M.Tech (EI)
Two Year (Four Semesters)
Scheme of Instruction and Syllabus
(Choice Based Credit System)

(With effect from 2015 – 2016 admitted batch onwards)

Department of Electronics and Communication Engineering
AU College of Engineering (Autonomous)
Visakhapatnam-530 003
2015-2016

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

A.U College of Engineering (A)
Andhra University, Visakhapatnam

M.Tech (EI), Two Year (Four Semesters)
Scheme to be valid with effect from the admitted batch of 2015 – 2016

Semester – I

Subject code	*Subject Title*	*Credits*	*Pds/Week*		*Sessionals*	*Uni.Exam marks*	*Total*
			Theory	Lab			
MTEI 1.1	Digital Signal Processing	4	4	-	30	70	100
MTEI 1.2	Microprocessor systems	4	4	-	30	70	100
MTEI 1.3	Transducers and Signal Conditioners	4	4	-	30	70	100
MTEI 1.4	VLSI	4	4	-	30	70	100
MTEI 1.5	Elective I a)Optical Fibers and Applications b)DSP Processors and Architecture c)Wireless Communications and	4	4	-	30	70	100

	Networks						
MTEI 1.6	Elective II a) EMI/EMC b) Artificial Intelligence and Neural Networks c) Application Specific Integrated Circuits (ASIC)	4	4	-	30	70	100
MTEI 1.7	Micro Processor Laboratory	2	-	3	100	-	100
MTEI 1.8	Seminar-I	2	-	3	100	-	100
	Total	28	24	6	380	420	800

Semester – II

Subject code	*Subject Title*	*Credits*	*Pds/Week*		*Sessionals*	*Uni.Exam marks*	*Total*
			Theory	Lab			
MTEI 2.1	Electronic Instrumentation Techniques	4	4	-	30	70	100
MTEI 2.2	Data Acquisition Systems	4	4	-	30	70	100
MTEI 2.3	Linear and Digital Systems Design	4	4	-	30	70	100
MTEI 2.4	Bio Medical Instrumentation	4	4	-	30	70	100
MTEI 2.5	Elective – III a)Processor Control Instrumentation b)Remote Sensing and Image Sensors c)GPS and Applications	4	4	-	30	70	100
MTEI 2.6	Elective – IV a)Nano Technology and Applications b)Microcontrollers and Embeded Systems c)Digital Image Processing	4	4	-	30	70	100
MTEI 2.7	Instrumentation Laboratory	2	-	3	100	-	100
MTEI 2.8	Seminar – II	2	-	3	100	-	100
	Total	28	24	6	380	420	800

Semester – III

Code No	*Course Title*	*Credits*	*Scheme of Examination*	*Total Marks*
MTEI 3.1	Thesis (Preliminary)	10	Viva- Voce	100

Semester – IV

Code No	*Course Title*	*Credits*	*Scheme of Examination*	*Total Marks*

MTEI 4.1	Thesis (Final)	14	Sessionals 30	External Viva 70	 100

1. The 3rd and 4th semesters are allocated for the project work.

2. At the end of 3rd semester, a project review is conducted by HOD with the committee consisting of the HOD, Chair person of BOS and the Guide. In the affiliated colleges, project (preliminary) will be evaluated by concerned HOD and thesis Guide of their respective Colleges.

3. At the end of 4th semester there will be a final viva voce for the project work conducted by the HOD with the committee consisting of HOD, Chair person of BOS, the Guide and an External examiner nominated by the University.

4. The Students need to complete 80 credits (in all the 4 semesters put together) to be qualified for getting M-Tech degree.

DIGITAL SIGNAL PROCESSING

Credits : 4

Subject Code : MTEI – 1.1 **Exam Marks :** 70

Semester-I **Sessionals :** 30

Common with M.Tech (Radar and Microwave Engineering), Digital Signal Processing (MTRM – 1.1)

Chapter – I : Advanced digital filter design techniques : Multiple band optimal FIR filters – design of filters with simultaneous constraints in time and frequency response, optimization methods for designing IIR filters, comparison of optimum FIR filters and delay equalized elliptic filters.

Chapter – II : Multirate DSP : The basic sample rate alteration – time – domain characterization, frequency – domain characterization : Cascade equivalences, filters in sampling rate alteration systems, digital filter banks and their analysis and applications, multi level filter banks, estimations of spectra from finite – duration observation of signals.

Chapter – III : linear prediction and optimum liner filters : forward and backward linear prediction, AR Lattice and ARMA lattice – ladder filters, Wieners filters for filtering on prediction.

Chapter – IV : DSP Algorithms : The Goertzel algorithm, the chirp – z transform algorithm the Levinson – Durbin algorithms, the Schur algorithm, and other algorithms, computations of the DFT, concept of tunable digital filters.

Chapter – V : Signal Processing Hardware : Multipliers, dividers, different forms of FIR Hardware, multiplexing, DTTR, TDM to FDM translator, realization of frequency synthesizer, FET hardware realization, different FFT architectures, special FFT processors, convolvers, Lincoln laboratory FDP and the compatible computer configurations.

