SCHEME & SYLLABUS

for

M.TECH. COURSE

in

Electronics & Communication Engineering

(w.e.f. Session 2018-2019)

DEPARTMENT OF ELECTRONICS ENGINEERING

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY
FARIDABAD

VISION

YMCA University of Science and Technology aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Department of Electronics Engineering

VISION

To be a Centre of Excellence for producing high quality engineers and scientists capable of providing sustainable solutions to complex problems and promoting cost effective indigenous technology in the area of Electronics, Communication & Control Engineering for Industry, Research Organizations, Academia and all sections of society.

MISSION

- To frame a well-balanced curriculum with an emphasis on basic theoretical knowledge as well the requirements of the industry.
- To motivate students to develop innovative solutions to the existing problems for betterment of the society.
- Collaboration with the industry, research establishments and other academic institutions to bolster the research and development activities.
- To provide infrastructure and financial support for culmination of novel ideas into useful prototypes.
- To promote research in emerging and interdisciplinary areas and act as a facilitator for knowledge generation and dissemination through Research, Institute - Industry and Institute-Institute interaction.

About Electronics Engineering Department

YMCA University of Science & Technology, Faridabad established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCA of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized field of engineering to meet specific technical manpower requirement of industries. Electronics Engineering Department started in 1969 and has been conducting B.Tech. Courses in Electronics Instrumentation and Control and Electronics and Communication Engineering of 4-Years duration since 1997. Students are admitted through centralized counseling nominated by state govt. in 1st Year and 2nd year through lateral entry entrance test. Besides under graduate degree courses, it is also running M.Tech. Courses in VLSI, Instrumentation and Electronics & Communication. Department of Electronics Engineering is also running Ph.D. Programme. All courses are duly approved by AICTE/ UGC. The Electronics Engineering Department has been well known for its track record of employment of the pass out students since its inception.

The Department has good infrastructure consisting of 11 laboratories, 10 Lecture Halls and 1 Conference Room beside 6 workshops. It has excellent faculty with 2 Professors, 2 Associate Professors and 21 Assistant Professors. At present, 6 faculty members are PhD in various specializations. The various syllabi of UG/PG courses have been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. During the project/dissertation work emphasis has been given on skill enhancement of students. Choice based system allows students to study the subjects of his/her choice from a number of elective courses /audit courses.

Program Educational Objectives (PEO):

Students of the Master of Technology programs in Electronics & Communication Engineering will demonstrate

1. Employability in the diversified sectors of the core industry, public sector or multinational corporations in the domain of semiconductor, microelectronics, wireless communication, optical and satellite communication, networking etc. and/or pursue higher education in technologies related to communication and networking platforms at institutes of high repute.
2. To provide technical skills in software and hardware tools related to the design and implementation of Communication and Embedded Systems
3. To inculcate research culture in the learners of the program with abilities to publish at national/international level and develop prototype technologies in the related domain.
4. Attitude of lifelong learning and skills of effective inter-person communication resulting in leading diverse teams, with ethical and social behavior.

Program Outcomes (PO):

On successful completion of the Program, the students will be able to

1. Demonstrate in-depth knowledge in the specialized domain of Analog & Digital Electronics, Microelectronics, digital communication, satellite communication, wireless communication, microwave & antenna, signal and image processing, embedded systems
2. Analyze complex engineering problems critically in the domains of Communication Engineering and Electronics Systems for conducting research.
3. Solve engineering problems to arrive at optimal solutions in the fields of Electronics and Communication Systems complying with societal needs.
4. Apply appropriate research methodologies and techniques for the development of scientific and technological knowledge in Analog & Digital Electronics, Microelectronics, Digital Communication, Satellite Communication, Wireless

Communication, Microwave & Antenna, Signal and Image Processing, Embedded Systems and Allied Areas.

5. Apply appropriate resources and modern tools to complex engineering activities in the field of Electronics and Communication systems.
6. Contribute to collaborative-multidisciplinary scientific work, demonstrate capacity for self-management, teamwork and decision making.
7. Manage projects as a member and leader with understanding of engineering and management principles with consideration to economic and financial factors.
8. Communicate effectively in professional and personal domains through verbal, written and graphical forms.
9. Engage in life-long learning to improve knowledge and competence in the world of rapid technological changes.
10. Follow ethical code of conduct in professional activities with understanding of responsibility for sustainable development of society.
11. Adapt to reflective self learning for continuous personal and professional development.
12. Participate and succeed in competitive examinations like GATE (for placements in PSU's),GRE (for higher studies).

GRADING SCHEME

Marks %	Grade	Grade points	Category
90-100	O	10	Outstanding
80<marks<90	A+	9	Excellent
70<marks< 80	A	8	Very good
60<marks< 70	B+	7	Good
50<marks< 60	B	6	Above average
45<marks< 50	C	5	Average
40<marks< 45	P	4	Pass
<40	F	0	Fail
	Ab	0	Absent

Percentage calculation= CGPA * 9.5

M. TECH. (Electronics & Communication Engineering)

Total Credits	**68**
Total Theory Subjects	**11+2 Audits**
Total Labs (including Projects)	**5**
Total Dissertation	**2**

Semester I

M. Tech. (Electronics & Communication Engineering)

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	MEC101	Advanced Communication Networks	3	0	0	3	25	75	100
2	PCC	MEC102	Wireless and Mobile Communication	3	0	0	3	25	75	100
3	PEC		Program Specific Elective-I	3	0	0	3	25	75	100
4	PEC		Program Specific Elective-II	3	0	0	3	25	75	100
5	PCC	ERM01	Research Methodology and IPR	2	0	0	2	25	75	100
6	AUD		Audit course 1	2	0	0	0	25	75	100
7	PCC	MEC151	Advanced Communication Networks Lab	0	0	4	2	15	35	50
8	PCC	MEC152	Wireless and Mobile Communication Lab	0	0	4	2	15	35	50
			Total Credits				**18**	180	520	700

	Course Name	Course Title
Program Elective-I	MECE101	Wireless Sensor Networks
	MECE102	Optical Networks
	MECE103	Statistical Information Processing
	MECE104	Optical Communication
Program Elective-II	MECE105	Cognitive Radio
	MECE106	RF and Microwave Circuit Design
	MECE107	DSP Architecture
	MECE108	Advanced Microprocessor and Microcontroller

AUD 1	**EAUD01**	English for Research Paper Writing
	EAUD02	Disaster Management
	EAUD03	Sanskrit for Technical Knowledge
	EAUD04	Value Education
	EAUD05	Constitution of India
	EAUD06	Pedagogy Studies
	EAUD07	Stress Management by Yoga
	EAUD08	Personality Development through Life Enlightenment Skills.
	EAUD09	Vivekananda Thoughts

