Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Master of Technology

SoE & Syllabus 20**20**

Communication Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. PG-301

M. Tech. SCHEME OF EXAMINATION 2020

Deptt. of Electronics & Telecommunication

(Communication Engineering)

Sl. No.	Sem	Course Code	Course Title	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
					L	T	P	Total Contact Hrs.		MSEs*	TA**	ESE	
I SEMESTER													
1	1	ET3901	Mathematical Foundations for Communication Engineering	T	3	0	0	3	3	30	30	40	3
2	1	ET3902	Passive RF Circuits & Systems	T	3	0	0	3	3	30	30	40	3
3	1	ET3903	**Lab:** Passive RF Circuits & Systems	P	0	0	2	2	1		60	40	
4	1	ET3904	Advanced Digital Communication	T	3	0	0	3	3	30	30	40	3
5	1	ET3905	**Lab:** Advanced Digital Communication	P	0	0	2	2	1		60	40	
6	1	ET3906	Adaptive Signal Processing	T	3	0	0	3	3	30	30	40	3
7	1	ET3907	**Lab:** Adaptive Signal Processing	P	0	0	2	2	1		60	40	
8	1		**Professional Elective- I**	**T**	3	0	0	3	3	30	30	40	3
9	1		**Professional Elective- II**	**T**	3	0	0	3	3	30	30	40	3
Total					**18**	**0**	**6**	**24**	**21**				

List of Professional Electives-I		
1	ET3908	PE I: Error Control Coding
1	ET3909	PE I: Embedded Systems & DSP Processor
1	ET3910	PE I: Pattern Recognition

List of Professional Electives-II		
1	ET3911	PE II: Multimedia Communications
1	ET3912	PE II: Active RF Devices and Circuits
1	ET3913	PE II: Soft Computing

II SEMESTER													
1	2	ET3915	Advanced Antenna Theory	T	3	0	0	3	3	30	30	40	3
2	2	ET3916	**Lab:** Advanced Antenna Theory	P	0	0	2	2	1		60	40	
3	2	ET3917	VLSI Signal Processing	T	3	0	0	3	3	30	30	40	3
4	2	ET3918	Digital Image processing	T	3	0	0	3	3	30	30	40	3
5	2	ET3919	**Lab:** Digital Image processing	P	0	0	2	2	1		60	40	
6	2	ET3920	Wireless Communications & Networks	T	3	0	0	3	3	30	30	40	3
7	2		**Professional Elective -III**	T	3	0	0	3	3	30	30	40	3
8	2		**Professional Elective -IV**	T	3	0	0	3	3	30	30	40	3
9	2	ET3928	Seminar	P	0	0	2	2	1		100		
Total					**18**	**0**	**6**	**24**	**21**				

List of Professional Electives-III		
2	ET3921	PE III: Selected Topics in Communication Systems
2	ET3922	PE III: Speech Processing
2	ET3923	PE III: Detection & Estimation Theory
2	ET3924	PE III: Real Time Operating System

List of Professional Electives-IV		
2	ET3925	PE IV: High Speed Networks
2	ET3926	PE IV: Wireless Sensor Networks
2	ET3927	PE IV: Micro Electro Mechanical Systems

III SEMESTER													
1	3	ET3939	Project Phase-I	P	0	0	16	16	8		100		
Total					**0**	**0**	**16**	**16**	**8**				

IV SEMESTER													
1	4	ET3940	Project Phase-II	P	0	0	24	24	12		60	40	
Total					**0**	**0**	**24**	**24**	**12**				
Total of Credits									**62**				

MSEs* = Three MSEs of 15 Marks each will conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 20 marks on lecture quizzes, 8 marks on assignments, 2 marks on class performance

TA = for Practical : MSPA will be 15 marks each**

		Jan,20	**1.00**	**Applicable for Sem 1 & 2 AY 2020-21 & Sem 3 & 4 AY 2021-22 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

I Semester

ET3901–Mathematical Foundations for Communication Engineering

Course Objective The student should be able to	Course Outcome The student will be able to
1) Understand probability laws. 2) Understand concept of random variable and advanced density functions. 3) Learn various types of distributions and expectation. 4) Understand Random vectors and random processes.	1) Calculate probabilities by applying probability laws. 2) Derive probability distributions of functions of random variables. 3) Identify an appropriate probability distribution for a given discrete or continuous random variable. 4) Determine covariance and spectral density of stationary random processes.

UNIT-1

Definitions, limitations of classical and relative-frequency-based definitions. Sets, fields, sample space and events; axiomatic definition of probability. Combinatory: Probability on finite sample spaces. Joint and conditional probabilities, independence, total probability; Bayes' rule and applications **06 Hours**

UNIT-2:

Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties. Jointly distributed random variables, conditional and joint density and distribution functions, independence; Bayes' rule for continuous and mixed random variables.**06 Hours**

UNIT-3:

Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution Functions of a random variable, Functions of two random variables; Sum of two independent random variables.**06 Hours**

UNIT 4:

Expectation: mean, variance and moments of a random variable. Joint moments, conditional expectation, Moment-generating and characteristic functions and their applications, Bounds and approximations:.Schwarz Inequality, Chebyshev inequality and Chernoff Bound, Central limit theorem and its significance.

06 Hours

I Semester

ET3901 –Mathematical Foundations for Communication Engineering

Unit 5:

Random vector: Joint distribution and densities, multiple transformation, mean vector, covariance matrix and properties, simultaneous, characteristic functions of random vectors, parameter estimation

(06 Hours)

Unit 6:

Basic definitions, important Random processes, continuous-time linear systems with random inputs white noise, classification of random processes, WSS processes and LSI systems.**(06 Hours)**

Text books:				
1	Probability and Random Processes	2002	H. Stark, J.W Woods	Pearson Education
2	Probability, Random Variables and Stochastic Processes	2002	A. Papoulis, S. U. Pillai,	McGraw Hill
Reference books:				
1	Probability and Stochastic Processes	1992	R D Yates, D J Goodman	John Wiley and Sons

I Semester

ET3902 –Passive RF Circuits and Systems

Course Objective	Course Outcomes
Students should be able to	Students will be able to
1) Understand various transmission lines and its characteristics.	1) Analyze various transmission lines and its characteristics.
2) Study various microwave network models and passive components.	2) Analyze various microwave network models and passive components.
3) Learn various switches, phase shifters and MIC filters.	3) Apply the knowledge of various switches, phase shifters and MIC filters.
4) Understand various MMIC and MEMS technologies.	4) Explorevarious MMIC and MEMS technologies.

UNIT-1:

Review of Basic Transmission Line Theory, Planar Transmission Lines - Stripline, microstrip line, Suspended strip line and coplanar line; Parallel coupled lines in Stripline and microstrip – Analysis, Design and characteristics.06 Hrs

UNIT-2:

Microwave Network Analysis - Microwave network representation, Impedance and admittance matrices, Scattering parameters, Typical two-port, three port, four port networks; Impedance Matching Techniques - Smith chart, Matching networks using lumped elements, Single- and double-stub matching, Quarter wave transformer, Baluns06 Hrs

UNIT-3

Basic Passive Components -Lumped elements in MIC, Discontinuities and resonators in microstrip, Analysis and design of Stripline/microstrip components- Directional couplers, Power divider, Hybrid ring.

