

TEACHING AND EXAMINATION SCHEME  
**SPECIALISATION DIGITAL COMMUNICATION ENGINEERING**  
**M.E. 1st Year (2015-2016)**

<i>Subject</i>	Period		Course work Marks	Examintion	
	per week	T/P		Marks	Hours
	Theory				

**FIRST SEMESTER**

EC-ME 34 A	Communication System Analysis (EC)	3	2	25	100	3
EC-ME 12 A	Information Theory (EC)	3	2	25	100	3
EC-ME 13 A	Digital Communication Systems (EC)	3	2	25	100	3
EC-ME 14 A	Optical Communication (EC)	3	2	25	100	3
EC-ME 15 A	Satelite Communication (EC)	3	2	25	100	3
EC-ME 16 B	Communication System Lab (EC)	-	6	50	75	-
<b>Total</b>		12	16	175	575	

**SECOND SEMESTER**

EC-ME 17 A	ISDN & Broadband Networks (EC)	3	2	25	100	3
EC-ME 18 A	Computer Communications (EC)	3	2	25	100	3
Elective I		3	2	25	100	3
Elective II		3	2	25	100	3
Elective III		3	2	25	100	3
EC-ME 19 B	Telematics Lab (EC)		6	50	75	
<b>Total</b>		15	16	175	575	

**M.E. II YEAR (2016-2017)**

**THIRD SEMESTER**

EC-ME 20 B	Seminar	-	-	100	-	-
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**FOURTH SEMESTER**

EC-ME 21 B	Dissertation	-	-	-	-	-
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<b>GRAND TOTAL OF MARKS</b>		<b>450 + 1150 = 1600</b>				
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**ELECTIVE PAPERS (ANY THREE)**

EC-ME 22 A	Digital Signal Processing & Applications (EC)
EC-ME 23 A	Microwave Communication & Remote Sensing (EC)
EC-ME 24 A	Detection & Estimation Theory (EC)
EC-ME 25 A	Theory of Coding & Decoding (EC)
EC-ME 26 A	Digital Coding of Speech and Video Wave Forms (EC)
EC-ME 27 A	Digital Image Processing (EC)
EC-ME 28 A	Telecommunication Switching & Networks (EC)
EC-ME 29 A	Spread Spectrum Techniques (EC)
EC-ME 30 A	Radar System Analysis (EC)
EC-ME 31 A	Advance Antenna Theory (EC)
EC-ME 32 A	Mobile Communication Engineering (EC)
MA-ME(EC) 33 A	Mathematics (EC)

# **ME (EC) DIGITAL COMMUNICATION ENGINEERING**

## **(First Semester)**

### **EC-ME 34 A - COMMUNICATION SYSTEM ANALYSIS (EC)**

Random Variables: Statistical Averages, Transformation of Random Variables

Random Processes: Stationarity, mean correlation & covariance functions, Ergodicity. Transmission of Random Process through a linear filter, power spectral density, Gaussian Process, Poisson Process, Markov Process.

Noise analysis in CW modulation system: noise in DSB-SC, SSB, AM, FM receiver, threshold effect in AM & FM Threshold reduction.

Performance of Baseband, PCM and delta modulator systems, Introductory study of spread spectrum modulation.

### **EC-ME 12 A - INFORMATION THEORY (EC)**

Self and mutual information. Entropy and channel capacity. Information in sources. Discrete memoryless systems. Continuous memoryless systems. Channel capacity of cascaded and parallel channels. Shannon-Hartely theorem and its implication for band limited signals. Communication Systems in the light of information theory. Ideal communication systems and bounds. Data translation, data capaction and data compression codes. Theory of error correction codes, Block codes and convolucional codes and their decoding.

### **EC-ME 13 A - DIGITAL COMMUNICATION SYSTEMS (EC)**

Theory and techniques of sampling and quantization. Design and performance of PAM, PCM and delta modulation systems. Wave form formatting and coding of digital signals. Inter symbol interference and partial response signalling. Equalization and filtering. Digital transmission and multiplexing. Theory of optimum receivers. Correlatin and matched filter receivers. Performance of various coherent and non-coherent digital carrier modulation methords. M-ary digital systems, synchronization techniques, Introduction to fading channels. Concepts of error control coding.

### **EC- ME 14 A - OPTICAL COMMUNICATION (EC)**

Introduction to theories of Optical propagation, Transmission characteristic of optical fibres-step. Indes fibres (Multimode and single mode), Graded index fibres Attenuation, Dispersion,

Scattering and Polarization, V-number-cutoff, No. of guided modes. Fabrication of optical fibres. Cables, Joints, Splices, couplers, Connectors.