Semester II

M. Tech. (Electronics & Communication Engineering)

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	MEC201	Antennas and Radiating Systems	3	0	0	3	25	75	100
2	PCC	MEC202	Advanced Digital Signal Processing	3	0	0	3	25	75	100
3	PEC		Program Specific Elective-III	3	0	0	3	25	75	100
4	PEC		Program Specific Elective-IV	3	0	0	3	25	75	100
5	AUD		Audit course 2	2	0	0	0	25	75	100
6	PCC	MEC251	Antennas and Radiating Systems Lab	0	0	4	2	15	35	50
7	PCC	MEC252	Advanced Digital Signal Processing Lab	0	0	4	2	15	35	50
8	PCC	MEC253	Minor Project	0	0	4	2	15	35	50
			Total Credits				**18**	170	480	650

	Course Name	Course Title
Program Elective-III	MECE201	Satellite Communication
	MECE202	Internet of Things
	MECE203	Voice and data networks
	MECE204	Digital Image Processing
Program Elective-IV	MECE205	Markov Chain and Queuing System
	MECE206	MIMO System
	MECE207	Programmable Networks – SDN, NFV
	MECE208	Advanced Digital Communication

AUD 2 (Audit 2 should be different from audit 1)	**EAUD01**	English for Research Paper Writing
	EAUD02	Disaster Management
	EAUD03	Sanskrit for Technical Knowledge
	EAUD04	Value Education
	EAUD05	Constitution of India
	EAUD06	Pedagogy Studies
	EAUD07	Stress Management by Yoga
	EAUD08	Personality Development through Life Enlightenment Skills.
	EAUD09	Vivekananda Thoughts

Semester III

M. Tech. (Electronics & Communication Engineering)

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PEC		Program Specific Elective-V	3	0	0	3	25	75	100
2	OEC		Open Elective	3	0	0	3	25	75	100
3	PCC	MEC351	Dissertation Phase – I	0	0	20	10	100	200	300
			Total Credits				**16**	150	350	500

	Course Name	Course Title
Program Elective-V	MECE301	High Performance Networks
	MECE302	Pattern Recognition and Machine Learning
	MECE303	Remote Sensing
	MECE304	Electronic System Design
Open Elective	MECO301	Business Analytics
	MECO302	Industrial Safety
	MECO303	Operations Research
	MECO304	Cost Management of Engineering Projects
	MECO 305	Composite Materials
	MECO306	Waste to Energy

Semester IV

M. Tech. (Electronics & Communication Engineering)

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	MEC401	Dissertation Phase – II	0	0	32	16	200	300	500
			Total Credits				**16**	**200**	**300**	**500**

MEC-101 **Advanced Communication Network**

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce the advanced concepts in Communication Networking.
- To introduce about the designing of protocols for Communication Networks.
- To introduce the mechanisms in Quality of Service in networking.
- To introduce about Network Design

Syllabus

Unit 1: 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.

Unit 2: 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 3: 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 4: IP address lookup-challenges, Packet classification algorithms and Flow Identification- Grid of Tries, Cross producting and controlled prefix expansion algorithms.

Unit 5: Admission control in Internet. Concept of Effective bandwidth. Measurement based admission control, Differentiated Services in Internet (DiffServ), DiffServ architecture and framework.

Unit 6 : IPV4, IPV6, IP tunnelling, IPswitching 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: On successful completion of this course, the students should be able to:

- Understand advanced concepts in Communication Networking.
- Design and develop protocols for Communication Networks.
- Understand the mechanisms in Quality of Service in networking.
- Optimise the Network Design

References:

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

MEC-102 **Wireless and Mobile Communication**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To study the concepts fundaments of cellular system design and evolution of mobile communication generations.
- To study the concept of FDMA, TDMA, CDMA.
- To study the concept of large sale propagation small scale propagation, fading & multipath propagation.
- To study the concept of Equalization & diversity.
- To study the concept of 4G & 5G.

Syllabus

Unit 1: 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 channelassignment.GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSML ogical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS),2.75 G Standards: EDGE,

Unit 2: Spectral efficiency analysis based on calculations for Multiple access technologies, TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas, Wireless network planning (Link budget and power spectrum calculations)

Unit 3: Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.

Unit 4: Equalization, Diversity, Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

Unit 5: 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.

Unit 6: 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: On successful completion of this course, the students should be able to:

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

References:

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

Program Elective –I

MECE-101 **Wireless Sensor Networks**

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To study the concept of different wireless networks.
- To introduce basic tools used for simulation of wireless network.
- To introduce basic concept of security in WSM.
- To study the hardware of various wireless networks with brief over new of protocols for sensor networks.

Syllabus

Unit 1: Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

Unit 2: Hardware, Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

Unit 3: Programming tools, C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

Unit 4: Overview of sensor network protocols (details of atleast 2 important protocol per layer), Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Unit 5: Data dissemination and processing, differences compared with other database management systems, data storage; query processing.

Unit 6: 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.

Course Outcomes: On successful completion of this course, the students should be able to:

- Design wireless sensor network system for different applications under consideration.
- Understand the hardware details of different types of sensors and select right type of sensor for various applications.
- Understand radio standards and communication protocols to be used for wireless sensor network based systems and application.
- Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.

- Handle special issues related to sensors like energy conservation and security challenges.

References:

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

MECE-102 **Optical Communication and Network System**

L T P CR	**Theory**	**: 75**
3 0 0 3	**Class Work**	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

1. To introduce the students about Basic of optical communication system and elements of fibre communication link
2. To introduce the students about basic theory of optics, ray theory and electromagnetic mode theory for optical propagation
3. To introduce the students about transmission characteristics of optical fibres, attenuation and their types, Dispersion and mathematical expressions
4. To introduce the students about basic principles of optical sources like LED and LASER and their characteristics and applications.
5. To introduce the students about basic principles of optical detector, characteristics of p-n photodiode and p-i-n photodiode & APD.
6. To introduce the students about Driver circuits for LED and LASER operation, Optical receiver, Link power budget, Rise time budget.

Syllabus:

Unit 1 – Overview of Optical Fibre Communication

Electromagnetic Spectrum, Optical spectral bands, Elements of an optical fibre transmission link, Transmission windows, Advantage of optical fibre link over conventional copper system, Applications of fibre optic transmission systems

Unit 2 – Optical Fibre Structure, Waveguide and Fabrications

Optical laws and definitions, Total internal reflection, Acceptance angle, Numerical aperture, Ray optics, Optical fibre modes and configurations, Mode theory, Step index and graded index fibres, Single mode and multimode fibres, V number, Modes supported by step index and graded index fibre, Fibre materials, Fibre fabrication techniques

Unit 3 – Signal Degradation in Optical Fibres

Attenuation – Absorption losses, Scattering losses, Bending losses, Core and Cladding losses ; Dispersion – Intermodal and Intra modal dispersion, Overall fibre dispersion, Dispersion optimization of single mode fibre, dispersion shifted fibres, dispersion flattened fibres.