06 Hrs

UNIT-4:

Switches and Phase Shifters Basic series and shunt switches in microstrip; SPST and SPDT switches, Switched line, branch line coupled and loaded line phase shifters in microstrip, Applications in phased arrays.06 Hrs

UNIT-5

MIC Filters - Lumped element filter design at RF. Impedance and Low pass scaling, Frequency transformation, High impedance/Low impedance low pass filter, Parallel coupled band pass filter, High pass filter, bandstop filter06 Hrs

I Semester

ET3902 –Passive RF Circuits and Systems

UNIT-6:

Basics of MIC, MMIC and MEMS technologies - Substrates used.06 Hrs

Text books:				
1	Radio Frequency and Microwave Electronics	2001	M.M. Radmanesh,	Pearson Education Asia,
2	Stripline-like Transmission Line for Microwave Integrated Circuits,	1989.	B. Bhat& S.K. Koul	New Age Intl. (P) Ltd.,
Reference books:				
1	Radio Frequency and Microwave Communication Circuits – Analysis and Design,	2001.	D. K. Misra,	John Wiley & Sons,

I Semester
ET3903 –Lab:Passive RF Circuits and Systems

Course Objective	**Course Outcomes**
Students should be able to	Students will be able to
1) Understand various transmission lines and its characteristics.	1) Analyze various transmission lines and its characteristics.
2) Study various microwave network models and passive components.	2) Analyze various microwave network models and passive components.
3) Learn various switches, phase shifters and MIC filters.	3) Apply the knowledge of various switches, phase shifters and MIC filters.
4) Understand various MMIC and MEMS technologies.	4) Explore various MMIC and MEMS technologies.

Ten Experiments based on

1. Low Pass, Band Pass, Band Stop Filters
2. Couplers
3. Phase Shifter
4. Power Divider
5. Hybrid ring Coupler
6. Switches

I Semester

ET3904 –Advanced Digital Communication

Course Objective	**Course Outcomes**
Students should be able to 1) Learn Baseband representation, reception and probability of error 2) Understand the transmission errors in digital communication systems 3) Understand the concept of spread spectrum modulation, its types and applications. 4) Understand the practical applications of Multichannel and multicarrier communication systems	Students will be able to 1) Distinguish various digital modulation techniques. 2) Analyze the probability of errors in digital communication systems. 3) Apply spread spectrum modulation for various applications of communication systems. 4) Distinguish Multichannel and multicarrier communication systems

UNIT-1:
Review of fundamental concepts and parameters in Digital Communications, Performance of BPSK and QPSK in AWGN channel, Performance of binary FSK and M-ary PSK in AWGN channel.06 Hrs

UNIT-2:
Minimum Shift Keying (MSK) Modulation, GMSK, Continuous Phase Modulation (CPM) Schemes Channel Characterization and Modeling, Orthogonal Frequency Division Multiplexing (OFDM), Carrier Synchronization, Timing synchronization06 Hrs

UNIT-3
Representations of band pass signal and systems, signal space representation, representation of digitally modulated signals, spectral characteristics of digitally modulated signals.06 Hrs

UNIT-4:
Baseband reception and probability of error, the ML and MAP detection strategies, ML detection with zero mean AWGN,the optimum filter, Schwarz's inequality, transfer function of optimum filter, matched filter, properties of Matched filter, correlation receiver,equalization,the zero forcing equalizer, adaptive equalizer, scrambling, the eye pattern.06 Hrs

UNIT-5

Spread spectrum signals for digital communications: Introduction to Spread Spectrum Modulation, DSSS, FHSS, and CDMA signals, Code Acquisition and Tracking, Spread Spectrum as a Multiple Access Technique. 06 Hrs

I Semester

ET3904 –Advanced Digital Communication

UNIT-6:

Multichannel and Multicarrier Systems; Digital Communications through Fading Multipath channels; Multi User Communications.06 Hrs

Text books:				
1	Digital Communications	1995 4th Edition	J.G.Proakis	McGraw Hill,
2	Digital Communications	1998	Simon Haykin	John Wiley & Sons
Reference books:				
1	Principles of Digital Communications and Coding	1979	J. Viterbi and J. K. Omura	McGraw Hill,
2	Spread Spectrum Communications	1995.	MarvinK.Simon,Jim K Omura,RobertA. Scholtz, Barry K.Levit	John Wiley & Sons
3	CDMA Principles of Spread Spectrum Communications	1995.	Andrew J Viterbi	Addison Wesley

I Semester
ET3905 – Lab:Advanced Digital Communication

Course Objective	Course Outcomes
Students should be able to 1) Learn Baseband representation, reception and probability of error 2) Understand the transmission errors in digital communication systems 3) Understand the concept of spread spectrum modulation, its types and applications. 4) Understand the practical applications of Multichannel and multicarrier communication systems	Students will be able to 1) Distinguish various digital modulation techniques. 2) Analyze the probability of errors in digital communication systems. 3) Apply spread spectrum modulation for various applications of communication systems. 4) Distinguish Multichannel and multicarrier communication systems

Ten Experiments based on

1. BPSK
2. QPSK
3. MSK
4. MIMO
5. OFDM
6. Channel Estimation

I Semester

ET3906 –Adaptive Signal Processing

Course Objective	Course Outcomes
Students should be able to 1) Introduce the concept and need of wiener filters 2) Learn the fundamentals of adaptive filters and application e.g noise cancellation, interference cancelling etc. 3) Understand basic principles transform domain adaptive filters by using mathematical perspective. 4) Study adaptive signal processing algorithms (e.g., the LMS algorithm). 5) Study Recursive least squares algorithms & FTRLS algorithm.	Students will be able to 1) Devise filtering solutions for optimising the cost function using wiener filters. 2) Analyse convergence and stability issues using LMS algorithm and its transform domain. 3) Evaluate the performance Recursive Least-Squares (RLS) techniques to improve convergence behaviour. 4) Devise filtering solutions for optimising using Kalman Filtering , Adaptive beam forming& FTRLS algorithm.

UNIT-1:
Wiener filtering.Optimum linear prediction.Levinson- Durbin algorithm. Prediction error filters. 06 Hrs

UNIT-2:
Adaptive filters. FIR adaptive LMS algorithm.Convergence of adaptive algorithms.Fast algorithms.Applications; Noise canceller, echo canceller and equalizer.06 Hrs

UNIT-3
Transform domain adaptive filters, theorthogonalization property of orthogonal transforms, The transform domain LMS algorithm.06 Hrs

UNIT-4:
Recursive least – squares algorithms. Matrix inversion lemma. Convergence analysis of the RLS algorithm.
06 Hrs

UNIT-5

Adaptive beam forming. Kalman filtering.06 Hrs

UNIT-6:

Fast RLS algorithm, Least square forward prediction, Least square backward prediction, least square lattice, The RLS algorithm, The FTRLS algorithm. Case studies and Industrial Applications.06 Hrs

I Semester

ET3906 –Adaptive Signal Processing

Text books:				
1	Adaptive Filters:Theory& Applications		B.FarhangBoroujeny	wiley Publication
2	Adaptive Filter Theory	1996,(3/e),	Simon Haykin	Prentice- Hall
Reference books:				
1	Statistical and Adaptive Signal Processing	2005	D.G.Manolakis	McGraw Hill,
2	Statistical Digital Signal Processing and Modelling	1995.	M.H.Hays,	John Wiley & Sons

I Semester
ET3907 – Lab:Adaptive Signal Processing

Course Objective	Course Outcomes
Students should be able to 6) Introduce the concept and need of wiener filters 7) Learn the fundamentals of adaptive filters and application e.g noise cancellation, interference cancelling etc. 8) Understand basic principles transform domain adaptive filters by using mathematical perspective. 9) Study adaptive signal processing algorithms (e.g., the LMS algorithm). 10) Study Recursive least squares algorithms & FTRLS algorithm.	Students will be able to 5) Devise filtering solutions for optimising the cost function using wiener filters. 6) Analyse convergence and stability issues using LMS algorithm and its transform domain. 7) Evaluate the performance Recursive Least-Squares (RLS) techniques to improve convergence behaviour. 8) Devise filtering solutions for optimising using Kalman Filtering , Adaptive beam forming& FTRLS algorithm.

