, "An Introduction to Signal Detection and Estimation", 2nd Edition,Springer, 1998.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC551C **ADVANCED DIGITAL SIGNAL PROCESSING**

M. Tech. Electronics and Comm Engg

Semester –III

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To apprise students about multirate digital signal processing and applications.
2. To understand adaptive Filters and necessary algorithms.
3. To solve normal equations and theory of Prediction.
4. To understand Power Density Spectrum and its estimation.

UNIT-I

Review of DSP, Multi rate DSP, Decimators and Interpolators, Bandpass sampling theorem, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in subband coding. Applications of Multi rate DSP.

UNIT-II

Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters. Wiener Filters for Filtering and Prediction.

UNIT-III

Adaptive Filters, Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm, Applications of DSP to Radar, speech processing, image Processing.

UNIT-IV

Estimation of Spectra from Finite-Duration Observations of Signals, Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation. Introduction to wavelets and its applications.

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

1. Understand theory of multirate DSP, solve numerical problems and write algorithms.
2. Understand theory of prediction and solution of normal equations.
3. Know adaptive filters and their algorithms & applications.
4. Estimate Power Density Spectrum and its significance.

Text/Reference Books:

1. J.G.Proakis and D.G.Manolakis"Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.
2. N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks –Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.
3. Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997.
4. M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & SonsInc., 2002.
5. S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.
6. D.G.Manolakis, V.K. Ingle and S.M.Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC553C **LASER COMMUNICATION**

M. Tech. Electronics and Comm Engg

Semester –III

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To learn the basic principles of lasers.
2. To learn the construction and working of different types of lasers.
3. Study of advance laser systems.
4. They will study the OPO and semiconductor lasers also.

UNIT I

Basics of lasers principles: Stimulated Emission, Einstein Coefficients, Concept of resonant cavity, Theories of Fox and Li, Boyd and Gordon, Different resonator geometries, Optical pumping schemes, Cavity modes, CW and Pulsed lasers, Mode Locking, Line width and broadening mechanisms.

UNIT II

Common laser systems : Ruby, He-Ne-, Nitrogen laser, Nd: YAG, Nd: Glass, Diode pumped solid state lasers, Er doped fiber laser Argon ion laser, Krypton ion laser, Copper vapor laser, color centre lasers Tunable Dye lasers , Standing wave and Ring Dye lasers.

UNIT III

Advanced laser systems: Excimer (with different wave lengths), X-ray laser, Free Electron Lasers, Ti_Sapphire (Femto second). Femtosecond laser systems (Tunable, fiber based systems)

Optical parametric Oscillators: (OPO) Autocorrelation and Cross correlation, Random lasers, Disc lasers.

UNIT IV

Semiconductor lasers: Double heterostructure and quantum well lasers and quantum Dots, VCSEL, DBR and DFB lasers. Concept of single Atom lasers

Course Outcomes:

1. This course provides the students a thorough understanding of the fundamentals of lasers: their unique properties, their operations and their applications.
2. It will equip the students with the knowledge of how a coherent light is generated and amplified.
3. They are aware of the techniques on different lasers' design.
4. They have learnt how lasers are used in communications, data storages, industries, medicine and biology.

Text/Reference Books:

1. Principles of lasers by O Svelto and David C Hanna
2. Laser fundamentals by William T Silfvast

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC555C **RELIABILITY ENGINEERING**

M. Tech. Electronics and Comm Engg

Semester –III

L	T	P	Credits
3	-	-	3

Class Work	:	25 Marks
Theory	:	75 Marks
Total	:	100 Marks
Duration of Exam.	:	3 Hrs.

Course Objectives:

1. To make students able to understand concepts of Reliability Engineering to illuminate or mitigate failure.
2. To make them aware to apply engineering knowledge to prevent or reduce the likelihood or frequency of failure and to identify and correct the causes of failure that does occur.
3. They determine ways of coping with failure that does occur. To apply methods of estimating the likely reliability of new design, and analyzing reliability data.
4. To provide knowledge of reliability testing, reliability estimation and implementation which motivate students to apply the knowledge and skill gained to research.

UNIT I

Introduction: Study of reliability and maintainability, concepts terms and definition, random events, bayes' formula, random variables, discrete distribution, binomial distribution, Poisson distribution, continuous distribution

Basic Reliability model: Reliability function, mean time to failure, hazards rate function, bath tab, conditional reliability, constant failure rate model, time dependent failure model.