Unit 4 – Optical Sources and Coupling

Direct and indirect band gap semiconductor, LED structures, Light source materials, Quantum efficiency, LED power, Spectral width, Modulation band width, LED to fibre coupling, LASER diode, Modes and threshold condition, External quantum efficiency, Temperature effects, Light source linearity, LASER to fibre coupling

Unit 5 – Photo Detectors

Principle for optical detection, Photocurrent and absorption coefficient, Quantum efficiency, Responsivity, Long wavelength cut-off, P-N photodiode, P-I-N photodiode, Avalanche photodiode (APD), APD noise, Comparison of photodetectors

Unit 6 – Optical Transmitter & Receiver Systems

Consideration for optical transmitter circuits, Drive circuits for LED operation, Drive circuits for LASER operation, Point to point link system considerations, Link power

budget and rise time budget, Methods for design of optical link, Optical receiver, Pre-amplifier, Coherent detection, Heterodyne detection, Homodyne detection .

Unit 7 – Optical Networks

Basic Networks - SONET/SDH- Broadcast, WDM networks elements, Optical line terminals and connectors, Operation principle of WDM , Performance of WDM, Nonlinear effects on network performance, Optical time division multiplexing, Synchronization.

TEXTBOOKS:

1. John Gowar, "Optical Communication Systems", PHI.
2.Gerd Keiser, "Optical Fiber Communication", TMH

REFERENCE BOOKS:

1. Franz JH & Jain VK, "Optical Communication", Narosa Pub Ins
2. John M. Senior, "Optical Communication", PHI

COURSE OUTCOMES:

On successful complete of this course, the students should be able to:

1. Understand basic of optical communication system and their advantages over conventional communication systems. Application and limitation of optical communication.
2. Understand basic theory of optics and different types of optical fibres.
3. Understand basic transmission characteristics of optical fibre like attenuation and dispersion.
4. Understand basic principal of optical sources like LED and LASER, their characteristics.
5. Understand principal of optical detectors like p-n photodiode p-i-n photodiode and APD.
6. Understand basic driver circuits for LED and LASER operation, concept of Optical receiver, Link power budget and rise time budget calculation,

MECE-103 **Statistical Information Processing**

L T P CR	**Theory**	**: 75**
3 0 0 3	**Class Work**	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce the random variable and random process.
- To study the random signal modelling.
- To introduce the statistical decision theory.
- To study the spectral analysis.
- To introduce the information theory and source coding and their application.

Syllabus

Unit 1: Review of random variables: Probability Concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebaychef inequality theorem, Central Limit theorem, Discrete &Continuous Random Variables. Random process: Expectations, Moments,Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and auto covariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

Unit 2: Random signal modelling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model & its applications ,Linear System with random input , Forward and Backward Predictions, Levinson Durbin Algorithm.

Unit 3: Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing. Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio Test ,Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum, Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate , Multiple Parameter Estimation Best Linear Unbiased Estimator ,Least-Square Estimation Recursive Least-Square Estimator.

Unit 4: Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.

Unit 5: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 6: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: On successful completion of this course, the students should be able to:

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

References:

1. Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes",4th Edition, McGraw-Hill, 2002.
2. D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.
3. 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", New York, North-Holland, 1977.
6. Rosen K.H, "Elementary Number Theory", Addison-Wesley, 6th edition, 2010.

Program Elective –II

MECE-104 **Cognitive Radio**

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objective:

- To introduce the student about fundament concepts & application of cognitive radio networks.
- To design made the students understand technologies to allow an efficient use of TVWS for radio communication based on two spectrum sharing business models/ policies.
- To introduce the students about designing of cognitive radio techniques as well as a number of optimisation techniques
- To introduce the students about fundamentals of dynamic spectrum access radio resource management & trading issues.

Syllabus

Unit 1: Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Unit 2: Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

Unit 3: Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

Unit 4: Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Unit 5: 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).

Unit 6: Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

Course Outcomes: On successful completion of this course, the students should be able to:

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

References:

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

MECE-105 **RF and Microwave Circuit Design**

L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Outcomes:

- To study the concept of transmission line theory.
- To familiarize with microware network analysis.
- To study the microware component and semiconductor devices.
- To study the concept of amplifier design.

Syllabus

Unit 1: Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

Unit 2:Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.

Unit 3:Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.

Unit 4:Nonlinearity And Time VarianceInter: symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.

Unit 5: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 6: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: On successful completion of this course, the students should be able to:

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

References:

1. Matthew M. Radmanesh, “Advanced RF & Microwave Circuit Design: The Ultimate Guide 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 And Non 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.

MECE-106 **DSP Architecture**

L T P CR

3 0 0 3

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

Course Outcomes:

- To introduce programmable DSP Hardware & special architecture modules.
- To familiarize with DSP processors, structural & architectural considerations.
- To study Multicourse DSPs, HPC, MPI, Multicourse DSP as HPC.
- To familiarize with FPGA based DSP systems & VLIW Architecture.

Syllabus

Unit 1 : Programmable DSP Hardware: Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating Point Computations, Special Architectures Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

Unit 2: Structural and Architectural Considerations: Parallelism in DSP processing, Texas Instruments TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors: TMS320C1X and TMS320C2X Family,TMS320C25 –Internal Architecture, Arithmetic and Logic Unit, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

Unit 3: VLIW Architecture: Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed Cand Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.

Unit 4: Multi-core DSPs: Introduction to Multi-core computing and applicability for DSP hardware, Concept of threads, introduction to P-thread, mutex and similar concepts, heterogeneous and homogenous multi-core systems, Shared Memory parallel programming OpenMP approach of parallel programming, PRAGMA directives, OpenMP Constructs for work sharing like for loop, sections, TI TMS320C6678 (Eight Core subsystem).

Unit 5: FPGA based DSP Systems: Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor.

Unit 6: High Performance Computing using P-DSP: Preliminaries of HPC, MPI, Open MP, multicore DSP as HPC infrastructure.

Course Outcomes: On successful completion of this course, the students should be able to:

- Identify and formalize architectural level characterization of P-DSP hardware
- Ability to design, programming (assembly and C), and testing code using Code Composer Studio environment
- Deployment of DSP hardware for Control, Audio and Video Signal processing applications
- Understanding of major areas and challenges in DSP based embedded systems

References:

1. M. Sasikumar, D. Shikhare, Ravi Prakash, "Introduction to Parallel Processing", 1st Edition, PHI, 2006.
2. Fayez Gebali, "Algorithms and Parallel Computing",1st Edition, John Wiley & Sons, 2011
3. Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff McDonald,"Parallel Programming in OpenMP", 1st Edition, Morgan Kaufman,2000.
4. Ann Melnichuk,Long Talk, "Multicore Embedded systems", 1st Edition, CRC Press,2010.
5. Wayne Wolf, "High Performance Embedded Computing: Architectures, Applications and Methodologies", 1st Edition, Morgan Kaufman, 2006.
6. E.S.Gopi, "Algorithmic Collections for Digital Signal Processing Applications Using MATLAB", 1st Edition, Springer Netherlands,2007.