Ten Experiments based on

1. Random Number generator and finding correlation and autocorrelation
2. Wiener filter
3. LMS and NLMS
4. Adaptive equalizer
5. Linear predictor
6. RLS algorithm and fast algorithm

I Semester

ET3908 – PE I: Error Control Coding

Course Objective Students should be able to	Course Outcomes Students will be able to
1. Understand the need for error correction in data communication and storage systems. 2. Understand numerical operations in finite fields by using both the exponential and polynomial representations of finite field elements. 3. Study an ability to compare and contrast the strengths and weaknesses of various errors correcting code for a given application. 4. Study different error correcting codes in digital communication system.	1. Apply the knowledge of error correction in data communication and storage systems. 2. Analyze numerical operations in finite fields by using both the exponential and polynomial representations of finite field elements. 3. Analyze an ability to compare and contrast the strengths and weaknesses of various errors correcting code for a given application. 4. Demonstrate competence in analyzing and evaluating the practice of different error correcting coded in digital communication system.

UNIT-1:
Coding for reliable digital transmission and storage. Groups, Rings, Vector Spaces, Galois Fields, Polynomial rings 06 Hrs

UNIT-2:
Channel models, Linear Block codes, syndrome and error detection, the minimum distance of block code, standard array and syndrome decoding, Cyclic codes, polynomials, the division algorithm for polynomials, circuit implementation of cyclic codes.06Hrs

UNIT-3
Convolution codes, decoding algorithms for Convolution codes, Viterbi, Stack and Fano algorithms, Application of Convolution codes .06 Hrs

UNIT-4:
BCH codes, primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, Reed Solomon Codes, Berlekamp-Massey and Euclid decoding algorithm, Decoding beyond the minimum distance Parameter, Applications of Reed-Solomon codes.06 Hrs

UNIT-5
Trellis coded Modulation, Combinatorial description of Block and Convolution codes, mapping by set partitioning, TCM design rules06 Hrs

I Semester

ET3908 – PE I: Error Control Coding

UNIT-6:

Soft decision decoding algorithms, Iterative decoding algorithms, Turbo-decoding, Two-way algorithm, LDPC codes, Use of LDPC codes in digital video broadcasting, belief propagation (BP) algorithms, Space-Time codes.06 Hrs

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Text books:				
1	Error Control Coding: Fundamentals and Applications	2003.	Shu Lin and Danicl J. Costello Jr	Prentice Hall
2	Error Control Systems for Digital Communication and Storage	1995	S. B Wicker	Prentice Hall
Reference books:				
1	Theory and Practise of Error Control Codes	2003.	Shu Lin and Danicl J. Costello Jr	Prentice Hall,
2	Error Control Systems for Digital Communication and Storage	1983.	Blahut R. E	Addisson Wesley
3	Algebraic codes for Data transmission	2003	Blahut R.E	Cambridge University Press
4	Fundamentals of Convolutional codes	1999	Johannesson R and Zigangirov K.S	IEEE press
5	Trellis structure of codes, Chapter 24 of Handbook of Theory.		V. S Pless and W. C Huffman, A. Vardy	
6	Error Correction Coding-Mathematical methods & algorithms		Todd K Moon	Wiley

I Semester
ET3909 – PE I: Embedded Systems & DSP Processor

Course Objective	Course Outcomes
Students should be able to 1. Understand basics of embedded systems 2. Understand ARM processor architecture and instruction set 3. Understand basics of DSP processor 4. Understand architectural features and instruction set of C3X DSP processor	Students will be able to 1. Explore different technologies related to embedded systems 2. Effectively utilise the knowledge gained about ARM processor architecture and its instruction set for programming. 3. Explore basics of DSP processor architecture 4. Effectively utilise the knowledge gained about c3x DSP processor and its instruction set for programming

UNIT-1:
Embedded Systems, Introduction, Design Metrics, Processor Technology, IC Technology, Design Technology, Design Productivity Gap, Custom Single purpose Processor Design, RT level design, FSMD, Data-paths, Optimization, Instruction set simulators for simple processors.06 Hrs

UNIT-2:
Architectural Features Of ARM: Processor modes, Register organization, Exceptions and its handling,Memory, Memory-mapped I/Os, ARM and THUMB instruction sets, Addressing modes, DSP extensions, ARM sample codes 06Hrs

UNIT-3
ARM7/9 Core: H/W architecture, Timing diagrams for Memory access, Co-processor interface, Debug support, Scan chains, Embedded Real Time ICE, Hardware and software breakpoints. Buses: AMBA, ASB, APB, Development tool like Compilers, Debuggers, IDE etc06 Hrs.

UNIT-4:
DSP Architecture: MAC, Modified bus structures and Memory access schemes, Multiple access Memory , Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes, On chip peripherals. 06 Hrs

UNIT-5
TMS320C3X -32 bit floating point DSP Processor: Introduction, features, Applications, Block diagram, Internal architecture, CPU & data paths, Functional units, Addressing modes, Memory architecture, External memory accesses, Pipeline operation, Peripherals. 06 Hrs

I Semester

ET3909 – PE I: Embedded Systems & DSP Processor

UNIT-6:

Assembly language programming. Hardware tools: DSP and other DSP boards Software tools: Assembly language tools.06 Hrs

Text books:				
1	ARM System Developer's Guide: Designing and Optimizing	2004	Sloss Andrew N, Symes Dominic, Wright Chris	Morgan Kaufman Publication
2	Digital signal processors	2002, 1 edition	Venkataramani, M Bhaskar	Tata McGraw Hill
Reference books:				
1	ARM System-on-Chip Architecture	2nd Edition,2002	Steve furber	Pearson Education
2	Embedded System Design	2002, 1st Edition	Frank Vahid and Tony Givargis	Wiely Publication
3	Embedded System Design	2003	Raj Kamal	Tata McGraw Hill

I Semester

ET3910 – PE I: Pattern Recognition

Course Objective	Course Outcomes
Students should be able to 1) Equip students with basic mathematical and statistical techniques commonly used in pattern recognition. 2) Understand clustering and probability theory to handle uncertainty and solve engineering problems 3) Introduce to the various pattern recognition algorithms for a given problem.	Students will be able to 1) Identify and describe pattern recognition techniques and their roles in building intelligent machines 2) Recognize the feasibility of applying pattern recognition methodology for a particular problem in pattern classification and regression 3) Apply clustering and probability theory to handle uncertainty and solve engineering problems 4) Evaluate and compare solutions by various pattern recognition approaches for a given problem.

UNIT-1:
Introduction,Applications of Pattern Recognition, Statistical Decision Theory, The Internet Pointers to the Literature, Problems05Hrs

UNIT-2:
Probability, Probabilities of Events, Random Variables, Joint Distributions and Densities Moments of Random Variables, Estimation of Parameters from Samples, Minimum Risk Estimators, Problems .06Hrs

UNIT-3
Statistical Decision Making
Introduction, Bayes' Theorem, Multiple Features, Conditionally Independent Features, Decision Boundaries ,Unequal Costs of Error ,Estimation of Error Rates ,The Leaving-One-Out Technique, Characteristic Curves, Estimating the Composition of Populations, Problems07Hrs

UNIT-4:
Nonparametric Decision Making
Introduction, Histograms, Kernel and Window Estimators, Nearest Neighbor Classification Techniques, Adaptive Decision Boundaries, Adaptive Discriminant Functions, and Minimum Squared Error Discriminant Functions, Choosing a Decision Making Technique, Problems.07Hrs

UNIT-5
Clustering
Introduction, Hierarchical Clustering, Partitional Clustering, Problems07 Hrs.

