SCHEME & SYLLABUS

for

M.TECH. COURSE

in

Signal Processing

(w.e.f. Session 2017-2018)

DEPARTMENT OF ELECTRONICS ENGINEERING

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

YMCA UNIVERSITY OF SCIENCE & TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATION
M.Tech 1st year –Signal Processing

SEMESTER-I

Subject Code	Course Title	Teaching Schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits
		L	P	Total		Theory	Practical		
E17S 601	Signal Theory	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 603	Digital Communication and Information system	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 605	Microprocessor and its applications	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 607	Digital Signal Processing	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 609	Numerical Techniques	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 611	Microprocessor Lab	**-**	**2**	**2**	**15**	**-**	**35**	**50**	**2**
E17S 613	Digital Signal Processing Lab	**-**	**2**	**2**	**15**	**-**	**35**	**50**	**2**
	Total	**20**	**4**	**24**	**155**	**375**	**70**	**600**	**24**

YMCA UNIVERSITY OF SCIENCE & TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATION

M.Tech 1st year –Signal Processing

SEMESTER –II

Subject Code	Course Title	Teaching Schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits
		L	P	Total		Theory	Practical		
E17S 602	Embedded Systems & Applications	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 604	Digital System Design	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 606	Advance Signal Processing	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 608	Analog MOS Integrated Circuits for Signal Processing	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
	Elective-I	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 612	Digital System Design Lab.	**-**	**2**	**2**	**15**	**-**	**35**	**50**	**2**
E17S 614	Advance Signal Processing Lab.	**-**	**2**	**2**	**15**	**-**	**35**	**50**	**2**
	Total	**20**	**4**	**24**	**155**	**375**	**70**	**600**	**24**

LIST OF ELECTIVE – I

E17S 610 A Wireless Communication
E17S 610 B Artificial Intelligence
E17S 610 C Optical Fiber Communication System

YMCA UNIVERSITY OF SCIENCE & TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATION
M.Tech 2nd year –Signal Processing

SEMESTER –III

Subject Code	Course Title	Teaching Schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits
		L	P	Total		Theory	Practical		
E17S 701	General & Special Purpose Digital Signal Processors	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 703	Statistical signal processing	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
	Elective-II	**4**	**-**	**4**	**25**	**75**	**-**	**100**	**4**
E17S 707	Seminar-I	**-**	**2**	**2**	**50**	**-**	**-**	**50**	**2**
E17S 709	Minor Project	**-**	**4**	**4**	**30**	**-**	**70**	**100**	**2**
E17S 711	DSP Processors & Application Lab	**-**	**2**	**2**	**15**	**-**	**35**	**50**	**2**
E17S 713	Statistical Signal processing Lab.	**-**	**2**	**2**	**15**	**-**	**35**	**50**	**2**
	Total	**24**	**2**	**26**	**185**	**225**	**140**	**550**	**20**

LIST OF ELECTIVE – II

E17S 705 A Radar System Analysis and Design

E17S 705 B Sonar Signal Processing

E17S 705 C Digital Image Processing

YMCA UNIVERSITY OF SCIENCE & TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATION
M.Tech 2nd year –Signal Processing

SEMESTER –IV

Subject Code	Course Title	Teaching Schedule			Marks for Sessionals	Marks for End Term Examination		Total Marks	Credits
		L	P	Total		Theory	Practical		
E17S 702	Dissertation	-	24	24	150	-	350	500	12
E17S 704	Seminar-II	-	2	2	50	-	-	50	2
	Total	-	26	26	200		350	550	16

SEMESTER – I

E17S 601 SIGNAL THEORY

L T P CR
4 0 0 4

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

UNIT-1 Probability, Joint and Conditional Probability, Independent Events, Random Variable: Random Variable Concept, Distribution Function, Density Function, Gaussian Random variable, Other distribution and Density Examples, Conditional Distribution and Density Functions.

UNIT-2 Operations on one Random Variable: Expectation, Moments, Functions that give Moments, Transformation of a Random Variable, Multiple Random Variable; Vector Random Variable, Joint Distribution and its Properties, Conditional Distribution and Density, Statistical Independence, Distribution and Density of a Sum of Random Variables, Central Limit Theorem.

UNIT-3 Operations on Multiple Random Variables: Expected Value of a function of Random variables, Joint Characteristic Functions, Joint Gaussian Random variables, Transformations of Multiple Random variables, Linear Transformation of Gaussian Random variables, Sampling and Estimation: Estimation of Mean, Power, and Variance

UNIT-4 Random Process – Temporal Characteristics: The Random Process Concept, Stationarity and Independence, Correlation Functions, Measurement of Correlation Functions, Gaussian Random processes, Complex Random Processes

UNIT-5 Random Processes – Spectral Characteristics: Power Density Spectrum, Cross-Power Density Spectrum and their properties, Relationship between power Spectrum and autocorrelation function, Relationship between Cross-Power Spectrum and Cross-Correlation Function, Power Spectrums for Discrete Time Processes and Sequences, White and Colored Noise.

UNIT-6 Linear Systems with Random Inputs: Random Signal Response of Linear Systems, Spectral Characteristics of System Response, Noise Bandwidth, Discrete Time Systems: A/D Conversion, D/A Conversion.