UNIT II

Data collection and empirical method: Data collection, Empirical Method, Ungrouped complete data, grouped complete data, ungrouped censored data, group censored data, static life estimation

Reliability Testing: product testing, reliability life testing, test time calculation, length of test, burn in testing, acceptance testing, experimental design, reliability growth process, idealized growth curve, Duane Growth Model, AMSAA Model.

UNIT III

Failure and Repair Distribution: candidate distribution, probability plots and least square curve fitting, parameter estimation, confidence intervals, parameter estimation for covariance model.

Goodness to fit test: Chi Square Goodness Of fit test, Bartletts test for exponential distribution, Mann's Test for Weibull Distribution, Kolmogosov Smirnov test for normal, Log normal Distribution, Test for Power Law process model, On fitting distribution.

UNIT IV

Reliability Estimation and Applications: Redundancy, burn in testing, preventive main furnace analysis, Reliability Allocation, Reliability growth testing, Repairable system analysis, multiply censored data.

Implementation: Objectives function and processes the economics of reliability and maintain ability and system design organisational consideration, data source and data collection methods, product reliability, warranties & related matters, Software Reliability.

Course Outcomes:

1. After successful completion of the course, student will be able to develop ability to understand the fundamentals of Reliability Engineering.
2. Also have a working knowledge of the techniques of reliability engineering.
3. Able to apply learned concepts to improving the maintenance, the maintainability, hazard risk.
4. They will be able to analysis of different failures of a component/equipment.

Text/ Reference Books:

1. Reliability and Maintain Ability Engineering. Charles E. Ebeling TMH.
2. System Eng. And analysis, PHI Blanchard B. S & W. J.Fabrycky.
3. Engineering Reliability: New Techniques & applications. Dhillon B.S & C. Singh. John Wiley
4. Reliability centred maintenance, Mc Grow Hill New York by Smith, A. M.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The use of programmable devices such as programmable claculators, phones, etc. and sharing of materials during the examination are not allowed.
3. A specific note shall be inserted in relevant question paper where ever the use of graph-papers, semi-log papers, steam-tables, etc. shall be allowed during the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

OPEN ELECTIVES

MTOE651C: BUSINESS ANALYTICS

M. Tech. Semester – III (Common for all Branches)

L	P	Credits			
3	--	3	**Class Work**	**:**	**25Marks**
			Examination	**:**	**75 Marks**
			Total	**:**	**100 Marks**
			Duration of Examination	**:**	**3 Hours**

Course Objectives:

The main objective of this course is to give the student a comprehensive understanding of business analytics methods

1. Understand the role of business analytics within an organization.
2. Business Analytics industry sequence is to familiarize the students with the concept of Data Analytics (Big Data) and its applicability in a business environment
3. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
4. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
5. To become familiar with processes needed to develop, report, and analyze business data.
6. Use decision-making tools/Operations research techniques.
7. Mange business process using analytical and management tools.

Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc

Course Outcomes:

1. At the end of the Fall semester, students should have acquired an understanding of Analytics – the terminology, concepts and familiarity of potential tools and solutions that exist today Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on dataand deep analytics
3. Students will demonstrate the ability to use technical skills in predicative and prescriptivemodeling to support business decision-making
4. Students will demonstrate the ability to translate data into clear, actionable insights. student should be better familiar with overall analytics tools/techniques and their use in corporate

Syllabus contents:

UNIT I: Business analytics: Overview of Business analytics, Scope of Business, analytics, Business Analytics Process, Relationship of Business Analytics, Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT II: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression, Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT III: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining

Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT IV: Decision Analysis: Formulating Decision Problems, Decision Strategies, with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making. Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time.

TEXT / REFERENCE BOOKS:

1. Project Management: The Managerial Process by Erik Larson and, Clifford Gray
2. Business Analysis by James Cadle et al.
3. Bajpai Naval, Business Statistics, Pearson, New Delhi.
4. Whigham David, Business Data Analysis, Oxford University, Press, Delhi.
5. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie or Die. Eric Siegel.
6. Big Data, Analytics and the Future of Marketing and Sales. McKinsey.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

MTOE653C: INDUSTRIAL SAFETY
M. Tech. Semester – III (Common for all Branches)

L	P	Credits			
3	--	3	Class Work	:	25Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Course Objectives:

Course Outcomes:

Syllabus contents:

UNIT I: **Industrial safety:** Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe the 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 the maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation to replacement economy, Service life of the equipment.