I Semester

ET3910 – PE I: Pattern Recognition

UNIT-6:

Recent trends in Pattern Recognition

. 03Hrs

Text books:				
1	Pattern Recognition and Image Analysis		Earl Gose,RichardJohnsonbaugh	Prentice Hall
2	Pattern Classification	2006,2nd Edition	Richard O. Duda, Peter E. Hart and David G. Stork	John Wiley,
Reference books:				
1	Pattern Recognition and Machine Learning	2009	C. M. Bishop	Springer,
2	Pattern Recognition	2009	Theodoridis and k Koutroumbas	Academic Press

I Semester
ET3911 – PE II: Multimedia Communications

Course Objective	Course Outcomes
Students should be able to 1) Understand basic concept of digital image representation 2) Learn basics of video and digital audio signal 3) Understand the concepts of image compression 4) Understand the concepts of video compression 5) Understand the concepts of audio compression	Students will be able to 1) Describe features of various image file formats and image data type 2) Explain characteristics of video signals like NTSC,PAL,SECAM Implement and describe various image compressiontechniques 3) Explain various video compression techniques 4) Explain various audio compression techniques

UNIT-1:
Introduction to multimedia, concept of non-temporal and temporal media, Graphics & image data representation: graphics & imagedata types, computer image processing: Image synthesis, analysis and transmission, popular file formats(GIF, TIFF, JPEG, PNG**)** **06 Hrs**

UNIT-2:
Fundamental concepts in video Types of video signals: component, composite and s-video, analog video :NTSC, PAL, SECAM video, digital video : chroma sub-sampling, CCIR standards for digital video, HDTV, **06 Hrs**

UNIT-3:
Basics of digital audio:
Digitization of sound, MIDI, quantization and transmission of audio **06 Hrs**

UNIT-4:
Multimedia data compression
Lossless compression algorithms: Run length coding, Huffman coding, arithmetic coding Lossy compression algorithms - DCT, Wavelet- Based Coding
Basic image compression standard- JPEG- **main steps in JPEG Image compression, Image preparation,**

JPEG modes- Lossy sequentialDCT based, Expanded lossy DCT based, Lossless and hierarchical mode **06 Hrs**

UNIT-5:
Video compression
Introduction to video compression, video compression based on motion compensation, search for motion vectors, detail study of various video compression standards-MPEG-1, MPEG-2, MPEG-4, MPEG-7
06 Hrs

UNIT-6:
Audio compression
Basic audio compression techniques, MPEG audio compression, Applications of multimedia related to image and video processing **06 Hrs**

I Semester

ET3911 – PE II: Multimedia Communications

Text books:					
1	Fundamentals of Multimedia	2004	Ze-Nian Li , Mark S Drew		PHI/Pearson Education
2	Multimedia Applications	2004	Steinmetz, Nahrst		Springer
Reference books:					
1	Multimedia Communications: Applications, Networks, Protocols and Standars	2001	Fred Halsall		Addison-Wesley

I Semester
ET3912 – PE II: Active RF Devices and Circuits

Course Objective	Course Outcomes
Students should be able to 1) Understand active devices, and their modeling. 2) Perform Amplifier Stability ,Stability Circle and Single stage amplifier design for specified gain. 3) An understanding amplifier design unilateral and bilateral cases and for maximum gain. 4) Learn detector and power amplifiers. 5) Understand theory and characteristics of mixer, oscillator, PLL.	Students will be able to 1) Explain different types RF Diodes, Linear &Non linear Diode Models. 2) Design Two Port power gain, Amplifier Stability and for Specified Gain 3) Devise Characteristics and equivalent circuit of detector and power amplifier. 4) Perform measurements on mixer, Oscillator and PLL

Unit 1
Active RF Component & their Modeling: RF Diodes, Linear &Non linear Diode Models, small & large signal Model of BJT & FET, Active Device Measurements**06 Hrs**

UNIT 2
Transistor Amplifiers - Types of amplifiers. S parameter characterization of transistors; Two Port power gain Amplifier Stability , Stability Circle , Test for Unconditional Stability, MOSFETs , Equivalent circuit model.**06 Hrs**

UNIT-3:
Single stage amplifier design- unilateral and bilateral cases, Design for Maximum Gain Constant gain, design for Specified Gain , DC bias circuits for amplifiers;**06 Hrs**

UNIT-4
Detectors - Point contact and Schottky barrier diodes. Characteristics and equivalent circuit, Theory of microwave detection, Detector circuit design, FM detectors. Low Noise amplifier and Power amplifier : Class A, B, AB, C, D, E, F**06 Hrs**

UNIT-5:
Types of mixers.Mixer theory and characteristics.SSB versus DSB mixers.Single-ended mixer and single-balanced mixer. Double balanced and image rejection mixers;**06 Hrs**

UNIT-6
Oscillators Oscillator versus amplifier design, Oscillation conditions; Gunn diode Modes of operation, Equivalent circuit. Design of Gunn diode oscillator, FET oscillators. Frequency tuning techniques.Phase Locked Loop (PLL).**06 Hrs**

I Semester

ET3912 – PE II: Active RF Devices and Circuits

Text books:				
1	Radio Frequency and Microwave CommunicationCircuits Analysis and Design	2004	D. K. Misra	John Wiley,
2	Microwave Engineering	1998	D. M. Pozar	John Wiley
3.	RF Circuits Design		Renhold Ludwig and PavelBretchko	Prentice Hall

Reference books:				
1	Microwave Transistor Amplifiers Analysis andDesign	1997.	G. Gonzalez	Prentice Hall
2	The Design of CMOS Radio-FrequencyIntegrated Circuits	Second	Thomas H. Lee	CAMBRIDGE
3	Microwave and Millimeter Wave Phase Shifters,Vol.II- SemiconductorAnd Delay Line Phase Shifters	1991	S.K. Koul and B. Bhat	Artech House
4	Microwave Circuit Design using Linear andNonlinear Techniques	1990	G.D. Vendelin, A.M. PavioandU.L. Rhode	

I Semester

ET3913 – PE II: Soft Computing

Course Objective	Course Outcomes
Students should be able 1) To have general understanding of soft computing methodologies including artificial neural networks, genetic algorithms, fuzzy sets and fuzzy logic systems. 2) To elaborates the basic concept of Genetic algorithm, genetic inheritance operator, the performance of algorithm and applications. 3) To introduce the fundamentals and explore the architecture of supervised and unsupervised neural networks. 4) To discuss the basic concept of fuzzy set theory and understand the hybrid architectures, fuzzy logic and fuzzy interface	Students will be able to 1) Identify and describe soft computing techniques and their roles in building intelligent machines 2) Recognize the feasibility of applying a soft computing methodology for a particular problem andApply genetic algorithms to optimization problems. 3) Identify supervised/unsupervised neural networks algorithms to solve pattern classification problems 4) Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems

Unit 1
Genetic algorithms: Population based search techniques, evolutionary strategies, mathematical foundations of genetic algorithms, search operators, genetic algorithms in function and combinational optimization, hybrid algorithms, application to pattern recognition**06 Hrs**

Unit 2
Introduction of neural networks, NN Architecture Neural learning and laws, Applications of ANN Evaluation of network,
Supervised Learning:Single layer network: MP neuron, Perceptron, Perceptron training algorithm, LMS algorithm, ADALINE**06 Hrs**

Unit 3
Multiplayer network: Multilevel Discrimination, Backpropogation Algorithm, Setting the parameter values, Accelerating the learning Process, MADALINE, Adaptive Multilayer Networks, Recurrent Network, RBF networks,**06 Hrs**

Unit 4
Unsupervised Learning: Winner Take Network, Learning Vector Quantizer, ART Networks, self-organizing feature maps, PCA, Associate Models**06 Hrs**

Unit 5
Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conorms Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers**06 Hrs**

I Semester

ET3913 – PE II: Soft Computing

Unit 6

Fuzzy equations, fuzzy relations , Fuzzy controllers, Defuzzification Methods, Fuzzy Inference Techniques, applications of fuzzy logic**06 Hrs**