UNIT-7 Modeling of Noise Sources: Receiver Noise Sources, Effective Noise Temperature, Incremental Modeling of Noisy Networks: Available Power Gain, Effective Input Noise temperature, Spot Noise Figures, Modeling of practical Noisy Networks: Average Noise Figures, Average Noise temperatures

Reference Books:

1. Probability, Random Variables and Random Signal Principles Payton Z. Peebles, JR 4^{th} edition, Mc-Graw Hill 2000
2. A Papoulis and S.U. Pillai Probability, Random Variables and Stochastic Processes 4^{th} Edition McGraw Hill 2002
3. H. Stark and J.W. Woods, Probability and Random Processes with Application to Signal Processing Prentice Hall 2002.

E17S 603 DIGITAL COMMUNICATION & INFORMATION THEORY

L T P CR
4 0 0 4

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

UNIT-1 Signals & classification, Fourier series and Fourier transform, autocorrelation and cross correlation, cross correlation of energy and power signal. Rayleigh energy theorem, probability theory, Gaussian Process.

UNIT -2 Noise: Sources of noise, signal to noise ratio, noise figure, noise temperature, Sampling theorem.

UNIT -3 Waveform Coding Techniques: Quantization, Pulse Code Modulation (PCM), PCM generator and Receiver, Companding in PCM, Delta Modulation, Adaptive Delta Modulation, Differential PCM, Comparison of Digital Pulse Modulation Method.

UNIT -4 Digital Modulation Techniques: Introduction, ASK, PSK, FSK, MSK, QPSK, BPSK, Detection of Binary Modulation Techniques in the presence of noise, error probability in ASK, PSK, FSK

UNIT -5 Information Theory: Concept of information and Entropy, Shannon Theorm, Channel Capacity Self Information, Discrete and Continuous Entropy, Mutual and Joint information, Redundancy

UNIT -6 Coding Theory; Source encoding & Channel encoding, Error detection and Correction, Various Codes for channel coding, Rate Distortion Functions.

UNIT -7 Error Control Code: Introduction to Block coding and Optimal Decoding, Binary Hamming Code, Structure of Linear Code, Decoding of Linear Block Code, Reed Muler Code, Structure of Cyclic Code, Bose Chaudhary Hocquenghem (BCH) codes, Cyclic Hamming Code

Reference books:

1. J. G. Proakis: Digital communication, Tata McGraw-hill (TMH) Publication, 3rd edition, 1990.
2. Bernard Sklar: Digital communications: Fundamentals and applications, PHI, 2003.
3. Simon Hawkins: Communication System, John Wiley, 3rd edition, 2004.
4. S.G.Wilson: Digital Modulation and Coding, PHI, 1996.

E17S 605 MICROPROCESSOR & ITS APPLICATIONS

L T P CR
4 0 0 4

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

UNIT -1 Microcomputer hardware: Microprocessor, architecture, system bus, memory organization, I/O, addressing modes, instruction types.

UNIT -2 Interrupts, timing and machine cycles, peripheral interfacing – DMA controller, CRT controller-8275, floppy disk interface and floppy disk controller-8272.

UNIT -3 Process control computer systems – process control languages, types of computers – main frames, minicomputers, microcomputers, performance evaluation techniques.

UNIT- 4 Microprocessor and microcomputer selection :Matching processors and applications, defining the application, software requirements, memory requirements, interfaces, coprocessor, future needs and expandability, power requirements, maintenance, cost effective design.

UNIT -5 Development Tools: Development systems for micros, software tools, logic analyzer, cross assemblers, compilers, and simulators.

UNIT- 6 Data Communication: Information coding, asynchronous and synchronous data communication, data communication standards – RS232C and RS485, USART, IEEE-488 GPIB.

UNIT -7 Applications: Stepper motor interface, temperature controller with an analog and digital computer using a temperature sensor, microprocessor based speed-monitoring unit of DC motor, frequency measurement.

Reference Books:

1. Rafiquzzaman: Microprocessor- Microprocessors and Microcomputer-Based System Design, CRC Press, 1990.
2. Slater: Microprocessor based design: A Comprehensive Guide to Effective Hardware Design, PHI, 2002.
3. A.P. Mathur: Introduction to Microprocessors, TMH, 1997.
4. Bray – Intel Microprocessor 8086/8088: Architecture, Programming and interfacing, PHI.
5. S. Ghoshal: Microprocessor Based System Design, Macmilan, 2000.

E17S 607 DIGITAL SIGNAL PROCESSING

L T P CR	
4 0 0 4	**Theory : 75**
	Class Work : 25
	Total : 100
	Duration of Exam : 3 Hrs.

UNIT-1 Discrete time signals and systems: Introduction, discrete-time signals: sequences i.e. basic sequences and operations, discrete time systems, memory-less systems, linear time invariant systems, causality, stability properties of linear time- invariant systems, frequency-domain representation of discrete-time signals and systems.

UNIT-2 Representation of sequences by Fourier transforms. Symmetry properties and Theorems of Fourier transform, discrete-time random signals.

UNIT-3 Z-Transforms: Introduction, properties of Z-transform, region of convergence, inverse Z-transform-partial fraction expansion, power series expansion. Application of Z-transform, system function, poles and Zeros.

UNIT-4 Structures of digital filters: Basic structures of Infinite Impulse Response (IIR) and Finite Impulse Response (FIR) Filters---direct form, cascade form, parallel form, feedback in IIR system, transposed forms Design of FIR and IIR filters using all standard procedures.

UNIT-5 Frequency transformations: Frequency transformations in the analog and digital domain. Discrete Fourier Transform (DFT): Properties of DFT, linear convolution using DFT, computation of DFT using fast Fourier Transform (FFT).

UNIT-6 Errors in Digital filtering: Errors resulting from rounding and truncation, round-off effects in digital filters. Finite word length effects in digital filter.