UNIT II: **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 III: **Fault Tracing:** Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision trees 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 IV: **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.

TEXT / REFERENCE BOOKS:

1	Maintenance Engineering Handbook	Higgins & Morrow	Da Information Services
2	Maintenance Engineering	H. P. Garg	S. Chand and Company
3	Pump-hydraulic Compressors,	Audels	Mcgraw Hill Publication

Approved in the 13th meeting of academic council held on 18/6/2018.

4	Foundation Engineering Handbook	Winterkorn, Hans	Chapman & Hall London.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

MTOE655C: OPERATIONS RESEARCH
M. Tech. Semester – III (Common for all Branches)

L	P	Credits			
3	--	3	Class Work	:	25Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Course Objectives:

1. To develop modeling skills in students.
2. To develop skill in students for efficient designing analysis and control of complete system.
3. To make students capable of formulating the practical problems into mathematical problems.
4. To acquaint student with linear as well as non-linear programming problem and their application.

Course Outcomes:

1. Students will be able to apply the dynamic programming to solve problems of discrete and continuous variables.
2. Students will be able to carry out sensitivity analysis.
3. Student will be able to model the real world problem and simulate it.
4. The students will be able to carry forward the operation research techniques in practical problems.

Syllabus contents:

UNIT I: Linear optimization methods: General mathematical model formation of L.P.P, its solution by Graphical method, Simplex method, big –M method, two phase method sensitivity analysis (change in cj, bj&aij's)

Revised Simplex method.Concept of duality, formation of Dual L.P.P, advantage of Duality, dual simplex method, parametric programming.

UNIT II: Non liner programming: NLPP Mathematical formulation and solution with equally constraints, Lagrange's method, Graphical method, Kuhn—Tucker necessary &sufficient conditions for the optimality of objective function in GNLP problem.

Dynamic programming: Kuhn –Tucker condition's, Wolfe's and Bcale's method.

UNIT III: Deterministic inventory control models: Meaning & function role of inventory control, reason for carrying inventory, single item inventory control model with & without shortages.

Probabilistic inventory control models: Inventory control models without set up cost and with set up cost.

UNIT IV: Project management; PERT and CPM, Basic difference between PERT & CPM, Phases up project management PERT /CPM network component & precedence relationships, critical path analyses, projects scheduling with uncertain activity times, project time –cost trade-off.

Sequencing problem: Processing an jobs through two machines, three machines and through m-machines. Theory of games: Two- person zero –sum games,pure strategies (with saddle points) mixed strategies (without saddle point), algebraic method only.

TEXT / REFERENCE BOOKS:

1. H.A Taha, Operations Research, An introduction, PHI, 2008
2. H.M.Wanger, Principles of Operation Research PHI, Delhi, 1982
3. J.K.Sharma, Operations Research, Mcmillan India. Ltd,1990
4. S.D.Sharma, Operations Research, KedarnathRamnath publication,1985

Approved in the 13th meeting of academic council held on 18/6/2018.

5. P.K.Gupta and D.S Hira, Operations Research, S.Chand& Co.,1987
6. Pannerselvam, Operations Research; PHI, 2010
7. Harvey M Wanger , Principles of Operations Research; PHI, 2010

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

MTOE657C: COST MANAGEMENT OF ENGINEERING PROJECTS
M. Tech. Semester – III (Common for all Branches)

L	P	Credits			
3	--	3	Class Work	:	25Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Course Objectives:

Course Outcomes:

Syllabus contents:

UNIT I: INTRODUCTION AND OVERVIEW

Chapter 1 Introduction, basic economic concepts, interest formulae, present worth, rate of return. Elements of financial accounting: depreciation, taxes and their impact in economic studies

Chapter 2 Cost concepts in decision making; elements of cost, relevant cost, overheads, differential cost, incremental cost and opportunity cost, objectives of a costing system, inventory valuation, creation of a data base for operational control, provision of data for decision making.