Optical Sources: Absorption and emission of radiation Semiconductor materials, heterojunction.

LEDs: Surface Emitting Edge Emitting, Planar, Coupling Characteristics and drawback of LEDs.

Lasers: Optical Feedback and lasing action. Multimode single mode injection lasers, confinement, various structures, characteristics and drawbacks.

Optical Detector: Principle and working, p-n, p-i-n and APD photo diode, Responsivity, other technique for detection.

Optical communication Systems: Intensity modulation, Direct detection Transmitter- Receiver performance, consideration. Subcarrier intensity modulation and detection. Introduction to optical pulse and digital communication techniques, Line coding, Performance and design consideration of optical communication system. Power budgeting. Coherent communication, Multiplexing, Practical constraints to repeaters less transmission.

Introduction to Parameters, Estimation and characterization in optical communication systems.

Application of optical Communications.

### **EC-ME 15 A - SATELLITE COMMUNICATION (EC)**

Satellite system parameters and constraints. Digital satellite link analysis and design. Transponder utilisation and design. Transmission losses and noise. Interference analysis. Rain induced attenuation and cross polarisation interference. Earth station design and antennas, high power amplifier. Low noise amplifier and convertor. Multiple access techniques analysis and design. Satellite position determination, multiple scanning beam systems Frequency relay links. Satellite packet communications. Introduction to satellite spread spectrum communications. Application of satellite circuits.

### **EC-ME 17 A - ISDN & BROADBAND NETWORKS (EC)**

ISDN standards and architectures. The S/T and U interfaces ISDN protocols, Subscriber loop technologies.

ISDN terminal equipment. Evolution of BISDN

Broadband telecommunication technologies. SDH frame structure and synchronous multiplexing. ATM theory, protocols, switching and connectivity. Introduction to congestion

control and performance evaluation of ATM networks. ASONET structure, components and tributaries, synchronization in broadband networks.

### **EC-ME 18 A - COMPUTER COMMUNICATIONS (EC)**

Subsystems of computer communications networks, ISO OSI model. Review of Markov processes and Queueing network models. Analysis of multiplexed data communication systems. Resource sharing. Resource sharing, Digital switching concentration and multiplexing. Packet switched systems. Capacity and flow assignment. Routing and congestion, Communication protocols and interface, Detailed study of TCP/IP protocol suite, Satellite and ground based packet broadcast, systems, Elements of network optimization

#### **Elective papers (any three)**

### **EC-ME 22 A – DIGITAL SIGNAL PROCESSING AND APPLICATIONS (EC)**

Discrete Fourier Transformer for processing of filters. IIR and FIR digital filter design. State variable analysis and its applications in digital filter design, Multi rate signal processing, Short time Fourier transform and wavelet transform. IIR and FIR Wiener filtering. Adaptive filtering gradient descent and recursive least square technique Parametric and Non Parametric spectrum estimation. General study of the application of digital signals processing to spectrum, image and radar signals.

### **EC-ME 23 A – MICROWAVE COMMUNICATION AND REMOTE SENSING (EC)**

Line of sight and Troposcatter Communications. Channel characterization, Propagation studies, Performance requirement, Impairments and evolutions of digital and analog communications using LOS and troposcatter systems. Design of LOS communication Systems, Link calculation.

Characterization of sub systems of line of sight communication system. Theory and system design of troposcatter communication system.

Introduction to Microwave Remote Sensing Theory and Principles of Microwave Remote Sensing.

Microwave Sensors both Passive and Active Microwave Receivers Radiometers, Real Aperture Radar Synthetic Aperture Radar. Scatterometers, Altimeters, Antenna System for Microwave Sensors. Characterization of Microwave Sensors.

Data Processing of Microwave, Data applications of Passive and Active Microwave sensors for Ocean Land and Atmosphere from tower aircraft and space craft

## **EC- ME 24 A – DETECTION AND ESTIMATION THEORY (EC)**

Hypothesis testing, Bayes, min-max and Neyman Pearson's criteria, General gaussian problem. Detection and Estimation of continuous signals in white and coloured noise, Wiener-Hopf and Kalman Bucy filtering, sequential detection, Introduction and Detection in doubly dispersive channels application to radar

## **EC-ME 25 A – THEORY OF CODING AND DECODING (EC)**

Review of linear algebraic concept regarding groups, rings fields and vector spaces, Linear block codes and their error detection and correction capabilities Encoding and decoding of cyclic codes, Error trapping, decoding and burst error corrections, BCH codes, Encoding and structure of convolutional codes, Maximum likelihood decoding and Viterbi decoding of convolutional codes, introductions to practical applications of error control codes