UNIT-7 Multirate Digital Signal processing (MDSP): Sampling rate conversion, multistage implementation of sampling rate conversion, application of multi rate DSP for design of phase shifters, narrow band low pass filters, Quadrature Mirror Filters, digital filter banks.

UNIT-8 Hardware implementation of DSP: Introduction to DSP processor, architecture of DSP processors.

DSP Devices: Von Neumann model, Harvard architecture.

Reference Books:

1. Digital signal processing: Alan V. Oppenheim, Ronald W. Schafer PHI 1998
2. Digital signal processing: Sanjit K. Mitra TMH, 2002
3. Digital Signal Processing: Proakis, PHI, 2002

E17S 609 NUMERICAL TECHNIQUES

L T P CR
4 0 0 4

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

UNIT-1 Linear equations- Matrix theory, solution of general linear system of equations, existence & uniqueness of solution, Echelon form of matrix, Gauss-elimination method for homogeneous & non-homogeneous systems of liner equations.

UNIT-2 Gauss-Jordan methods, round off errors, I, II conditioned matrices Eigen value & Eigen vectors, Unitary, Hermittian & normal matrices.

UNIT-3 Non-linear equations-Bisection methods, Linear interpolation methods, Newton's method, Muller's method, Bairstow's methods for the quadratic factors, other methods for the polynomials.

UNIT-4 Interpolation problems-Lagrangian polynomial, Divided differences, Interpolating with cubic spline, Bexier curves and B-spline curves, polynomial approximation of the surfaces, least square method.

UNIT-5 Differentiation & integration-derivatives from difference table, higher order derivatives, Extrapolation techniques, Integration formulas-Simpson's rule, Trapezoidal rule, Gaussian uadrature, Adaptive integration, multiple integrals.

UNIT-6 Solution of ordinary differential equation – modifier Euler methods, Milne's methods Adam's moulton method, Convergence criteria, Errors & error propagation, Comparison of different methods.

UNIT-7 Boundary value problems:- shooting methods, Rayliegh-Ritz, collocation and Galerkin methods, characteristic value problem, Eigen values by iteration and QR method, application of Eigen values.

UNIT-8 Solution of partial differential equation – Laplace's equations on a rectangular region, iterative method for the Laplace equation, Poisson equation, A.D.I method, Solution of parabolic differential equation by Crank – Nicholson method, Theta method, Solution of wave equation by Finite differences, Wave equation in two dimensions.

Reference Books:

1. Kreyszg, Erwin, "Advanced Engineering Mathematics" John 1999.
2. Greenberg, Mchale. D "Advanced Engineering Mathematics" Second Edition Pearson, 1998.
3. Jain, R.K. & lyengar, S.R.K. "Advanced Engineering Mathematics" Narosa 2002.
4. Gerald Curts F & Wheatley, Patrick O, Applied Numerical Analysis" 5th Ed. Wesley 1998.
5. Jain, M.K. lyengar, S.R.K. & Jain R.K. "Numerical Methods for scientific & Engineering Computation". New Age 1993

E17S 611 MICROPROCESSOR LAB

L T P CR	
0 0 2 2	**Theory : 35**
	Class Work : 15
	Total : 50
	Duration of Exam : 3 Hrs.

LIST OF EXPERIMENTS

1. Familiarization with architecture and operation of single board microcomputer.
2. Performing mathematical and logical operations on a single board microcomputer.
3. Familiarization with DEBUG program and its commands to execute and debug Assembly Language Programs (ALP).
4. Write a program for a 16 bit processor to
   (a) Find the largest number in a data array.
   (b) Find the smallest number in a data array.
5. Write a program for a 16 bit processor to find the sum of a series of 16 bit numbers.
6. Write a program for speed control of DC series motor.
7. Design a microprocessor based temperature monitoring unit.
8. Write a program for a traffic light control with emergency control using Interrupts.
9. Familiarization with architecture and operation of an 8 bit Microcontroller.
10. Write an ALP to generate 10 KHz square wave.
11. Write an ALP to interface Microprocessor and LCD display.
12. Write an ALP to interface one microcontroller with other using serial communication.

Note: At least ten experiments have to be performed in the semester. At least seven experiments should be performed form the above list. Remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

E17S 613 DIGITAL SIGNAL PROCESSING LAB

L T P CR	Theory : 35
0 0 2 2	Class Work : 15
	Total : 50
	Duration of Exam : 3 Hrs.

LIST OF EXPERIMENTS USING MATLAB:

1. Write a Program for generation of unit impulse, unit step, ramp, exponential, sinusoidal and cosine sequence.
2. Write a Program for computing inverse Z-transform of a rational transfer function.
3. Write a Program for linear convolution
4. Write a Program for plotting the frequency response of first order system.
5. Write a Program for computing Discrete Fourier Transform (DFT).
6. Design a Butterworth Low pass IIR filter using Bilinear Z-transform method.
7. Design FIR Low pass filter and High pass filter using Rectangular window.
8. Transform an analog filter in to a digital filter using Impulse Invariant method.
9. Design a Chebyshev Low pass filter.
10. Design FIR low pass filter using Kaiser Window.
11. Determine the execution time of the FFT function.
12. Demonstrate the effectiveness of high-speed convolution FFT algorithm

Note: At least ten experiments have to be performed in the semester. At least seven experiments should be performed form the above list. Remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

SEMESTER-II

E17S 602 EMBEDDED SYSTEMS & APPLICATIONS

L T P CR
4 0 0 4

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

UNIT-1 Introduction to embedded system, Categories of embedded systems, Hardware Architecture, CPU, Processor Architecture interrupts, CISC & RISC, Memory, I/O devices, DMA, ADC & DAC, Serial Peripheral integrate, inter – integrated circuits bus-TCP/IP protocol

UNIT- 2 Software architecture, services provided by an operating system, architecture of embedded operating system, categories of embedded operating system

UNIT-3 Process of embedded system development, waterfall model, requirements engineering, Design tradeoffs, co-design, Hardware design, Software design, Implementation, Integration & Testing, Configuration Management. Managing embedded-system development projects

UNIT-4 Communication Interfaces, RS-232/UART, RS-422/485, IEEE 1394, USB, Ethernet, wireless interfaces, IEEE 802.11, Bluetooth.