MECE-107 ADVANCED MICROPROCESSOR & MICROCONTROLLERS

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objective:

- To introduce students to design of basic microprocessor architectural concepts, memory addressing architectural & ALU.
- To introduce the students to various types of instruction interrupts and I/O devices.
- To introduce the students to 8051architectural, programming model & instructions.
- To introduce the students regarding architectural of advanced microprocessor, addressing models, instruction set & interrupts.
- To introduce the students regarding interfacing I/O devices, A/D converter & D/A convertors to microprocessor.
- To introduce the students for developing microprocessor based products.

Syllabus

Unit 1 Design of basic microprocessor architectural Concepts: Microprocessor architecture, word Lengths, addressable memory, Microprocessor's speed architectural characteristics, registers, instruction, memory addressing architecture, ALU, GPR's Control logic & internal data bus.

Unit 2 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 OM. Controllers.

Unit 3 Microcontroller: Introduction 8051 architecture and programming model. Internal RAM and registers, I/O ports, Interrupt system &Instruction sets.

Unit 4 Advanced Micro processors: lntel X86 family of advanced Microprocessor, programming model for 86 family. X86 addressing modes, instruction set, hardware of 186, 286, 386, 486 & Pentium processors. Motorola 68 XXX family of microprocessor, 68 XXX addressing modes, instruction set, hardware.

Unit 5 Microprocessor 110: Data Communication, parallel I/O serial communication, Serial interface and UART, modems, I/O devices, D/A, A/D interface, special I/O devices.

Unit 6 Developing Microprocessor Based Products: Introduction to the Design Process, Preparing the specifications, Developing a design, Implementing and Testing and design, Regulatory Compliance Testing, design tool for Microprocessor Development.

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand the microprocessor architecture, programming and instructions.
- Understand the concepts of 8051, instructions, addressing models and programs.
- To interface I/O devices, A/D & D/A converters with microprocessor & microcontroller.

- Understand the advanced microprocessors along with their architecture, programming model & addressing models.
- Understand the testing & design tolls for microprocessor development and its based product.

Text Books:

1. C.M. Gilmore, "Microprocessors Principals and Application", MGH
2. Rajkamal, "Embedded System, Architecture &Programming",TMH

Reference Books:

1. Berry B. Berry, "Inter Series of microprocessors", PHI
2. D. V. Hall, "Microprocessor &Interfacing", TMH
3. Peatman, "Microprocessor Based System Design", Pearson

ERM01 **Research Methodology and IPR**

L T P CR

2 0 0 2

Theory : 75

Class Work : 25

Total : 100

Duration of Exam : 2 Hrs.

Syllabus

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism , Research ethics,

Unit 3: 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 4: 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 5: Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications.

Unit 6: 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: On successful completion of this course, the students should be able to:

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- 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.
- 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.

References:

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 New Technological Age”, 2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

MEC151 Advanced Communication Networks Laboratory

List of Assignments:

1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.
2. Linux Network Configuration.
    a. Configuring NIC's IP Address.
    b. Determining IP Address and MAC Address using if-config command.
    c. Changing IP Address using if-config.
    d. Static IP Address and Configuration by Editing.
    e. Determining IP Address using DHCP.
    f. Configuring Hostname in /etc/hosts file.
3. Design TCP iterative Client and Server application to reverse the given input sentence.
4. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".
5. Design UDP Client Server to transfer a file.
6. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.
    a. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.
7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.
8. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700MB.Use a TFTP client and repeat the experiment.
9. Signaling and QoS of labeled paths using RSVP in MPLS.
10. Find shortest paths through provider network for RSVP and BGP.
11. Understand configuration, forwarding tables, and debugging of MPLS

Course Outcomes:

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

- Identify the different types of network devices and their functions within a network.
- Understand and build the skills of sub-netting and routing mechanisms.
- Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation.

MEC152 Wireless and Mobile Communication Laboratory

List of Assignments:

1. Understanding Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, multi path environment, Coverage and Capacity issues using communication software.
2. Knowing GSM and CDMA architecture, network concepts, call management, call setup, call release,Security and Power Control, Handoff Process and types, Rake Receiver etc.
3. Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
4. To study transmitters and receiver section in mobile handset and measure frequency band signal and GMSK modulating signal.
5. To study various GSM AT Commands their use and developing new application using it. Understating of 3G Communication System with features like; transmission of voice and videocalls, SMS, MMS, TCP/IP, HTTP, GPS and File system by AT Commands in 3G network.
6. Study of DSSS technique for CDMA, observe effect of variation of types of PN codes, chip rate, spreading factor, processing gain on performance.
7. To learn and develop concepts of Software Radio in real time environment by studying the building blocks like Base band and RF section, convolution encoder, Interleaver and De- Interleaver.
8. To study and analyze different modulation techniques in time and frequency domain using SDR kit.

Course Outcomes:

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

- Understanding Cellular concepts, GSM and CDMA networks
- To study GSM handset by experimentation and fault insertion techniques
- Understating of 3G communication system by means of various AT commands usage in GSM
- Understanding CDMA concept using DSSS kit
- To learn, understand and develop concepts of Software Radio in real time environment

MEC-201 **Antennas and Radiating Systems**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To familiarize with concept of antenna parameters and radiation mechanism.
- To study the design and analysis of linear wire antennas.
- To understand the concept of antenna arrays.
- To study the design of Aperture antenna, Micro strip antenna and reflector antenna.

Syllabus

Unit 1: 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, Friis Transmission equation, Antenna Temperature.

Unit 2: 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 3: LinearArrays: Two element array, N Element array, Uniform Amplitude and spacing, Broadside and End fire array, Super directivity, Planar array, Design consideration.

Unit 4: 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 5: Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis, Rectangular Patch, Circular Patch.

Unit 6: Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introduction to MIMO.

Course Outcomes: On successful completion of this course, the students should be able to:

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

References:

1. Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 4th edition, 2016.
2. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas for All Applications", Tata McGraw-Hill, 2002.

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

MEC-202 **Advanced Digital Signal Processing**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Outcomes:

- To give overview of DSP, FET alogwith, FIR & IIR filters.
- To introduce the multi rate DSP.
- To study prediction filters, wiener filter.
- To introduce adaptive filter, LMS algorithm, minimum mean square criterion.
- To introduce structures estimation
- To study the applications of DSP.

Syllabus

Unit 1: Overview of DSP, Characterization in time and frequency, FFT Algorithms, Digital filter design and structures, Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, parallel realization of IIR.

Unit 2 : Multi rate DSP, Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in subband coding.

Unit 3: 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 4: Adaptive Filters, Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm

Unit 5: Estimation of Spectra from Finite, Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum-Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation.

Unit 6: Application of DSP & Multi rate DSP, Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications

Course Outcomes: On successful completion of this course, the students should be able to:

- To understand theory of different filters and algorithms
- To understand theory of multirate DSP, solve numerical problems and write algorithms
- To understand theory of prediction and solution of normal equations
- To know applications of DSP at block level.