UNIT II: PROJECT

Chapter 3 Meaning, different types, why to manage, cost overrun centres, various stages of project execution, concept to commissioning. Project execution as conglomeration of technical and non technical activities. Detailed engineering activities, Pre project execution main clearances and documents project team: Role of each member.

Chapter 4 Importance Project site: Data required with significance. Project contracts.Types and contents. Project cost control. Bar charts and network diagram. Project commissioning: Mechanical and process. Project appraisal and selection, recent trends in project management

UNIT III: ECONOMIC ANALYSIS FOR ENGINEERING PROJECTS

Chapter 5 Cost behavior and profit planning, Marginal costing, distinction between marginal costing and absorption costing, Break even analysis, cost volume profit relationship, various decision making problems.

Standard costing and variance analysis, pricing strategies Pareto analysis, Target analysis, life cycle costing, Costing of service sector.

Chapter 6 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, value chain analysis,

Budgetory control, Flexible budget, Performane budget, Zero based budget, Measurement of divisional profitability pricing decisions including transfer pricing.

UNIT IV: QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT

Chapter 7 PERT CPM; Activity networks, basic PERT/CPM calculations, Planning and scheduling of activity networks, Assumptions in PERT modeling, time cost tradeoffs, PERT/

cost accounting, Scheduling with limited resources, Generalized activity networks GERT, Prospects of PERT/CPM

Chapter 8 Linear programming, Transportation problems, Assignment problems, Simulation, Learning curve theory.

TEXT / REFERENCE BOOKS:

1	Cost Accounting: A Managerial Emphasis	Charles T. Horngren, Srikant M. Datar, Madhav V. Rajan	Pearson Edu.
2	Fundamentals of Financial Management	Prasanna Chandra	Tata McGraw Hill
3	Quantitative Techniques in Management	N D Vohra	Tata McGraw Hill
4	Foundation Engineering Handbook	Winterkorn, Hans	Chapman & Hall London.
5	Principles and Practice of cost accounting	Ashish K Bhattacharya	A H Wheeler
6	Principles of engineering economy	E L Grant et al.	John Wiley and Sons, New York.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

MTOE659C: COMPOSITE MATERIALS

M. Tech. Semester – III (Common for all Branches)

L	P	Credits			
3	--	3	Class Work	:	25Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Course Objectives:

Course Outcomes:

Syllabus contents:

UNIT I: **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. Isostrain and Isostress conditions.

UNIT II: **Manufacturing of Metal Matrix Composites:** Casting – Solid Stat e diffusion technique, Cladding – Hot isostatic pressing.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 III: **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 IV: **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 / REFERENCE BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Ca hn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
3. Hand Book of Composite Materials-ed-Lubin.
4. Composite Materials – K.K.Chawla.
5. Composite Materials Science and Applications – Deborah D.L. Chung.
6. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTOE661C: WASTE TO ENERGY
M. Tech. Semester – III (Common for all Branches)

L	P	Credits			
3	--	3	Class Work	:	25Marks
			Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

Course Objectives:

To give an idea about different biomass and other solid waste materials as energy source and their processing and utilization for recovery of energy and other valuable products. A comprehensive knowledge of how wastes are utilized for recovery of value would be immensely useful for the students from all fields.

Course Outcomes:

In these days of energy crisis and environmental deterioration, students will understand the concept of energy by waste products. It is being used globally to generate electricity and provide industrial and domestic applications. Students will also enable to understand the environmental issues related to harnessing and utilization of various sources of energy and related environmental degradation.

Syllabus contents:

UNIT I: Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment. Various Methods of using solar energy –Photothermal, Photovoltaic, Photosynthesis, Present & Future Scope of Solar energy.

UNIT II: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste, MSW

UNIT III: 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, Types of biogas Plants, Applications.

UNIT IV: Thermo-chemical Conversion: Pyrolysis, Combustion, Gasification, Liquification. Bio-Chemical Conversion: Aerobic and Anaerobic conversion, Fermentation etc. Bio-fuels: Importance, Production and applications. Bio-fuels: Types of Bio-fuels, Production processes and technologies, Bio fuel applications, Ethanol as a fuel for I.C. engines, Relevance with Indian Economy.

TEXT / REFERENCE BOOKS:

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.

NOTE:

1. In the semester examination, the examiner will set 08 questions in all selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.
2. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
3. Electronics gadgets including Cellular phones are not allowed in the examination.