UNIT-5 Representative embedded systems, Digital Thermometer, Handheld Computer, GPS Navigation System, Internet Phone, Software – defined Radio, smart cards, RF tags,

UNIT-6 Embedded operating system, features of O/S, POSIX, Difference in various O/S, Embedded NT, Windows XP Embedded and embedded Linux

Reference Books:

1. Embedded System by Dr. K.V.K.K. Prasad, Dreamtech Press, 2005.
2. Embedded System and applications by Raj Kamal, TMS, 2002

E17S 604 DIGITAL SYSTEM DESIGN

L T P CR
4 0 0 4

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

UNIT 1 Introduction to computer aided design: Hardware Description language (HDL), VHSIC Hardware Description Language (VHDL), Data Objects, Data Types, Operators.

UNIT 2 Introduction to Modeling: Entity Declaration, Architecture Body, Behavioral Flow Modeling, Structural Modeling and Data flow modeling.

UNIT 3 VHDL models of combinational and sequential circuits, memory implementation of Boolean function, code converter, ALU.

UNIT 4 Hardware & software firmware consideration in designing control units for arithmetic logical processors, I/O Processor with different methods of the data handling, electronics switching, process interface design.

UNIT 5 Programmable Logic Arrays (PLA) and designing with PLA, PAL, FPGA

UNIT 6 Approaches to Sequential analysis and design: State Diagram, Analysis of Sequential Synchronous circuits, Design steps for Sequential Synchronous Circuits, State Reduction, Design of output Decoders, Counters, Shift Registers and Memory.

UNIT 7 Asynchronous Finite State Machines: Scope, Asynchronous Analysis, Design of Asynchronous Machines, Cycles and Races, Plotting and Reading the Excitation Map, ssential Hazards Map Entered Variable (MEV), MEV approaches to Asynchronous Design.

Reference Books:

1. Fletcher: Engineering approach to digital design, PHI, 1993.
2. Bhasker: A VHDL Primer, Pearson Education, Prentice Hall PTR, 2006.
3. Mano: Digital logic and computer design, PHI, 1994
4. Wakerly Digital Design: Principles and practices, Pearson Education, 2005.
5. D. Smith: HDL Chip Design, Doon Publications 1996.

E17S 606 ADVANCE SIGNAL PROCESSING

L T P CR	
4 0 0 4	**Theory : 75**
	Class Work : 25
	Total : 100
	Duration of Exam : 3 Hrs.

UNIT 1 Digital Filter Structures: FIR digital filter structures; Direct form, Cascade form, Frequency Sampling structures, Lattice structure, IIR digital filter structure; Direct form, Cascade realization, Parallel realization, Lattice-Ladder filter structure.

UNIT 2 Design of FIR filters: Concept of Linear Phase, Design of Linear Phase FIR filters using Windows, Design of FIR filter using Frequency sampling methods, Design of FIR differentiators.

UNIT 3 Design of IIR filters: Design of IIR filters using Bilinear transformation method, Design of IIR filter using Impulse Invariant method.

UNIT 4 Quantization of Filer Coefficients: Coefficient quantization effects in FIR and IIR filters, Round-off effects in digital filters, Statistical characterization of quantization effects.

UNIT 5 Sampling and Reconstruction of Signals: Representation of Band Pass signal, Sampling of Band Pass signal, A/D conversion, Sample and Hold, Quantization and Coding, Analysis of quantization error, White Noise model of quantization error, oversampling A/D converters, Sigma-Delta A/D converter.

UNIT 6 Multirate Digital Signal Processing: Decimation by a factor D, Interpolation by a factor I, Sampling Rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate conversion, Sampling Rate conversion by an arbitrary factor; First Order approximation, Second Order approximation

Reference Books:

1. Proakis, John G., Dimitris G. Manolakis, and D. Sharma: Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2006
2. Digital Signal processing, A Practical Approach, Emmanuel C. Ifeachor, Barrie W Jervis, Pearson education, 2002
3. Mitra Sanjit.K: Digital Signal Processing a computer Based approach, Tata McGraw-Hill, 2001

E17S 608 ANALOG MOS INTEGRATED CIRCUITS FOR SIGNAL PROCESSING

L T P CR
4 0 0 4

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

UNIT 1 Overview of MOS technology, analog signal processing, basic MOS semiconductor fabrication process -PN junction, resistor, capacitor.

UNIT 2 Use of Device models in circuit analysis: MOS models, Bipolar models, monolithic resistors and capacitors.

UNIT 3 Analog CMOS sub circuit: MOS switch, CMOS current source, current mirrors - Wilson, cascade.

UNIT 4 Digital to analog and Analog to digital conversion: Medium speed, High speed.

UNIT 5 Switched capacitor circuit, switch capacitor amplifier, switched capacitor Integrator, Z domain or first order and second order switched capacitor circuit.

UNIT 6 Non-filtering applications of switched capacitor circuits; gain stage, programmable capacitor arrays, switched-capacitor rectifiers, detectors, oscillators, application in signal processing.