References:

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

MECE-201 **Satellite Communication**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objective:

- To study basics of satellite communication & laws governing the satellite motion.
- To familiarize various satellite subsystem satellite structure & equation
- To introduce various satellite subsystems & their applications & effect of various atmospheric.
- To study various multiple access schemes & special purposes satellite condition on satellite working.

Syllabus

Unit 1: Architecture of Satellite Communication System: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks.

Unit 2: Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.

Unit 3: Satellite sub-systems: Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems, antenna sub system.

Unit 4: Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Unit 5: Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.

Unit 6: Modulation and Multiple Access Schemes used in satellite communication. Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO. GPS.

Course Outcomes: On successful completion of this course, the students should be able to:

- Visualize the architecture of satellite systems as a means of high speed, high range communication system.
- State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
- Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

- To understand multiple access schemes used in satellite communication & applications of various antenna.

References:

1. Timothy Pratt and Others, “Satellite Communications”, Wiley India, 2nd edition,2010.
2. S. K. Raman, “Fundamentals of Satellite Communication”, PearsonEducation India, 2011.
3. Tri T. Ha, “Digital Satellite Communications”, Tata McGraw Hill, 2009.
4. Dennis Roddy, “Satellite Communication”, McGraw Hill, 4th Edition, 2008.

MECE-202 **Internet of things**

L T P CR	**Theory**	**: 75**
3 0 0 3	**Class Work**	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce various internet protocols & its application in designing systems.
- To understand network challenge & key scientific problems involved in IOT development.
- To describe core concept of IOT, role & scope of smart sensors for technology convergence.
- To outline various research application & scope for IOT legislation.

Syllabus

Unit 1: Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M and peer networking concepts, Ipv4 and IPV6.

Unit 2: Software Defined Networks SDN, From Cloud to Fog and MIST networking for IoT communications, Principles of Edge/P2P networking, Protocols to support IoT communications, modular design and abstraction, security and privacy in fog.

Unit 3: Wireless sensor networks: introduction, IOT networks (PAN, LAN and WAN), Edge resource pooling and caching, client side control and configuration.

Unit 4: Smart objects as building blocks for IoT, Open source hardware and Embedded systems platforms for IoT, Edge/gateway, IO drivers, C Programming, multithreading concepts.

Unit 5: Operating systems requirement of IoT environment, study of mbed, RIoT, and Contiki operating systems, Introductory concepts of big data for IoT applications.

Unit 6: Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation.

Course Outcomes: On successful completion of this course, the students should be able to:

- Understand what IoT technologies are used for today, and what is required in certain scenarios.
- Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions.
- Apply these technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications.

References:

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

4. Samuel Greenguard, “Internet of things”, MIT Press, 2015.

Web resources:

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

MECE-203 **Voice and Data Networks**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce the students about Data network designing & communication on designed networks.
- To introduce the student about network design issues.
- To provide the students information about various models of networks and protocols used for flow control on data link layer.
- To introduce the students about congestions & congestion control algorithms.

Syllabus

Unit 1: Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

Unit 2: 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 3: 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.

Unit 4: Queuing Models of Networks , Traffic Models , Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols , Aloha System , Carrier Sensing , Examples of Local area networks,

Unit 5: 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 6: Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

Course Outcomes: On successful completion of this course, the students should be able to:

- Understand protocol, algorithms, trade-offs rationale
- Understand routing, transport, DNS resolutions
- Understand queuing model and network congestion avoidance
- Understand network extensions and next generation architectures

References:

1. D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, Prentice Hall, 1992.
2. L. Peterson and B. S. Davie, “Computer Networks: A Systems Approach”,5th Edition, Morgan Kaufman, 2011.

3. Kumar, D. Manjunath and J. Kuri, “Communication Networking: An analytical approach”, 1st Edition, Morgan Kaufman, 2004.
4. Walrand, “Communications Network: A First Course”, 2nd Edition, McGraw Hill, 2002.
5. Leonard Kleinrock, “Queuing Systems, Volume I: Theory”, 1st Edition, John Wiley and Sons, 1975.
6. Aaron Kershenbaum, “Telecommunication Network Design Algorithms”, McGraw Hill, 1993.
7. Vijay Ahuja, “Design and Analysis of Computer Communication Networks”, McGraw Hill, 1987

MECE-204 **Digital Image Processing**

L T P CR

3 0 0 3

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

Unit 1: Digital Image Fundamentals: Visual Perception, concept of uniform and non-uniform sampling & quantization, Relationships between pixels-neighbours of pixel, connectivity labelling of connected components. Relations, equivalence and Transitive closure (Warshall's Algorithm), Distance measures, Arithmetic/ Logic operation, Basic transformation.

Unit 2: Image Transforms: Discrete Fourier transform, Properties of DFT, Fast Fourier transform, Discrete Cosine transform, Hadmard transform.

Unit 3:Image Enhancement: Spatial and frequency domain methods, intensity transformation, Histogram processing and Averaging spatial filtering, Low pass and high pass filters, Homomorphic filters, Colour image processing.

Unit 4:Image Restoration: Degradation model, digitalization of circulate and block circulate metrics, Algebraic approved inverse filtering, wiener filter, constrained least square restoration, Interactive restoration in spatial domain.

Unit 5:Image Segmentation: Detection of Discontinuities, Point detection, Line detection, Edge detection, Edge linking and boundary detection, Thresholding, Global thresholding, Adaptive Thresholding, Optimum thresholding, Regional oriented segmentation.

Unit 6:Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and closing, Hit or Miss transform, Some Basic Morphological Algorithms- Boundary Extraction, Region Filling.

Unit 7:Compression: Lossy and Lossless Compression, Basic Compression Methods- Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-Length Coding, JPEG Compression.

TextBooks:

I. Anil K Jain, "Fundamentals of Digital Image Processing", PHI Edition 1997.
II. Keenneth R Castleman, " Digital Image Processing", Pearson

Reference Books:

III. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing"
IV. Pearson Chanda & Majumder "Digital image processing and analysis".

MECE-205 **Markov Chains and Queuing Systems**

L T P CR	**Theory**	**: 75**
3 0 0 3	**Class Work**	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce the students about the basics of probability theory & randomness of numbers.
- To introduce the students about markov chain in discrete & continuous time domain and also regenerative processes used in mathematical modelling.
- To introduce students about modelling a system as uening system as aranom proce in markov chains.

Syllabus

Unit 1: Introduction: Review of basic probability, properties of nonnegative random variables, laws of large numbers and the Central Limit Theorem.

Unit 2: Renewal Processes: Basic definitions, recurrence times, rewards and renewal reward theorem, point processes, Poisson process, Walds equation, Blackwell's theorem.

Unit 3: Discrete time Markov chains: definitions and properties, matrix representation, Perron- Frobenius theory.