Text books:				
1	Neural networks	2004	C. Mohan and S. Ranka	Penram publications
2	Fuzzy sets and fuzzy logic, Theory andApplications ,	2009	George J. Klir, Bo Yuan	PHI
3	Neural Networks: A comprehensive foundation	1999	S. Haykin	Pearson
Reference books:				
1	Introduction to artificial neural networks	1997	J. M. Zurada	Jaico publishing
2	Artificial Neural Networks	1999	B. Yejnanarayana	PHI
3	Neural Networks, Fuzzy Logic, and Geneticalgorithms, Synthesis and Applications	2006	S.Rajasekaran, G.A.ViayalakshmiPai	Prentice Hall

II Semester

ET3915 –Advanced Antenna Theory

Course Objective The student should be able to	Course Outcome The student will be able to
5) Learn the basic principles and of antenna parameters. 6) Design and analyze antennas & Arrays. 7) Design and Analyze Planer antenna 8) Design & Analyze aperture, Reflector Antennas 9) Study different Smart antenna techniques	1) Evaluate various parameters of antennas. 2) Analyze performance parameters of various antennas & antenna array. 3) Understand smart antenna measurement techniques. 4) Design and analyze various antenna

UNIT-1:
Fundamental Parameters of Antenna, Radiation Integrals &Auxillary Potential Function **06Hrs**

UNIT-2:
Planar Antennas Microstrip rectangular and circular patch antennas. Analysis and design, Feeding Methods; Circularly polarized microstrip antennas, Broadbanding techniques. Printed slot antennas. **06Hrs**

UNIT-3

Yagi array of linear elements and printed version, Log-periodic dipole array. Frequency Independent Antennas Planar spiral antenna, **06Hrs**

UNIT-4:
Array Theory Linear array; Broadside and end fire arrays, Self and mutual impedance of between Linear elements, grating lobe considerations.Planar array, Array factor, beamwidth, directivity. Example of microstrip patches arrays and feed networks & analysis**. 06Hrs**

UNIT-5
Aperture Antennas- Field equivalence principle, Babinet's principle. Rectangular waveguide horn antenna, Parabolic reflector antenna. Uniqueness theorem**06Hrs**

UNIT-6:
Antennas for mobile communication. Handset antennas: FIFA, Smart antennas, Switch beam system, Adaptive array system, Spatial Division Multiple Access. **06 Hrs**

II Semester
ET3915 –Advanced Antenna Theory

Text books:

1	Antenna Theory and Design	1997.	C. A. Balanis	John Wiley & Sons

Reference books:

1	CAD of Microstrip Antennas for Wireless Applications	1996.	R.A. Sainati	Artech House
2	Antenna design Handbook	1988	R. Garg, P. Bharhia, I. Bahl, and A. Ittipiboo	Artech House.
3	Microstrip Antennas: Theory & Design		J. R. James, P.S. Hall and C.Wood, , Peter Peregrinns	UK

II Semester
ET3916 –Lab:Advanced Antenna Theory

Course Objective The student should be able to	Course Outcome The student will be able to
1) Learn the basic principles and of antenna parameters. 2) Design and analyze antennas & Arrays. 3) Design and Analyze Planer antenna 4) Design & Analyze aperture, Reflector Antennas 5) Study different Smart antenna techniques	1) Evaluate various parameters of antennas. 2) Analyze performance parameters of various antennas & antenna array. 3) Understand smart antenna measurement techniques. 4) Design and analyze various antenna

Sr. No.	Ten Experiments Based on
1.	Microstrip patch antenna
2.	Slot Antenna
3.	YagiUda Antenna
4.	Log periodic Antenna
5.	Horn Antenna
6.	Antenna Arrays

II Semester

ET3917 –VLSI Signal Processing

Course Objective The student should be able	Course Outcome The student will be able to
1) To understand basic concepts of implementing DSP algorithms in VLSI circuits	1) Design parallel and pipelining processing systems for speed, power and area optimization.
2) To learn about the concept of pipelining and parallel processing in VLSI.	2) Implement the pipelined and parallel architectures using folding and unfolding techniques.
3) To understand the analysis of VLSI system with high speed and low power.	3) Analyse Systolic Design for Space Representations containing Delays
4) To equip the students with knowledge of Systolic Design for Space Representations containing Delays	4) Apply algorithmic strength reduction techniques such as Fast Convolution algorithms and FDCT algorithms for increasing the speed of computation.
5) To learn the algorithms for numeric and algorithmic strength reduction.	5) Design DSP algorithms with reduced numerical strength by subexpression sharing techniques.

UNIT-1:
Introduction to DSP systems – Typical DSP algorithms, Data flow and Dependence graphs - critical path, Loop bound, iteration bound, longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power **06Hrs**

UNIT-2:
Retiming – definitions and properties. Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application . **06Hrs**

UNIT-3
Folding transformation, Register minimisationtechniquesSystolic architecture design, FIR systolic arrays, selection of scheduling vector, 2d systolic array design, systolic design for space representations containing delays. **06Hrs**

UNIT-4:
Fast convolution – Cook-Toom algorithm, modified Cook-Toom algorithm
Pipelined and parallel recursive filters – Look-Ahead pipelining in first-order IIR filters, Look-Ahead pipelining with power-of-2 decomposition, Clustered look-ahead pipelining, Parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters**.** **06 Hrs**

UNIT-5
Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using
Horner's rule for precision improvement **06 Hrs**

II Semester
ET3917 –VLSI Signal Processing

UNIT-6:

Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture

Numerical strength reduction- subexpression elimination, multiple constant multiplication, iterative matching, sub-expression sharing in digital filters, additive and multiplicative number splitting **6 Hrs**

Text books:

1	VLSI Digital Signal Processing Systems, Design and implementation	2007 1st Edition	Keshab K. Parhi	Wiley Interscience,.

Reference books:

1	"DigitalSignalProcessingwithField Programmable Gate Arrays".	2nd Edition, 2004	U. Meyer- Bease,	Springer,

II Semester

ET3918- Digital Image Processing

Course Objective The student should be able	Course Outcome The student will be able to
1) Learn the fundamentals of digital image processing algorithms and filtering methods. 2) Study the performance of digital images in frequency domain. 3) Learn restoration, compression and segmentation of digital images through various algorithms 4) Understand the process of image representation and description	1) Apply basic image processing algorithms for image enhancement. 2) Interpret the digital images in frequency domain by using various transform techniques. 3) Understand noise models and degradation process for image restoration 4) Implement the algorithms for image compression and segmentation. Implement the algorithms for image representation and description

UNIT I :
Digital image fundamentals – image acquisition, representation, visual perception, quality measures, Sampling and quantization, basic relationship between pixels, imaging geometry, color spaces, Image enhancement – point processing, spatial domain filtering and Frequency domain filtering.**06Hrs**

UNIT II :
Image transforms - DFT, DCT, Haar, KL transform, Wavelets and multiresolution processing, Sub-band coding, Multiresolution expansion, One dimensional wavelet transform, Wavelet series expansion, Discrete wavelet transform, Continuous wavelet transform, fast wavelet transform, 2-D wavelet transform, Wavelet packets
06Hrs

UNIT III : Image restoration/degradation model, Restoration-spatial domain filtering, Periodic Noise Reduction by Frequency Domain filtering, Motion debluring, Estimation the degradation function, Inverse filtering, Minimum Mean Square Error (Wiener Filtering),Constrained Least square filter**.06Hrs**

UNIT IV: Image compression – Data redundancy, lossless and lossy compression techniques, standards for image compression– JPEG, JPEG2000**06Hrs**

UNIT V :
Image Segmentation-The detection of Discontinuities: Point, Line and Edge Detections Gradient Operators and Laplacian, Edge linking and Boundary detection: Local Processing and Global Processing Via Hough Transform, Thresholding. Region based segmentation, Clustering technique, Active Contour.**06Hrs**

UNIT VI:
Representation Schemes, Chain Codes, Polygon Approximation, signatures, Skeleton, Boundary Descriptors: Simple Descriptors, Shape Numbers, Fourier Descriptors, Region Descriptor: statistical moments, simple descriptor, Topological descriptor, Texture, Dilation and erosion, opening and closing hit-or-miss transformation,morphologicalalgorithms**06Hrs**.