Approved in the 13th meeting of academic council held on 18/6/2018.

MTEC585C **DISSERTATION (PHASE-I)**

M. Tech. Electronics and Comm Engg

Semester –III

L	T	P	Credits			
-	-	20	10	Class Work	:	50 Marks
				Exams	:	100 Marks
				Total	:	150 Marks

The objective of this course is to develop in students the capacity for analysis & judgment and the ability to carry out independent investigation in design/development through a dissertation work involving creativity, innovation and ingenuity. The work should start with comprehensive literature search and critical appreciation thereof so as to select a research problem and finalize the topic of dissertation.

Each student will carry out an independent dissertation under the supervision of a supervisor; in no case, more than two supervisors may be associated with one dissertation work. The first supervisor must be from the department, however, for interdisciplinary research work,the second supervisor may be from other department of the university/ outside university/industry. In the latter case, consent of the second supervisor with justification thereof needs to be submitted to the dissertation coordinator.

The Dissertation (Phase-I) involving literature survey and problem formulation along with data collection (if required) commences in 3rd semester &will be completed as Dissertation (Phase-II) in 4th semester. Each student will be required to present two seminar talks, first towards the beginning of the Dissertation (Phase-I) to present the scope of the work and to finalize the topic, and the second towards the end of the semester, presenting the progress report containing literature survey, partial results (if any) of the work carried out by him/her in the semester.The student will be required to submit one copy of spiral-bound progress report to the M.Tech. Coordinator.

Internal evaluation of Dissertation (Phase-I) will be done by following committee:

1. Chairperson / Head of Department / Nominee : Chairperson
2. M.Tech. Coordinator/Senior Faculty : Member-Secretary
3. Respective Dissertation Supervisor(s) : Member(s)

Final exam will be conducted by the internal examiner (M.Tech. Coordinator/ faculty nominated by Chairperson) &an external examiner to be appointed by Controller of Examinations from a panel of examiners submitted by the Dept.

For this course, M. Tech. coordinator will be assigned a load of 1 hour per week excluding his/ her own guiding load. Dissertation supervisor (guiding teacher) will be assigned a load of 1 hour per week for the first student and additional 1 hour per week (for their own department only) for the subsequent student(s) subject to a maximum load of 2 hours. Work load allocated for the joint supervision within the department will be treated as half for each supervisor.

MTEC586C **DISSERTATION (PHASE-II)**

M. Tech. Electronics and Comm Engg

Semester –IV

L	T	P	Credits			
-	-	32	16	Class Work	:	100 Marks
				Exams	:	200 Marks
				Total	:	300 Marks

The Dissertation (Phase-II) shall be the extension of Dissertation (Phase-I) carried out in 3rd semester. Each student will be required to present three seminar talks, first at the beginning of the semester to present the progress made during the winter break; second in the middle of the semester involving partial results obtained and comparative analysis; and third towards the end of the semester, presenting the dissertation report of the work carried out. Each student will be required to submit two copies of dissertation report to M.Tech. coordinator. The committee constituted by the Chairperson of the department will screen all the presentations so as to award the sessional marks.

INTERNAL ASSESSMENT:

The internal assessment (Class-work evaluation) will be effected through presentation and discussion thereon by the following committee:

1. Chairperson/Head of Department / Nominee : Chairperson
2. M.Tech. Coordinator/Senior Faculty : Member-Secretary
3. Respective Dissertation Supervisor(s) : Member(s)

EXTERNAL ASSESSMENT:

Dissertation will be evaluated by the following committee:

1. Chairperson/Head of the Department / Nominee : Chairperson
2. Respective Dissertation Supervisor(s) : Member(s)
3. External Expert : To be appointed by the University.

For this course, supervisor(s) will be assigned a load of 2hours per week for the first student and additional 1 hour per week for the subsequent student(s) subject to a maximum load of 3 hours. Work load allocated for the joint supervision within the department will be treated as half for each supervisor.

NOTE: There is a desirable requirement of one publication in a UGC-listed journal / unpaid journal. The external expert must be from the respective area of the specialization. Chairperson & M.Tech. Coordinator in mutual consultation will divide the submitted dissertations into groups depending upon area of specialization and recommend the list of experts for each group separately to the Vice-Chancellor for selecting the examiners (*one examiner for not more than four students of a group*).