Reference Books:

1. Allen: CMOS analog circuit design, Oxford University press, 2002.
2. Schaumann: Design of analog filters, Oxford University press, 2001
3. Warner and Grung: MOSFET Theory and Design, Oxford University Press, 1999.
4 Gregorian and Temes: Analog MOS integrated Circuits for Signal Processing, John Wiley, 1986.

ELECTIVE-I

E17S 610A WIRELESS COMMUNICATION

L T P CR
4 0 0 4

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

UNIT-1 Introduction to wireless communication system, various generation wireless networks, cellular concepts, interface and system capacity, trunking and grade of service improving converge and capacity in cellular system.

UNIT-2 Fading and mobile characteristics representation, small scale fading, frequency selective fading, fading effect due to Doppler spread, coherence BW and coherence time, Rayleigh fading distribution, Ricean fading, Nakagami distribution, level crossing.

UNIT-3 Diversity, coding and equalization

UNIT-4 Modulation techniques for mobile radio, pulse shaping techniques, linear modulation techniques, constant envelope modulation, spread spectrum modulation techniques, rake receiver.

UNIT-5 Multiple Access (MA) techniques for wireless communication; FDMA, TDMA, CDMA, spectral effect of multiple access Schemes.

UNIT-6 GSM services and features, Architecture, frame structure, GSM channel, signal processing in GSM.

UNIT-7 Design parameters at base and mobile unit, Antenna configurations, Noise, power and field strength.

Reference Books:

1. T.S Rappaport: Wireless Communications, Prentice Hall, 1996.
2. Mobile Communications Design Fundamentals, 2nd Edition, William C.Y. Lee, John Wiley, February 1993.
3. Gordon L. Stuber: Principles of Mobile communication, Kluwer Academic, 2nd Edition., 2001.
4. W. Stallings: Wireless Command Network, PHI, 2003.
5. J. Schiller: Mobile Communication, Addison Wesley, 2002.
6. D.J. Goodman: Wireless Personal Communication Systems, Addison Wesley 1997.

E17S 610B ARTIFICIAL INTELLIGENCE

L T P CR
4 0 0 4

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

UNIT 1 **Predicate Calculus in AI**: Introduction, the Propositional calculus, The Predicate calculus, Expressions using interference Rules, knowledge representation through predicate calculus.

UNIT-2 **Structures And Strategies for State Space Search**: Introduction, Graph, Theory, Strategies for State Space Search, Heuristic Search, Algorithms for Heuristic Search, Admissibility, Monotonicity and Informedness, Game Playing (minimax) using Heuristic, Back Tracking Strategies, Graph Search Strategies, Heuristic Graph Search.

UNIT-3 **Control Strategies of State Space Search**: Introduction, Recursion-Based Search, Pattern-Directed Search Production Systems.

UNIT-4 **Knowledge Representation**: Issues in Knowledge Representation, A Brief illustration of AI Representational systems, Knowledge representation using Predicate logic, Semantics Net, Concept of Frames, Meta knowledge.

UNIT-5 **Rule Based Systems**: A forward deduction system, backward deduction system, combination of forward and backward system, Control Knowledge for Rule Based Deduction Systems.

UNIT-6 **Artificial Neural Networks**: Introduction, different learning laws and architectures, learning through error back propagation, Radial Basis function, Neural computing model – Hopfield net, Boltzman Machine.

UNIT-7 **Uncertainty Handling**: Bayesian networks, Dempster-Shafer theory, certainty factors, introduction to Fuzzy Logic.

UNIT-8 **Expert Systems**: Introduction, Architecture of expert system, knowledge acquisition and representation methods in expert systems, few applications of expert systems. **Prolog Programming**: An introduction and brief overview of the language.

Reference Books

1. George Luger, "Artificial Intelligence: Structure and Strategies for complex problem solving", Pearson Education, 2004.
2. Iven Bratko, "Prolog: Programming for artificial intelligence" Person Education., Addison Wesley, 2000.
3. Nils J. Nilsson, "Artificial Intelligence: A New synthesis, Harcart Asia Pvt. Ltd., 1998.
4. "Artificial Intelligence": by S.V. Kataipoulos
5. Masound, Yazani, "Artificial Intelligence", Intellect, 1986.
6. "Introduction to ANN" by Jack., M. Zwadu

E17S 610C OPTICAL FIBER COMMUNICATION SYSTEMS

L T P CR
4 0 0 4

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

UNIT 1 Overview of Optical Communication Systems.

UNIT 2 Review of Optics: Wave Theory of Light, Reflection/Refraction of plane waves, Fresnel's Formulas, Interface, Diffraction, Optical Coherence, Polarization of Light.

UNIT 3 Propagation of light in Fibers: Concepts of modes and single mode fibers, Dispersion and attenuation in Fibers, Comparison of different types of Fibers and optical choice of Fibers.

UNIT 4 Optical Wave Guide: Planar Conducting waveguides, planar dielectric wave guides, optical fiber wave guides

UNIT 5 Optical Sources and transmitters: LED, semiconductor lasers and their characteristics

UNIT-6 Optical detectors and receivers: Photo detectors and their characteristics, receiver design, noise and sensitivity issues.

UNIT-7 System Design: Selection of detectors based on speed, sensitivity and signal to noise ratio, determination of crucial parameters for basic optical devices, translate design requirement into system parameters, optical link design, power and noise budget, jitter / rise time budget.