II Semester
ET3918- Digital Image Processing

Text books:

1	Digital Image Processing	2nd edition	R.C. Gonzalez & R.E. Woods	Wesley/Pearson education publication 2002
2	Fundamentals of Digital Image processing	2nd edition	A. K. Jain	PHI publication

Reference books:

1	Digital Image processing using MATLAB	2nd edition	R.C. Gonzalez & R.E. Woods	Wesley/Pearson education publication 2002
2	Digital Image processing	3rd Edition	William K. Pratt	John Wiley 2004

II Semester

ET3918–Lab : Digital Image Processing

Course Objective The student should be able	Course Outcome The student will be able to
1) Learn the fundamentals of digital image processing algorithms and filtering methods. 2) Study the performance of digital images in frequency domain. 3) Learn restoration, compression and segmentation of digital images through various algorithms 4) Understand the process of image representation and description	1) Apply basic image processing algorithms for image enhancement. 2) Interpret the digital images in frequency domain by using various transform techniques. 3) Understand noise models and degradation process for image restoration 4) Implement the algorithms for image compression and segmentation. Implement the algorithms for image representation and description

Ten Experiments based on

1. Image Enhancement & Spatial Domain Filtering
2. Image Transforms
3. Frequency Domain Filtering
4. Image Compression
5. Image Segmentation
6. Morphological Operations

II Semester

ET3920 –Wireless Communications & Networks

Course Objective The student should be able to	Course Outcome The student will be able to
1) Understand the concept of radio propagation , fading and different techniques to improve signalquality and link performance. 2) Understand various Multicarrier Modulation and Multiple access techniques for wireless communication 3) Learn Wireless Systems and Standards 4) Know various generations of mobile communication systems	1) Quantify causes and effects of path loss and signal fading on received signal characteristic and used various technique to improve signal quality and link performance. 2) Analyze various Multicarrier Modulation and Multiple access techniques for wireless communication 3) Analyze GSM & CDMA systems andunderstand the fundamentals of wireless networking. 4) Elaborate and compare various generations of mobile communication systems

UNIT-1:
Radio Propagation Characteristics: Reflection, diffraction and Scattering, Models for path loss, shadowing and multipath fading (delay Spread, coherence band width, coherence time, Doppler spread), Multipath Fading Models.**06 Hrs**

UNIT-2:
Diversity**:** Realization of Independent Fading Paths,Diversity System Model , Selection Combining , Threshold Combining , Maximal Ratio Combining, Equal-Gain Combining ,Moment Generating Functions in Diversity Analysis , Diversity Analysis for MRC , Diversity Analysis for EGC and SC , Diversity Analysis for Noncoherent and Differentially Coherent Modulation , Transmitter Diversity **06 Hrs**

UNIT-3
Multicarrier Modulation ,Fading across Subcarriers , Frequency Equalization , Precoding , Adaptive Loading ,Coding across Sub channels RAKE receivers ,**06 Hrs**

UNIT-4.:
Multiple access techniques for wireless communication: SDMA ,Packet radio protocols: Pure & Slotted ALOHA,CSMA **06 Hrs**

UNIT-5:
Wireless Systems and Standards: GSM-GSM services and features, Architecture, Radio Subsystem, GSM channel types, Frame structure and signal processing in GSM, CDMA-Forward CDMA channel, Reverse CDMA channel **06 Hrs**

II Semester

ET3920 –Wireless Communications & Networks

UNIT-6:

3G Overview, 3GPP Network Architecture, 4G features and challenges, Introduction to wireless LANs - IEEE 802.11 WLANs, Blue tooth , Wi-Max, Zigbee **06 Hrs**

TEXTBOOK

1	Wireless communications	2003.	Rappaport. T.S	Pearson Education
2	Wireless Communications	2007.	Andrea Goldsmith	Cambridge University Press

REFERENCES:

1.	FixedBroadbandWireless System Design	2003.	HARRY R. ANDERSON	John Wiley –India
2.	3G Wireless Networks	2nd Edition, 2007	Smith P.E., and Clint . Daniel Collins	Tata McGraw Hill
3.	Wireless Communication and Networking	2007	Vijay. K. Garg, Kaufmann	Morgan Publishers, http://books.elsevier.com/9780123735805
4.	Principles of Wireless Networks	2006.	KavethPahlavan,. K. Prashanth Krishnamuorthy	Prentice Hall of India,
5.	WirelessCommunication sand Networks	2nd Ed., 2007.	William Stallings	Pearson / Prentice Hall of India,

II Semester

ET3921 –PE III: Selected Topics in Communication Systems

Course Objective The student should be able to	Course Outcome The student will be able to
1) Make the students understand the fundamentals physical modeling of channels in free space along with time varying systems.	1) Understand and design physical modeling of channels in free space along with time varying systems.
2) Understand the working of time diversity detection in a Rayleigh fading channel and to analyze orthogonal frequency division multiplexing.	2) Compare and analyze Non-coherent and Coherent detection Time diversity.
3) Understand the modeling of MIMO,SIMO,MISO along with time varying channels and selective fading.	3) Elaborate key features of various standards related to modeling of MIMO,SIMO,MISO
4) Understand and compare parallel and scalar channels.	4) Understand and analyze V-BLAST and D-BLAST architecture
	5) Design and understand multiplexing tradeoff - Universal code design for scalar channels, parallel channels

UNIT-1:
Physical modeling for wireless channels**:** Free space, fixed transmit and receive antennas, moving antenna , Reflection from wall, Reflection from a ground plane , Power decay with distance and shadowing ,Moving antenna with multiple reflectors Input /output model of the wireless channel: linear time-varying system, Baseband equivalent model, A discrete-time baseband model, Degrees of freedom, Additive white noise Time and frequency coherence **:**Doppler spread and coherence time, Delay spread and coherence bandwidth. Statistical channel models **:**Rayleigh and Rician fading**. 06Hrs**

UNIT-2:
Detection in a Rayleigh fading channel: Non-coherent and Coherent detection Time diversity
Antenna diversity : Receive diversity, Transmit diversity, MIMO. Frequency diversity: Single-carrier with ISI equalization, Direct-sequence spread-spectrum**06 Hrs**

UNIT-3
AWGN channel capacity Capacity of Flat: Fading Channels- Channel Distribution Information (CDI), Channel Side Information at Receiver,
Channel Side Information at Transmitter and Receiver, Capacity with Receiver Diversity Capacity of Frequency: Selective Fading Channels-Linear time-invariant, Time-Varying Channels **06 Hrs**

UNIT-4:
Multiplexing capability of deterministic MIMO channels : Capacity via singular value decomposition, Rank and condition number. Physical modeling of MIMO channels: Line-of-sight SIMO channel ,Line-of-sight MISO channel , Antenna arrays with only a line-of-sight path ,Geographically separated antennas,Line-of-sight plus one reflected path Modeling of MIMO fading channels**. 06 Hrs**

II Semester

ET3921 –PE III: Selected Topics in Communication Systems

UNIT-5

The V-BLAST architecture Fast fading MIMO channel: Capacity with CSI at receiver and Full CSI. Receiver architectures: Linear decorrelator, Successive cancellation, Linear MMSE receiver D-BLAST**:** an outage-optimal architecture, Coding across transmit antennas: D- BLAST. **06 Hrs**

UNIT-6:

Diversity–multiplexing tradeoff: Scalar Rayleigh channel, Parallel Rayleigh channel, MISO Rayleigh channel, 2×2 MIMO Rayleigh channel, nt×nr MIMO i.i.d. Rayleigh channel Universal code design for optimal diversity: multiplexing tradeoff - Universal code design for scalarchannels, parallel channels, MISO channels, MIMO channels Uplink with multiple receive antennas: Space-division multiple access ,SDMA capacity region MIMO uplink:SDMA with multiple transmit antennas, Downlink with multiple transmit antennas MIMO downlink. **06 Hrs**

Text books:

1	Fundamentals of Wireless Communications	2005	David Tse, PramodViswanath	Cambridge University Press

Reference books:

1	Coding for Wireless Channels	2007	E. Biglieri,	Springer,
2	MIMO Wireless Communications	2007	E. Biglieri,	Cambridge University Press
3	WIRELESS COMMUNICATIONS	2005	Andrea Goldsmith	Cambridge University Press

II Semester

ET3922 –PE III: Speech Processing

Course Objective The student should be able to	Course Outcome The student will be able to
1) Learn speech production mechanism. 2) Understand time and frequency domain method for speech processing. 3) Learn linear predictive coding analysis of speech. 4) Understand various speech and speaker recognition methods.	1) Identify digital speech productionmodel. 2) Process speech using time and frequency domain method. 3) Analyze speech by linear predictive coding method. 4) Recognize speech and speaker.