Unit 4: 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 5: 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.

Unit 6: Advanced queuing models: priority, vacation and retrials in queues.

Course Outcomes: On successful completion of this course, the students should be able to:

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

References:

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.

MECE-206 **MIMO System**

L T P CR

3 0 0 3

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

Course Objectives:

- To study multi antenna system and diversity.
- To study channel modelling and propagation.
- To study the concept of MIMO receiver & multi antenna system.
- To study the mathematical modelling and analysis of MIMO system

Syllabus

Unit 1: Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems.

Unit 2: Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency an capacity, Transmitting independent streams in parallel, Mathematical notation

Unit 3: The generic MIMO problem, Singular Value Decomposition, Eigen values and eigenvectors, Equalising MIMO systems, Disadvantages of equalising MIMO systems, Pre distortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of precoding and combining, Channel state information.

Unit 4: Codebooks for MIMO, Beam forming, Beam forming principles, increased spectrum efficiency, Interference cancellation, Switched beam former, Adaptive beam former, Narrowband beam former, Wideband beam former

Unit 5: Case study: MIMO in LTE, Code words to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beam forming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models

Unit 6: Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

Course Outcomes: On successful completion of this course, the students should be able to:

- Understand channel modelling and propagation, MIMO Capacity, space-time coding,
- MIMO receivers, MIMO for multi-carrier systems (e.g. MIMO-OFDM), multi-user communications, multi-user MIMO.
- Understand cooperative and coordinated multi-cell MIMO, introduction to MIMO in 4G (LTE, LTE-Advanced, WiMAX).
- Perform Mathematical modelling and analysis of MIMO systems.

References:

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

MECE-207 **Programmable Networks - SDN, NFV**

L T P CR	**Theory**	**: 75**
3 0 0 3	**Class Work**	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce the students programmable networks.
- To make the students aware of concept & protocols control & data plane separation.
- To introduce the students about the concept of network virtualization & control plane on SDN.
- To give the students brief knowledge on programming SDNs, Architecture & topologies of SDN.

Syllabus

Unit 1 : 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.

Unit 2 : Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the basics of OpenFlow protocol.

Unit 3 : Network Virtualization: Concepts, Applications, Existing Network Virtualization Framework, Mininet A simulation environment for SDN.

Unit 4 : 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 Hadrware-based, Programmable Network Hardware.

Unit 5 : 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 6 : Data Center Networks: Packet, Optical and Wireless Architectures, Networkn Topologies, Use Cases of SDNs, Data Centers, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.

Course Outcomes: On successful completion of this course, the students should be able to:

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

References:

1. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies”, O'Reilly Media, August 2013.
2. Paul Goransson, Chuck Black, Timothy Culver. “Software Defined Networks: A Comprehensive Approach”, Morgan Kaufmann Publishers, 2016.

3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, CRC Press, 2014.
4. Vivek Tiwari, “SDN and OpenFlow for Beginners”, Amazon Digital Services, Inc., ASIN: 2013.
5. Nick Feamster, Jennifer Rexford and Ellen Zegura, “The Road to SDN: An Intellectual History of Programmable Networks” ACM CCR April 2014.
6. Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015.
7. OpenFlow standards, http://www.openflow.org, 2015.

MECE-208 **ADVANCE DIGITAL COMMUNICATION**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

COURSE OBJECTIVES:

- To learn the concept of Complex baseband representation of signals Geometric representation of signals, Gram –Schmidt Orthogonalisation procedure .
- To learn the differenent types of digital modulation schemes.
- To learn the concept of Additive White Gaussian Noise(AWGN) Channel, different types of filters and detectors.
- To Learn the concept of different types of band-limited channels and their performance.
- To learn the concept of Different synchronization techniques.

SYLLABUS

UNIT 1: Introduction: Digital communication system (description of different modules of the block diagram), Complex baseband representation of signals, Gram-Schmidt orthogonalization procedure. M-ary orthogonal signals, bi-orthogonal signals, simplex signal waveforms.

UNIT 2: Modulation:Pulse amplitude modulation (binary and M-ary, QAM), Pulse position modulation (binary and M-ary), Carrier modulation (M-ary ASK, PSK, FSK, DPSK), Continuous phase modulation (QPSK and variants, MSK, GMSK).

UNIT 3: Receiver in additive white Gaussian noise channels:Coherent and noncoherent demodulation: Matched filter, Correlator demodulator, square-law, and envelope detection; Detector: Optimum rule for ML and MAP detection Performance: Bit-error-rate, symbol error rate for coherent and noncoherent schemes.

UNIT 4: Band-limited channels: Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (duobinary and modified duobinary pulses), demodulation; Channel with distortion: Design of transmitting and receiving filters for a known channel and for time varying channel (equalization); Performance: Symbol by symbol detection and BER, symbol and sequence detection

UNIT5: Synchronization:Different synchronization techniques (Early-Late Gate, MMSE, ML and spectral line methods.

Text Books:

1. Taub and Schilling, “Principal of Communication System”,TMH
2. S.Haykin, “Digital communication”,Willey Pub.

Reference Books:

1. WayenTomasi, “Electronic Communication System” ,Pearson pub.
2. J.Dass, S.K.Mullick& P.K. Chatterjee, “Principal of Digital Communication” , Willey Eastern Pub

3. John G. Proakis, "Digital Communication", McGraw Hill, 4th edition, 2001.
4. Bernard Sklar, "Digital Communication - Fundamental and applications", Pearson education (Asia), Pvt. Ltd., 2nd edition, 2001.

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand the concept of Complex baseband representation of signals Geometric representation of signals, Gram –Schmidt Orthogonalisation procedure. .
- Analyze of different types of digital modulation schemes.
- Deduce the Additive White Gaussian Noise(AWGN) Channel, different types of filters and detectors.
- Describe the different types of band-limited channels and their performance and Different synchronization techniques.

MEC251 Antennas and Radiating Systems Laboratory

List of Assignments:

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

Course Outcomes:

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

- Determine specifications, design, construct and test antenna.
- Explore and use tools for designing, analyzing and testing antennas. These tools include Antenna design and analysis software, network analyzers, spectrum analyzers, and antenna pattern measurement techniques.

MEC252 **Advanced Digital Signal Processing Lab**

List of Assignments:

1. Basic Signal Representation
2. Correlation Auto And Cross
3. Stability Using Hurwitz Routh Criteria
4. Sampling FFT of Input Sequence
5. Butterworth Lowpass and Highpass Filter Design
6. Chebychev Type I, II Filter
7. State Space Matrix from Differential Equation
8. Normal Equation Using Levinson Durbin
9. Decimation And Interpolation Using Rationale Factors
10. Maximally Decimated Analysis DFT Filter
11. Cascade Digital IIR Filter Realization
12. Convolution And M Fold Decimation &PSD Estimator
13. Estimation Of PSD
14. Inverse Z Transform
15. Group Delay Calculation
16. Separation of T/F
17. Parallel Realization of IIR filter

Course Outcomes:

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

- Design different digital filters in software
- Apply various transforms in time and frequency
- Perform decimation and interpolation

MECE-301 **PEV- High Performance Networks**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce with types of networks, network design issues, network design tools, protocols & architecture.
- To introduce the students about VOIP system architecture and VPN remote Access.
- To introduce the students about traffic modelling.
- To familiarize the students about network security & management & infrastructure for network management.