Reference Books:

1. Govind P. Aggarwal: Fiber Optic Communication System, 3rd Edition, John Wiley Publication., 1989.
2. Joseph C. Palais: Fiber Optic Communication, 4th Edition, PHI, 2005.
3. R. Ramaswami and K.N.Swarajan,, "Optical Networks: a Practical Perspective" , Morgan Kaufmann Publishers, 1998.
4. J.Gowar: Optical Fiber Communication System, PHI, 1995
5. G.Keiser: Optical fiber communication, Tata McGraw Hill, 2000.
6. J.M Senior: Optical fiber Communication Principles and Practice, PHI, 1992

E17S 612 DIGITAL SYSTEM DESIGN LAB

L T P CR
0 0 2 2

Theory : 35
Class Work : 15
Total : 50
Duration of Exam : 3 Hrs.

1. Write VHDL code for 3 to 8 priority encoder.
2. Write structural code for 16:1 multiplexer.
3. Write VHDL code of full adder using two half adder.
4. Write VHDL code of BCD to 7 segment code converter using Data Style of modeling.
5. Design a three bit up/down counter using T flip flop.
6. Design a four bit synchronous counter with parallel load using T and D flip flops.
7. Write Behavioral VHDL code for module-12 up counter with synchronous reset.
8. Write VHDL Code for left to right shift registers with enable pin.
9. Create an entity that represents 3 to 8 binary encoder using two instances of 2 to 4 entity.
10. Design four bit comparator using Behavioral and Structural type of modeling.
11. Design an ALU capable of performing arithmetic and logical operations.
12. Design a module-6 counter which counts in the sequence 0,1,2,3,4,5,0,1, the counter counts the clock pulse if its enable pin is equal to 1

Note: At least ten experiments have to be performed in the semester. At least seven experiments should be performed form the above list. Remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

E17S 614 ADVANCE SIGNAL PROCESSING LAB

L T P CR	Theory : 35
0 0 2 2	Class Work : 15
	Total : 50
	Duration of Exam : 3 Hrs.

LIST OF EXPERIMENTS USING MATLAB

1. Implement a Cascade and Parallel form realization of IIR Filter and write a MATLAB Program to convert Cascade and Parallel form to direct form.
2. Write a MATLAB program that converts a direct form FIR filter structure to Frequency Sampling form FIR.
3. Implement a Lattice/Ladder IIR filter using MATLAB.
4. Implement a Lattice form realization of FIR filter.
5. Simulate the effect of coefficient quantization on the frequency response of a direct form IIR digital filter.
6. Simulate the effect of coefficient quantization on the frequency response of a Direct form FIR digital filter.
7. Calculate output noise variance due to input quantization of a digital filter (Partial – Fraction Approach)
8. Compute output round-off noise variance of a 4^{th} order digital filter.
9. Design a digital FIR low pass filter using Window Techniques.
10. Design a Low Pass, Discrete time filter with Butterworth Characteristic using Bilinear Transformation method and Impulse Invariant Method.
11. Write a MATLAB program to generate a discrete time equivalent of the signal. Interpolate the discrete time signal and Decimate the output of interpolator.
12. Operation of a Sigma-Delta A/D converter for a sinusoidal input using MATLAB.

Note: At least ten experiments have to be performed in the semester. At least seven experiments should be performed form the above list. Remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

SEMESTER – III

E17S 701 GENERAL AND SPECIAL PURPOSE DIGITAL SIGNAL PROCESSORS

L T P CR
4 0 0 4

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

UNIT 1 Introduction, computer architectures for signal processing, Harvard Architecture, pipelining.

UNIT 2 Hardware multiplier accumulator, special instructions, Replication, on chip memory/cache, extended parallelism – SIMD, VLIW and static superscalar processing.

UNIT 3 General purpose digital signal processors – fixed point DSP's, Architecture of first generation fixed point DSP processors, Architecture of second generation fixed point DSP's, Architecture of third generation fixed point DSP's, Architecture of fourth generation fixed point processors, floating point digital signal processors.

UNIT 4 Selecting digital signal processors – architectural features, execution speed, type of arithmetic, word length, support for development tools, packaging of a DSP, Clock frequency and MIPS rating.

UNIT 5 Implementation of DSP algorithms on general purpose DSP's – FIR digital filtering, IIR digital filtering, FFT processing, multirate processing.

UNIT 6 Special purpose DSP hardware – Basic requirements of special purpose DSP's, hardware digital filters, hardware FFT processors, architecture of hardware FFT processors, double buffering in real time FFT.

Reference books:

1. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital signal processing – A practical Approach", Second Edition, Pearson Education, 2004.
2. Digital Signal Processing – Principles, Algorithms and applications, by John G. Proakis, Dimitris Manolakis, Pearson Education, 2006.
3. Chassaing R, Horning D.W. "Digital Signal Processing with the TMS320C2S" , Wiley Publications, 1990.
4. Digital Signal Processor Applications with Motorola's DSP 56002 , Mohammed EL. Sharkawy

E17S 703 STATISTICAL SIGNAL PROCESSING

L T P CR
4 0 0 4

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

UNIT-1 Digital Filter design using least-square method: Least Square error criterion in the design of Pole-zero filters, FIR least squares inverse filters.

UNIT-2 Spectral Estimation and Analysis - Non parametric methods: Periodogram, Bartlett and Welch modified periodogram, Blackman-Tukey Methods.

UNIT-3 Spectral estimation and analysis - Parametric methods: wide sense stationary random process, rational power spectra: Auto Regressive (AR) Process, Moving Average (MA) Process, ARMA Process, Relationship between the Filter Parameters and the auto correlation sequence.

UNIT-4 Forward and backward Linear Prediction: Forward Linear Prediction, Backward Linear Prediction, Relationship of an AR process to Linear Prediction: Yule–Walker Method, Levinson–Durbin Algorithm.