UNIT-1: Speech Production

Human speech production mechanism, acoustic theory of speech production, Digital models for speech production. **06Hrs**

UNIT-2: TIME DOMAIN MODELS FOR SPEECH PROCESSING

Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate ,Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function. **06Hrs**

UNIT-3: FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING

Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays - Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems: Phase vocoder, Channel Vocoder -Homomorphic speech analysis: Cepstral analysis of Speech, Formant and Pitch Estimation, HomomorphicVocoders. **07Hrs**

UNIT-4: LINEAR PREDICTIVE CODING (LPC) ANALYSIS

Basic principles of Linear Predictive Analysis:The Autocorrelation Method, The Covariance Method,Solution of Lpc Equations: Cholesky Decomposition, Solution for Covariance Method, Durbin's Recursive Solution for the AutoCorrelation Equations, Comparision between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters. **07Hrs**

II Semester
ET3922 –PE III: Speech Processing

UNIT-5: Speaker Recognition:

Issues in speaker recognition, Speaker verification vs identification, Text-dependent vs text-independent speaker recognition, Vector quantization models applications in speaker recognition, and Gaussian mixture modeling for speaker and speech recognition **06Hrs**

UNIT-6: Discrete and Continuous Hidden Markov modeling for isolated word and continuous speech recognition, DTW. **06Hrs**

Text books:

1	Discrete-time speech signal processing: Principles and Practice	2002	T.F Quatieri	Pearson
2	Digital Processing of Speech Signals	1978.	L R Rabiner,	Pearson
3.	Fundamentals of Speech Recognition	1993	L. Rabiner and B. Juang	Pearson

Reference books:

1	Speech Communication – Human and Machine	2000	Douglas O'Shaugnessy	IEEE Press

II Semester
ET3923 –PE III: Detection & Estimation Theory

UNIT-1:
Review of Probability Theory; Stochastic Processes; Representation of Stochastic Processes **06Hrs**

UNIT-2:
Classical Detection and Estimation Theory Elementary hypothesis testing, Bayes rule, minimax rule, Neyman-Pearson rule; composite hypothesis testing. **06Hrs**

UNIT-3
Detection of deterministic and random signals in Gaussian noise; Detection in non-Gaussian noise; Chernoff bound, asymptotic relative efficiency; sequential and distributed detection; **06Hrs**

UNIT-4:
Estimation Theory:estimation of parameters, Random parameters: Bayes Estimates, Estimation of , Nonrandom parameters, Properties ofEstimators, LMSE. **06Hrs**

UNIT-5
Estimation of Waveforms: Linear MMSE Estimation of waveforms, Estimation of Stationary processes: Wiener filter, Estimation of Non-stationary processes: Kalman filter, Nonlinear estimation **06Hrs**

UNIT-6:
Nonparametric detection, Locally optimal detection, Robust detection and estimation.
Applications of detection and estimation Applications in diverse fields such as communications, system identification, adaptive filtering,pattern recognition. **06Hrs**

Text books:

1	Introduction to statistical Signal processing with Applications	1989.	Srinath, Rajasekaran&Viswanathan	Prentice Hall of India, New Delhi
2	An Introduction to Signal Detection and Estimation	1994	H.V. Poor	2nd edition, Springer,
3	Fundamentals of Statistical Signal Processing:Vols.1& 2	1993, 1998	S.M. Kay	Prentice Hall,

Reference books:

1	Detection, Estimation and Modulation Theory	1968.	. E.L. Van Trees	Wiley, New York,
2	Detection of signals in noise and estimation	1985	Shanmugam and Breipohl	John Wiley & Sons, New York
3	Signal processing: Discrete Spectral analysis, Detection and Estimation	1975	Mischa Schwartz and Leonard Shaw	Mc-Graw Hill Book Company

II Semester

ET3924 –PE III: Real Time Operating System

Course Objective The student should be able to	Course Outcome The student will be able to
1) Understand real time systems with reference model 2) Know functional parameters, resources and scheduling. 3) Study Faults and error containment. 4) Learn Memory management and I/O system process management.	1) Analyzethe various real time systems with reference model 2) Discuss the various functional parameters , resources and scheduling. 3) Detect multiple Faults and reduce error containment. 4) Explore the various Memory management and Input/Output system process management

UNIT-1:
Overview Of Commands, File I/O. (Open, Create, Close, Lseek, Read, Write), Process Control (Fork, Vfork, Exit, Wait, Waitpid, Exec), Signals, Inter Process Communication (Pipes, FIFOs, Message Queues, Semaphores, Shared Memory). **06 Hrs**

UNIT-2:
Typical Real Time Application, Hard Vs Soft Real Time Systems, a Reference Model of Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency. **06 Hrs**

UNIT-3
Functional Parameters, Resource Parameters of Jobs and Parameters of Resources Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs State Systems, Effective Release Times and Dead Lines, Offline Vs Online Scheduling. **06 Hrs**

UNIT-4:
Overview, Time Services and Scheduling Mechanisms, other Basic Operating System Function, Processor Reserves and Resource Kernel.Capabilities of Commercial Real Time Operating Systems.
06 Hrs

UNIT-5
Introduction, Fault Causes, Types, Detection, Fault and Error Containment, Redundancy: Hardware, Software, Time. Integrated Failure Handling. **06 Hrs**

UNIT-6:
Memory Managements Task State Transition Diagram, Pre-Emptive Priority, Scheduling, Context Switches – Semaphore – Binary Mutex, Counting: Watch Dogs, I/O System Process Management, Scheduling, Interrupt Management, and Synchronization. **06 Hrs**

II Semester

ET3924 –PE III: Real Time Operating System

Text books:

1	Real Time Systems	1999	Jane W.S. Liu	Pearson
2	Real Time Systems		C.M.Krishna, KANG G. Shin	McGraw. Hill

Reference books:

1	Advanced Unix Programming	Richard Stevens

II Semester
ET3925 –PE IV: High Speed Networks

Course Objective **The student should be able to**	**Course Outcome** **The student will be able to**
1) Understand different networks and network topologies	1) analyze different networks and network topologies
2) Know protocols used in high speed networks	2) Compare different protocols used in high speed networks
3) Study Network design issues	3) Solve Network design issues
4) Study optical sensors and Networks	4) Compare optical sensors and Networks

UNIT-1:
Network services, Network Elements, Basic Network Mechanism, High Performance Networks, Traffic Characterization and quality of service, Applications, Layered Architecture.**06 Hrs**

UNIT-2:
OSI and IP Models, Frame Relay, Internet Protocol, TCP and UDP, Performance of TCP/IP networks, Internet Success and Limitation**06 Hrs**

UNIT-3 :
Wireless Networks: Introduction, The wireless Channel, Link Level Design, Channel Access, Network Design**06 Hrs**

UNIT-4:
Control of Networks: Objectives and Methods of Control, Circuit-switched Networks, Datagram Networks, Mathematical Background of Control Networks.**06 Hrs**