## **EC-ME 26 A – DIGITAL CODING OF SPEECH AND VIDEO WAVEFORMS (EC)**

Characteristic of speech and image waveforms, analysis and synthesis of speech and radio signals, sampling and reconstructions of band limited waveforms Quantization audio and speech wave Forms, importance of bandwidth and bit-rate reduction Study of Redundancies, DPCM, delta modulation and adaptive delta modulation Introduction to encoding of other signals like ECG, EEG

## **EC ME 27 - A DIGITAL IMAGE PROCESSING (EC)**

Digital image fundamentals, Image modal sampling and quantization, Elements of visual perception, Image transform FFT, Haar, Hadamard, Sine and cosine transforms, Differential filters in frequency domain, Compression schemes, Smoothing Edge enhancement, Image restoration, Inverse filter Wiener filter, constrained deconvolution and recursive filtering, texture analysis, Region segmentation, Thresholding geometry and shape description

## **EC ME – 28 A – TELECOMMUNICATION SWITCHING AND NETWORKS (EC)**

Multiplexing hierarchies. Analog and digital switching, Circuit switched, message switched and packet switched networks, Switching system controls and architecture, Switching System software. Time and space division switching. Integrated and hybrid Switching TASI and DSI, Interface to digital transmission facilities, Digital signal processing in digital switching, Telecommunication traffic analysis, Loss systems, blocking system and delay systems, Queueing

analysis. Problems associated with traffic imbalances. Services on telecommunication networks

### **EC-ME 29 A- SPREAD SPECTRUM TECHNIQUES (EC)**

Theory of spread spectrum. Processing gain and jamming margin, Direct sequence spectrum spreading, Frequency hopping, Time hopping FM Chirp, Hybrid techniques, Coding for spread spectrum communication and ranging, Wideband carrier modulation, Analog and digital matched filter, Acquisition, tracking and synchronization, Spread spectrum communication transmitter and receiver, Application of spread spectrum.

### **EC-ME 30 A- RADAR SYSTEM ANALYSIS (EC)**

Radar cross sections and its measurement simple and complex targets clutter cross sections for different types. Concepts of resolution and ambiguity, Pulse compression, Radar signal analysis for range accuracy and resolution, Radar signal detection and estimation techniques. The ambiguity function, large time BW signal their generation and matched filtering . Digital ambiguity function and digital signal processing as applied to, Radar principle of electronic beam steering, Synthetic aperture radar resolution analysis, satellite tracking radar systems.

### **EC-ME 31 A – ADVANCE ANTENNA THEORY (EC)**

Parameters of Antennas, General solution of the fields, methods of reflectors with arbitrary shape-geometrical optics methods, current distribution methods aperture field method, linear planar and circular arrays-self and mutual impedances and finite diameter effects Broadband and frequency independent antennas, Geometric theory of diffraction aperture antennas and ground plan edge effects, Horn-slot, reflector and lens dielectric and metal antennas, Phased concept, Antennas synthesis and continuous sources.

### **EC-ME 32 A – MOBILE COMMUNICATION ENGINEERING (EC)**

The cellular concepts and its implementation. Analog and digital cellular mobile system. Cellular mobile systems. Wireless system including wireless LAN and wireless ATM. Mobile network and transport layers and protocols, General study of third generation mobile communication system. Global mobile satellite systems . Mobile data communication.

## **MA – ME(EC) 33 A – MATHEMATICS (EC)**

Theory of groups and fields : Definition group, subgroup, examples elementary properties cosets, Lagrange theorem, homomorphism Cayley's theorem, conjugate elements, normal subgroup, quotient group homomorphism, Isomorphism theorems.

Definition of Rings fields, Integral domain, subring, subfields, ideals, difference rings, polynomial rings, Euclidean domains, principal ideal ring

Definition of vector space, subspace, linear combination of vectors linear dependence and independence of vector quotient space. Direct sum of two subspaces, Basis and dimensions of vector spaces. Definition of Prime fields, Extension of fields, separable and inseparable extensions, monomorphism, normal extension and fundamental theorem of Galois Theory.

Queueing Theory: Structure, technique and basic theory, poisson and non poisson queues. Special non poisson cases, bulk queues, single server and many server queueing process, telephone traffic process, process of servicing machines, a process of practical counting, the basic renewal theory, discrete and continuous cases transient solution of M/M/P.

Stochastic : General Introduction random sequences, renewal markov chains, process in continuous time, poisson process, the trunking problem infinitely many channels, waiting lines for a finite number of channels, servicing of machines with one and many repairmen, the power supply problem.