UNIT-5 Wiener Filters for Filtering and Prediction: FIR wiener filter, Orthogonality principle in the Linear Mean-square error (MSE) estimation, IIR Wiener Filter.

UNIT-6 Adaptive Algorithms to adjust coefficients of digital filters: Least Mean Square (LMS), Recursive Least Square (RLS) and Kalman Filter Algorithms.

Reference Books:

1. Proakis, John G., Dimitris G. Manolakis, and D. Sharma: Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2006
2. Vinay K. Ingle and John G. Proakis: Digital Signal Processing Using MATLAB, Brooks/Cole/Thomson Learning, 2001.
3. Digital Signal processing, A Practical Approach, Emmanuel C. Lfeachor, Barrie W Jervis, Pearson education, 2002
4. Mitra Sanjit.K: Digital Signal Processing a computer Based approach, Tata McGraw-Hill,2001.
5. Simon Haykin: Adaptive Filter Theory ,Pearson Education, 2002..
6. B. Widrow & S Stearns: Adaptive Signal Processing, PHI, 1985
7. Dimitris, Manolakis: Statistical and Adaptive Signal Processing, McGraw Hill, 2000.

ELECTIVE-II

E17S 705A RADAR SYSTEM ANALYSIS & DESIGN

L T P CR
4 0 0 4

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

UNIT-1 Radar fundamentals : Radar Classifications, Range, Range Resolution, Doppler Frequency Coherence, Radar Equation, Low Pulse Repetition frequency (PRF) Radar Equation, High PRF Radar Equation, Surveillance Radar Equation, Radar Losses, Noise Figure

UNIT-2 Signal Processing, Discrete Power Spectrum, Windowing Techniques

UNIT-3 Continuous Wave (CW) and Pulsed Radars: Functional Block Diagram, CW Radar Equation, Frequency Modulation (FM), Linear FM CW Radar Pulsed Radar, Range & Doppler Ambiguities, Resolving Range Ambiguities, Resolving Doppler Ambiguities.

UNIT-4 Radar Detection : Detection in Presence of Noise, Probability of Fake Alarm, Probability of Detection, Pulse Integration, Detection of Fluctuating Targets, Probability of Detection Calculation

UNIT-5 Radar Wave propagation : Earth Atmosphere, Refraction, Four-Third Earth Model, Ground Reflection, Pattern Propagation Factor, Diffraction, Atmosphere Attenuation.

UNIT-6 Clutter and Moving Target Indicator: Clutter Definition, Surface Clutter, Volume Clutter, Clutter Spectrum, Moving Target Indicator-Single Delay Line canceller, Double Delay Line canceller.

UNIT-7 Radar Antennas: Directivity, Power Gain, Effective aperture, Near and Far Fields, General Arrays, Linear Arrays, Planer Arrays, Array Scan Loss, Conventional Beam Forming

UNIT-8 Radar Cross Section (RCS): RCS definition, Dependency on Aspect Angle and Frequency RCS Dependence on Polarization, RCS of Simple objects, Simplistic Approach to calculating the RCS of Complex objects

Reference Books:

1. Bassem R. Mahafza : Radar System Analysis and Design Using MAT Lab., Chapman & Hall /CRC Press, 2005
2. Merrill I. Skolnik: Introduction to Radar Systems, Tata McGraw-Hill, 2001
3. Byron Eddie: Radar Principles, Technology, Applications, Pearson Education, 1995

E17S 705B SONAR SIGNAL PROCESSING

L T P CR	
4 0 0 4	**Theory : 75**
	Class Work : 25
	Total : 100
	Duration of Exam : 3 Hrs.

UNIT 1 Overview of sonar systems

UNIT 2 Sonar Basics: Propagation of sound in the ocean, noise in the ocean.

UNIT 3 Analysis of Sonar Signals: The sonar equation, signal/noise considerations, Generation of underwtaer sound, Nonlinear effect of depth

UNIT 4 Detection of Sonar signals: Threshold concept, Various types of detector, Typical problems in detection of sonar signals, Adaptive digital filters, Digital Doppler nullification

UNIT 5 Sonar Array Processing: Conventional beamforming, Adaptive beamforming, Beam Steering

UNIT 6 Sonar Systems Design Implementaion: Passive sonar design consideration, Active sonar design consideration

Reference Books:

1. Fracois Le Chevalier: Principles of Radar and Sonar Signal Processing, ARTECH House, 2002.
2. R.Urick: Principles of under water sound, McGraw Hill, 1983
3. A.D.Waite: Sonar for Practicing Engineers, 2002.

E17S 705C DIGITAL IMAGE PROCESSING

L T P CR
4 0 0 4

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

UNIT-1 Introduction: Elements of Digital Image Processing Systems, Image Acquisition, Storage, Processing Communication Display.

UNIT-2 Digital Image Fundamentals: Visual Perception, simple image models, concept of uniform and nonuniform sampling and quantization, Relationships between pixels-neighbors of pixel, connectivity labeling of connected components. Relations, equivalence and Transitive closure, Distance measures, Arithmetic/Logic operation, Imaging geometry Basic and perspective transformation stereo imaging.

UNIT-3 Image Transforms: Discrete Fourier transform, 2-D Fourier Transforms and its properties. Fast Fourier transform and its uses. Walsh, Hadamard Discrete cosine, Heir and slant transforms hostelling their algorithms and computer implementations.

UNIT-4 Image Enhancement: Spatial and frequency domain methods point processing, intensity transformation, Histogram processing image substation and Averaging spatial filtering, LP, HP and homo-morphic felling, generation of spatial marks, Color image processing.