Syllabus

Unit 1: 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 2: 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, signalling protocols for VoIP, PSTN gateways, VoIP applications.

Unit 3: VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN, MPLSoperation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

Unit 4: Traffic Modeling: Little's theorem, Need for modeling, Poisson modeling, Non-poisson models, Network performance evaluation.

Unit 5: Network Security and Management: Principles of cryptography, Authentication, integrity, key distribution and certification, Access control and fire walls, attacks and counter measures, security in many layers.

Unit 6: Infrastructure for network management, The internet standard management framework – SMI, MIB, SNMP, Security and administration, ASN.1.

Course Outcomes: On successful completion of this course, the students should be able to:

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

References:

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

MECE-302 **Pattern Recognition and Machine Learning**

L T P CR	**Theory**	**: 75**
3 0 0 3	**Class Work**	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce the students about basic theories of pattern recognition.
- To introduce the students about parametric linear models of regression.
- To introduce the students about neural network designing linear discriminant functions.
- To introduce the students about machine independent & unsupervised learning techniques.

Syllabus

Unit 1: 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

Unit 2: Linear models: Linear Models for Regression, linear regression, logistic regression Linear Models for Classification.

Unit 3: Neural Network: Perceptron, multi-layer perceptron, backpropagation algorithm, error surfaces, practical techniques for improving backpropagation, additional networks and training methods, Adaboost, Deep Learning

Unit 4: Linear discriminant functions - decision surfaces, two-category, multi-category, minimumsquared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

Unit 5: Algorithm independent machine learning: lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers

Unit 6: Unsupervised learning and clustering: k-means clustering, fuzzy k-means clustering, hierarchical clustering

Course Outcomes: On successful completion of this course, the students should be able to:

- Study the parametric and linear models for classification
- Design neural network and SVM for classification
- Develop machine independent and unsupervised learning techniques

References:

1. Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2nd Edition John Wiley & 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.

MECE-303 **Remote Sensing**

L T P CR **Theory : 75**

3 0 0 3 **Class Work : 25**

Total : 100

Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce physics of remote sensing via atmospheric conditions.
- To give exposure to students regarding various data acquisition techniques for remote sensing application.
- To study myriad remote sensing platform , airborne, space borne, sensor.
- To learn enhancement protocols for efficient data analysis via remote sensing.

Syllabus

Unit 1: Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing, Effects of Atmosphere, Scattering, Different types Absorption, Atmospheric window, Energy interaction with surface features, Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.

Unit 2: Data Acquisition: Types of Platforms different types of aircrafts, Manned and Unmanned spacecrafts, sun synchronous and geo synchronous satellites, Types and characteristics of different platforms, LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD etc

Unit 3: Photographic products, B/W, color, color IR film and their characteristics: resolving power of lens and film, Opto mechanical electro optical sensors, across track and along track, scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery-calibration of thermal scanners.

Unit 4: Scattering System: Microwave scatterometry, types of RADAR, SLAR, resolution range and azimuth, real aperture and synthetic aperture RADAR, Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms airborne and space borne, sensors ERS, JERS, RADARSAT, RISAT Scatterometer, Altimeter LiDAR remote sensing, principles, applications.

Unit 5: Thermal And Hyper Spectral Remote Sensing: Sensors characteristics principle of spectroscopy-imaging spectroscopy field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing thermal sensors, principles, thermal data processing, applications.

Unit 6: Data Analysis: Resolution: Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio data products and their characteristics-visual and digital interpretation, Basic principles of data processing, Radiometric correction, Image enhancement, Image classification, Principles of LiDAR, Aerial Laser Terrain Mapping.

Course Outcomes: On successful completion of this course, the students should be able to:

- Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles.
- Understand various types of remote sensing techniques.
- Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.
- Design various data processing techniques for radiometer correct & image enhancement.

References:

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

MECE-304 **Electronics System Design**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce the students about basics of Digital Electronics.
- To introduce the students about the design of Combinational Circuit
- To introduce the students about design of Sequential Circuit
- To introduce the students about Multi Input System Controller Design
- To introduce the students about Asynchronous Finite State Machines.

Syllabus

Unit 1 Review of Digital Electronics concept

Unit 2 MSI and LSI Circuits And Their Applications: Arithmetic Circuits, Comparators, Multiplexers, Code Converters, XOR And AND-OR INVERTER Gates, Wired Logic, Bus Oriented Structures, Tri-State Bus System, Propagation Delay.

Unit 3 Sequential Machines: The Concept Of Memory, The Binary Cell, The Cell And The Bouncing Switch, Set I Reset, D, Clocked T, Clocked JK Flip Flop, Design Of Clock FIF, Conversion, Clocking Aspects, Clock Skew, State Diagram Synchronous Analysis Process, Design Steps For Traditional Synchronous Sequential Circuits, State Reduction, Design Steps For Next State Decoders, Design Of Out Put Decoders, Counters, Shift Registers and Memory.

Unit 4 Multi Input System Controller Design: System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design. Introduction to the CPLD & FPGA.

Unit 5 Asynchronous Finite State Machines: Scope, Asynchronous Analysis, Design Of Asynchronous Machines, Cycle And Races, Plotting And Reading The Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches To Asynchronous Design, Hazards In Circuit Developed By MEV Method.

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand all the basic gates, number system and corresponding conversions, various binary codes and codes available for error detection and correction.
- Understand the design and explain working of various types of combinational circuits.
- Understand the design and analysis of different sequential circuits.
- Understand the design and analysis of Multi input system controller.

- Understand the design and analysis of Asynchronous finite state machines.

Text Books:

1. Fletcher, "An Engineering Approach to Digital Design" PHI 1990
2. Z. Kohavi, "Switching and Finite Automata Theory", TMH

Reference Books

1. Markovitz, "Introduction to Logic Design", TMH
2. Mano, "Digital Design", PHI

OPEN ELECTIVES

MECO-301 **Business Analytics**

L T P CR	**Theory**	**: 75**
3 0 0 3	**Class Work**	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- 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.

Syllabus

Unit1: 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 2: 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 3: 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 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Unit 6: Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Course Outcomes: On successful complete of this course, the students should be able to:

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.