UNIT-5:
Introduction to Adhoc Wireless Networks, Issues, Routing approaches, Table-Driven of Routing Protocols, On-Demand Routing Protocols, Hierarchical routing Protocols. Ad hoc network security- Requirements, Issues and Challenges**06 Hrs**

UNIT-6:
SONET, Optical Links, WDM Systems, Optical Cross-Connects, Optical LANs, Optical Paths and Networks**06 Hrs**

Text books:

1	Computer Networking	2005	J.F.Kurose& K.W. Ross	Pearson
2	High-Performance Communication Networks	2e	Jean WarlandPravinVaraiya	Elsevier

Reference books:

1	Adhoc Wireless Networks	2005	C.Siva Ram Murthy &B.S.Manoj	Pearson Education, 2005.

II Semester

ET3926 –PE IV: Wireless Sensor Networks

Course Objective	Course Outcome
The student should be able to	**The student will be able to**
1) To Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology 2) Understand the medium access control protocols and address physical layer issues 3) Learn key routing protocols for sensor networks and main design issues 4) Learn transport layer protocols for sensor networks, and design requirements 5) Understand the Sensor management, sensor network middleware, operating systems.	1) Understand and explain common wireless sensor node architectures. 2) Carry out simple analysis and planning of WSNs. 3) Demonstrate knowledge of MAC protocols developed for WSN. 4) Demonstrate knowledge of routing protocols developed for WSN. 5) Understand and explain mobile data-centric networking principles. 6) Be familiar with WSN standards.

UNIT-1:
Introduction to sensors**-** Definition of sensor & its difference from transducer, Classification of sensors, application of sensors in various fields. Architecture-single node architecture-hardware components, energy consumption of sensor nodes, operating system and execution environments
06Hrs

UNIT-2:
Network architecture-optimization goal and figure of merit-design principles for WSN, service interface of WSN, Gateway concept challenges of WSN, comparison with other network.**06Hrs**

UNIT-3
Wireless channel and communication fundamental, physical layer and transceiver design consideration in WSN.
06Hrs

UNIT-4:
MAC Protocols-Fundamental of MAC Protocol, low duty cycle protocol and wakeup concepts, schedule based protocols , Link layer protocols, routing protocols **06Hrs**

UNIT-5
Naming and addressing, Time synchronization, Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement.**06Hrs**

UNIT-6:
Data centric routing, Data aggregation, Data centric storage, Topology control-controlling topology in a flat network, Hirarical network by dominating set, Hierarchical network by clustering, combining Hierarchical topologies and power control**.06Hrs**

II Semester
ET3926 –PE IV: Wireless Sensor Networks

Text books:

1	Protocols and architecture for Wireless Sensor Networks	2007	Holger Karl, Andreas Willig,	Wiley
2	Handbook of Algorithms for Wireless Networking and Mobile Computing	2006	AzzedineBoukerche	Chapman & Hall/CRC, 2006

Reference books:

1	Wireless Sensor Network Designs,	2003	Anna Hac	Wiley
2	Wireless Sensor Networks : A systems perspective	2005	NirupamaBulusu and Sanjay Jha	ArtechHouse,August 2005.
3	Wireless Sensor Networks : Architecture and Protocols	2003	Jr., Edgar H. Callaway,	Auerbach, 2003.
4	Wireless Sensor Networks	2005	C.S. Raghavendra, Krishna M. Sivalingam and TaiebZnati	Springer,

II Semester

ET3927 –PE IV: Micro Electro Mechanical Systems

UNIT-1:
Intrinsic Characteristic of MEMS :- Energy Domains & Transducers. Sensors & Actuators. Introduction to Micro fabrication- silicon based MEMS processes. New Materials- Review of Electrical and Mechanical concepts in MEMS. Semiconductor devices- Stress & Strain analysis- Flexural beam bending, Torsional deflection**06Hrs**

UNIT-2:
Electrostatic sensors- Parallel Plate capacitors, Applications, Interdigital Finger capacitor,Com drive devices, Thermal sensing and Actuation, Thermal Expansion, Thermal couples, Thermal resistors, Applications, Magnetic Actuators, Micro magnetic Components, Case studies of MEMS in magnetic actuators**06Hrs**

UNIT-3
Piezoresistive sensors, Piezoresistive sensor materials, Stress analysis of mechanical elements, Applications to Inertia, Pressure, Acoustic, Tactile and Flow sensors, Piezoelectric sensors and actuators, Piezoelectric effects, Piezoelectric materials.**06Hrs**

UNIT-4:
Silicon Anisotropic Wet Etching, Dry Etching of Silicon, Plasma Etching, Deep reaction Ion Etching (DRIE), Isotropic Wet Etching, Gas phase Etchants-Case studies, Basic surface micromachining processes, Structural and sacrificial materials, Acceleration of sacrificial Etch, Striction and Anistriction methods, Assembly of 3D MEMS,Foundry process**06Hrs**

UNIT-5
Polymers in MEMS ,Polimide, SU-8, Liquid Crystal Polymer(LCP), PDMS, PMMA, Parylene,Flurocarbon, Application to acceleration, Pressure, Flow and Tactile sensors**06Hrs**

UNIT-6:
Optical MEMS, Lensens and Mirrors, Actuators for Active Optical MEMS.**06Hrs**

Text books:

1	Foundations of MEMS	2006	Chang Liu,	Pearson Education Inc

Reference books:

1	An Introduction to Micro electro mechanical system design	2000	NadimMaluf	Artech House
2	The MEMS Handbook	2000	Mohames Gad-el-Hak	CRDC press Baco Raton
3	MEMS & Micro systems Design and Manufacture	2002	Tai Ran Hsu,	Tata Mcgraw Hill, New Delhi.

II Semester

ET3928 –Seminar

Course Objective **The student should be able to**	**Course Outcome** **The student will be able to**
1) Gain profound knowledge about English language. . 2) Learn logical and critical reasoning skills 3) Know mathematical formulae for quantitative reasoning 4) Acquire sound technical knowledge	1) Write effectively in English. 2) Analyze logically and critically on different issues. 3) Solve quantitative problems effectively. 4) Apply fundamentals of Electronics and Telecommunication for practical applications.

III Semester
ET3939 - Project Phase-I

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students the academic environment to carry out literature survey of advanced topics in structural engineering 2. To motivate the students to use the modern tools and software. 3. To provide the students the understanding of various aspects like effective communication skills, working independently and in a team and the importance of lifelong learning etc. to carry out project.	1. An ability to understand the advances in structural engineering. 2. An ability to understand the use of modern tools. 3. An ability to work independently and in a team for effective communication 4. An ability to understand the importance of lifelong learning.
PO Mapped : 1,2,3,4,5,6,	

Contents:

1. Literature review on current topic related to the structural engineering.
2. Preparation and presentation of progress seminars on topic selected for dissertation.
3. Submission of project report including introduction, literature review, objective and scope of investigation and pilot studies carried out during the semester.

IV Semester
ET3940 - Project Phase-II

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students the academic environment to carry out literature survey of advanced topics in structural engineering. 2. To provide the students the understanding of real world structural engineering problems and their solution. 3. To motivate the students to use the modern tools and software. 4. To provide the students the understanding of various aspects like effective communication skills, working independently and in a team and the importance of lifelong learning etc. to carry out project.	1. An ability to understand the advances in structural engineering. 2. An ability to solve real world structural engineering problems. 3. An ability to understand the importance of lifelong learning and the use of modern tools. 4. An ability to work independently and in a team for effective communication.
PO Mapped : 1,2,3,4,5,6,	

Contents:

1. The of detailed study of a work including collection and analysis of data, determining solution, design, scientific research on topic selected for dissertation.
2. Preparation and presentation of progress seminars on topic selected for dissertation.
3. Submission of project report on the entire studies carried out during the semester