UNIT-5 Image Restoration: Degradation model, digitalization of circulate and block circulate metrics, Algebraic approved invoice filtering, wiener filter, constrained least square restoration, Interactive restoration in spatial domain geometric transformation.

UNIT-6 Image Compression: Redundancy models, error free compression, Lossy compression, Image compression standards.

UNIT-7 Image Segmentation: Detection of Discontinuity, Edge detection, Boundary detection, Thresholding, Regional oriented segmentation use of motion in segmentation.

UNIT-8 Representation and Description: Image analysis, Pattern and their classes, Decision theoretical methods, Structural methods, Interpretation.

Reference Books:

1. Anil K Jain, “Fundamentals of Digital Image Processing”, PHI Edition 1997.
2. Refael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, “Digital Image Processing using MATLAB”, Pearson Education, 2004.
3. Keenneth R Castleman, “Digital Image Processing”, Pearson Education, 1995.
4. Refael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education, 2002.

E17S 707 SEMINAR-I

L T P CR		
0 0 2 2	Theory	: 35
	Class Work	: 15
	Total	: 50
	Duration of Exam	: 3 Hrs.

The student has to undertake extensive literature survey on a topic with the approval of the Supervisor appointed by Head of The Department for this purpose.

Extensive search of print, audio, video materials, internet surfing is to be carried out by the student. He/She has to give a seminar on his/her work. Evaluation will be based on continuous monitoring of his/her work during the semester, by his/her supervisor and the report on seminar evaluation by committee appointed by the Head of the Department.

E17S 709 MINOR PROJECT

L T P CR		
0 0 2 2	Theory	: 35
	Class Work	: 15
	Total	: 50
	Duration of Exam	: 3 Hrs.

Every student will carry out dissertation under the supervision of a Supervisor(s). The topic shall be approved by a committee constituted by the Head of the department.

Every student will be required to give two seminars, first at the beginning of dissertation (Phase-I) to present the scope of the work and to finalize the topic, and second toward the end of the semester, presenting the work carried out by him/her during the semester. The committee will screen both the presentation so as to award the sessional grades.

E17S 711 DSP PROCESSORS AND APPLICATION LAB

L T P CR
0 0 2 2

Theory : 35
Class Work : 15
Total : 50
Duration of Exam : 3 Hrs.

EXPT. 1 Familiarization with the architecture and operation of first generation fixed point DSP Texas Instruments TMS320C10.

EXPT. 2 Familiarization with the architecture and operation of second generation fixed point DSP Texas Instruments TMS320C50.

EXPT. 3 Familiarization with the architecture and operation of third generation fixed point DSP Texas Instruments TMS320C54x.

EXPT. 4 Familiarization with the architecture and operation of fourth generation fixed point DSP Texas Instruments TMS320C62x

EXPT. 5 Write an assembly language program for TMS320C10 based FIR digital notch filter.

EXPT. 6 Write an assembly language program for TMS320C10 based FIR digital band pass filter.

EXPT. 7 Write an assembly language program for TMS 320C25 based FIR digital notch filter.

Note: Each experiment has to be performed and these are very challenging and difficult experiments, so we limited to seven experiment.

E17S 713 STATISTICAL SIGNAL PROCESSING LAB

L T P CR	
0 0 2 2	**Theory : 35**
	Class Work : 15
	Total : 50
	Duration of Exam : 3 Hrs.

LIST OF EXPERIMENTS USING MATLAB

1. Using MATLAB find the signal energy or power of the signals.
2. Plot correlograms in MATLAB.
3. Periodogram of a signal containing two Sinusoidal components corrupted with White noise using MATLAB.
4. Power Spectrum estimate of a random signal using Bartlett Method.
5. Power Spectrum estimate of a random signal using Welch Method.
6. Implementation of LMS algorithm for optimum filter coefficients.

Note: Each experiment has to be performed and these are very challenging and difficult experiments, so we limited to six experiment.

SEMESTER – IV

E17S 702 DISSERTATION

L T P CR	
0 0 2 2	

Theory : 35
Class Work : 15
Total : 50
Duration of Exam : 3 Hrs.

The dissertation Phase-I will be continued as dissertation in IV semester.

At the end of the semester every student will be required to submit three copies of his/her Master Dissertation to the office of the ECE-department. Out of these one copy will be kept for department records and one copy shall be for the supervisor. Third copy of the Dissertation will be sent to the external examiner by mail by the department upon receipt of intimation of the examiner from the YMCAUST. Dissertation will be evaluated by a committee consisting of Head of the Department, Dissertation supervisor and one external examiner.

The external examiner shall be appointed by the University from a panel of examiners submitted by the respective Head of the Department to the Chairman, Board of Studies (B.O.S.). In case the external examiner so appointed by the University does not respond to the offer, the Chairman, B.O.S. may be empowered to appoint the next external examiner from the panel of examiners already submitted.

The student will defend his/her Dissertation before this committee and the committee will award one of the grades.

E17S 704 SEMINAR – II

L T P CR		
0 0 2 2	Theory	: 35
	Class Work	: 15
	Total	: 50
	Duration of Exam	: 3 Hrs.

The student has to undertake extensive literature survey on a topic with the approval of the Supervisor appointed by Head of The Department for this purpose.

Extensive search of print, audio, video materials, internet surfing is to be carried out by the student. He/She has to give a seminar on his/her work. Evaluation will be based on continuous monitoring of his/her work during the semester, by his/her supervisor and the report on seminar evaluation by committee appointed by the Head of the Department.

Committee will award the sessional grades.