MECO-302 **Industrial Safety**

L T P CR
3 0 0 3

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

Syllabus

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

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

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

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

Reference:

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

MECO-303 **Operations Research**

L T P CR

3 0 0 3

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

Syllabus

Unit 1: Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2 Formulation of a LPP, Graphical solution revised simplex method, duality theory, dual simplex method - sensitivity analysis - parametric programming

Unit 3: Nonlinear programming problem, Kuhn-Tucker conditions min cost flow problem, max flow problem, CPM/PERT

Unit 4: Scheduling and sequencing - single server and multiple server models, deterministic inventory models, Probabilistic inventory control models, Geometric Programming.

Unit 5: Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

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

- Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
- Students should able to apply the concept of non-linear programming
- Students should able to carry out sensitivity analysis
- Student should able to model the real world problem and simulate it.

References:

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

MECO-304 **Cost Management of Engineering Projects**

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Syllabus

Unit 1: Introduction and Overview of the Strategic Cost Management Process

Unit 2: Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making. Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities, Pre project execution main clearances and documents Project team, Role of each member. Importance Project site, Data required with significance. Project contracts, Types and contents, Project execution Project cost control, Bar charts and Network diagram, Project commissioning, mechanical and process.

Unit 3: Cost Behavior and Profit Planning Marginal Costing, Distinction between Marginal Costing and Absorption Costing, Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Standard Costing and Variance Analysis, Pricing strategies, Pareto Analysis, Target costing, Life Cycle Costing, Costing of service sector, Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints, Activity-Based Cost Management, Bench Marking, Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets, Performance budgets, Zero-based budgets, Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit 4: Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

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

MECO-305 **Composite Materials**

L T P CR

3 0 0 3

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

Syllabus

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.

UNIT – II: **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 – III: Manufacturing of Metal Matrix Composites: Casting, Solid State 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–IV: 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 V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, Maximum strain criteria, interacting failure criteria, hygrothermal failure, Laminate first play failure-insight strength, Laminate strength-ply discount truncated maximum strain criterion, strength design using caplet plots, stress concentrations.

TEXT BOOKS:

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

References:

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

MECO-306 **Waste to Energy**

L T P CR
3 0 0 3

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

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

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

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

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

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

References:

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

ENGLISH FOR RESEARCH PAPER WRITING

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course objectives:

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

Unit 1: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit 4: key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 5: skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit 6: useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies:

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's

Book .

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

DISASTER MANAGEMENT

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Syllabus

Unit1: Introduction: Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Unit 2: Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3: Disaster Prone Areas In India: Study Of Seismic Zones, Areas Prone To Floods And Droughts, Landslides And Avalanches, Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami, Post-Disaster Diseases And Epidemics.

Unit 4: Disaster Preparedness And Management: Preparedness, Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk, Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports, Governmental And Community Preparedness.

Unit 5: Risk Assessment: Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation, Techniques of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Unit 6: Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends in Mitigation, Structural Mitigation And Non-Structural Mitigation, Programs of Disaster Mitigation In India.

SUGGESTED READINGS:

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

SANSKRIT FOR TECHNICAL KNOWLEDGE

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Unit 1: Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

Unit 2: Order, Introduction of roots, Technical information about Sanskrit Literature

Unit 3: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Suggested reading

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

Course Output

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

VALUE EDUCATION

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

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

Unit 1: Values and self-development, Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non, moral valuation. Standards and principles, Value judgements

Unit 2: Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism.Love for nature ,Discipline

Unit 3: Personality and Behavior Development, Soul and Scientific, attitude, positive thinking, integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature

Unit 4: Character and Competence, Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence ,Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

Suggested reading

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

Course outcomes

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

CONSTITUTION OF INDIA

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- 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.
- 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.

Syllabus

Unit 1: History of Making of the Indian Constitution: History**,** Drafting Committee, (Composition & Working)

Unit 2: Philosophy of the Indian Constitution: Preamble, Salient Features.

Unit 3: Contours of Constitutional Rights & Duties: Fundamental Rights, Right to quality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Unit 4: Organs of Governance: Parliament, Composition, Qualifications and is qualifications, Powers and Functions, Executive, President, Governor, Council of Minister, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit 5: Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj, Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat, Position and role, Block level, Organizational Hierarchy (Different departments), Village level, Role of Elected and Appointed officials, Importance of grass root democracy

Unit 6: Election Commission: Election Commission, Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission, Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Course Outcomes:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Suggested reading

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

PEDAGOGY STUDIES

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Unit 1: Introduction and Methodology: Aims and rationale, Policy background, Conceptual, framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions**,** Overview of methodology and Searching,

Unit 2: Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

Unit 3: Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change, Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 4: Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

Unit 5: Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Course Outcomes:

Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal, Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

STRESS MANAGEMENT BY YOGA

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- To achieve overall health of body and mind
- To overcome stress

Syllabus

Unit 1: Definitions of Eight parts of yog. (Ashtanga)

Unit 2: Yam and Niyam, Do`s and Don't's in life., i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 3: Asan and Pranayam, i) Various yog poses and their benefits for mind & body, ii)Regularization of breathing techniques and its effects-Types of pranayam

Course Outcomes:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

Suggested reading

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

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Unit 1: Neetisatakam-Holistic development of personality, Verses 19,20,21,22 (wisdom), Verses 29,31,32 (pride & heroism), Verses 26,28,63,65 (virtue), Verses 52,53,59 (dont's), Verses 71,73,75,78 (do's)

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

Unit 3: Statements of basic knowledge, Shrimad Bhagwad Geeta: Chapter2 Verses 56, 62, 68**,** Chapter 12 Verses 13, 14, 15, 16,17, 18**,** Personality of Role model. Shrimad Bhagwad Geeta, Chapter2 Verses 17, Chapter3 Verses 36,37,42, Chapter4 Verses 18, 38,39**,** Chapter18 Verses 37,38,63

Course Outcomes:

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

Suggested reading

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

SWAMI VIVEKANANDA'S THOUGHTS

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce biography and philosophical thought of Swami Vivekananda
- To present Swami Vivekananda's views on major religions of the world and Universal Religion
- To present Swami Vivekananda' teaching and views on social issues.

Syllabus

Unit 1: Swami Vivekananda a Brief biography, Influence of Ramakrishna on Vivekananda, Parliament of Religions, Establishment of Ramakrishna mission.

Unit 2: Philosophy of Swami Vivekananda, Nature of Reality, Nature of Self, Nature of the universe, The doctrine of Maya, Identity of Self and God, Karma Yoga, Raj Yoga , Bhakti Yoga, Gyan Yoga.

Unit 3: Swami Vivekananda's observations on major religions of the world (a) Hinduism (b) Christianity (c) Islam

Unit 4: The concept of Universal Religion and its characteristic, Fundamental unity of all religions, acceptance and not tolerance is the principle.

Unit 5: Vivekananda and Nationalism, The message of patriotism, spirituality as the basis of patriotism, Sociological views of Vivekananda, His views on caste and untouchability, status of women, His views on Education, Swami Vivekananda's concept of Vedantic Socialism

Books: The Complete Works of Swami Vivekananda Vol. 1 to 8 Relevant Chapters