Chapter – VI : Applications of DSP :

a) Speech : Model of speech production, speech analysis – synthesis system vocoder analyzers and synthesizers, linear prediction of speech.

b) DTMF System

Suggested Books :

1. Theory and applications of digital signal processing by Lawrence R. Rabiner and Bernard Gold, PHI
2. Digital Signal Processing. Principles, algorithms, and applications by John G. Proakis and Dimitris G. Manolakis, PHI, 1997.
3. Digital Signal Processing, A Computer – Based approach, by Sanjit K. Mitra, Tata Mc Graw-Hill, 1998

MICROPROCESSOR SYSTEMS

Credits: 4

Subject Code : MTEI – 1.2 **Exam Marks :** 70

Semester-I **Sessionals:** 30

Common with M.Tech (Radar and Microwave Engineering), Microprocessor Systems (MTRM-1.2)

Introduction : Historical background, Microprocessor based personal computer systems, RISC processor, Micro controllers, comparison of 8048, 8049, 8051 and 8052, Architecture of 8051.

Introduction and comparison of 8086, 8088, 80186 / 80188, 80286, 80386, 80486, Pentium and Pentium – Pro Processors, Addressing modes, Memory and Architecture. 8086 / 8088 Hardware specifications – Memory interface – I/O Interface – Interrupts – DMA – The Arithmetic Coprocessor Bus Interface - 8086 / 8088 Addressing Modes – Instructions – Programming.

References :

1. The Intel Microprocessors 8086 / 8088, 80186, 80188, 80286, 80386, 80486, Pentium and Pentium – Pro Processor Architecture, Programming and Interface by Barray B. Berry, 4th Edition, PHI.

2. Microprocessors Principles and Applications by Gilmore, 2nd Edition, TMH.

3. Microprocessors and Interfacing Programming and Applications by Douglas V. Hall, Mc Graw Hill.

4. Microprocessors / Microcomputers Architecture, Software and Systems by A.J. Khambata, John Wiely & Sons.

5. Advanced Microprocessors by Daniel Tabak, Mc Graw Hill, 1995.

TRANSDUCERS AND SIGNAL CONDITIONERS

Credits : 4

Subject Code : MTEI – 1.3 **Max. Marks :** 70

Semester-I **Sessionals :** 30

Unfraned theory of bilateral electromachenical transducers, sensitivity and linearlity analysis, static and dynamic responses, transfer function analysis of various transducers and their associated circuits, electrodynamic variable, variable inductance, variable capacitance, piezoelectric and force – balance transducers.

Design and construction of the above types of transducers :

Uses of the above transducers in measurement of displacement, velocity and acceleration. Thermo couples, Quartz thermometers, transducers for pressure and flow measurements. Ionization ganges, load cell and force – balanced transducers. Doppler shift flow meter, thermal transport flow meter. Magnetic flow meter.

Text Books :

1. H.K.P. Neubert Instrument Transducers Oxford University Press : (Second edition)
2. E.O. Doebelin 'Measurement Systems' Mc Graw Hill.

VLSI

Credits : 4

Subject Code : MTEI – 1.4 **Max. Marks :** 70

Semester-I **Sessionals :** 30

1. Digital Systems and VLSI : why design integrated circuits? – integrated circuits manufacturing – CMOS Technology – Integrated Circuit Design Techniques.

2. Transistors and Layout : Introduction – Fabrication processes – transistors – wires and vias – design rules – layout design and tools.

3. Logic Gates : Introduction – combinational logic functions – static complementary gates – switch logic – low power gates – delay through resistive interconnect-delay through inductive interconnect.

4. Combinatinal Logic Networks : Introduction – standard cell – based layout – simulation – combinational network delay – logic and interconnect design – power optimization – switch logic networks – combinational logic testing.

5. Sequential Machines : Introduction – latches and flip-flops – sequential systems and clocking disciplines – sequential system design – power optimization – design validation – sequential testing.

6. Subsystem Design : Introduction – subsystem design principles – combinational shifters – address – high density memory – field – programmable gate arrays – programmable logic arrays – floorplanning methods – off-chip connections.

Text books :

1. Modern VLSI Design, System – on – Chip by Wayne Wolf, Pearson Education, 3rd Edition.

References :

1. Introduction to VLSI Systems by C. Mead and L. Conway, Addison Wesley, 1980.

2. Introduction to VLSI Design by Eugene D. Fabrecius, McGraw Hill, 1990.

3. Basic VLSI Design by D.A. Pucknell & K. Eshragian, PHI, 3rd Edition.

ELECTIVE-I

OPTICAL FIBERS AND APPLICATIONS

Credits : 4

Subject Code : MTEI-1.5(a) **Exam Marks : 70**

Semester – I **Sessionals : 30**

Common with M.Tech (Radar and Microwave Engineering), Optical Fibers And Their Applications (MTRM-1.5(a))

1. Optic Fiber Waveguides

   Step – Index Fiber, Graded – Index Fiber, Attenuation, Modes in Step-Index Fibers, Modes in Graded – Index Fibers, Pulse Distortion and Information Rate in Optic Fibers, Construction of Optic Fibers, Optic Fibers, Optic Fiber Cables,

2. Light Sources and Detectors

   Light-Emitting Diodes, Light-Emitting – Diodes Operating Characteristics, Laser Principles, Laser Diodes, Laser-Diode Operating Characteristics, Distributed – Feedback Laser Diode, Optical Amplifiers, Fiber Laser, Vertical-Cavity Surface-Emitting Laser Diodes

   Principles of Photodetection, Photomultiplier, Semiconductor Photodiode, PIN Photodiode, Avalanche Photodiode,

3. Couplers and Connectors

   Principles, Fiber end Preparation, Splices, Connectors, Source Coupling, Distribution Networks and Fiber Components, Distribution Networks, Directional Couplers, Star Couplers, Switches, Fiber Optical Isolator, Wavelength-Division Multiplexing, Fiber Bragg Gratings, Other Components : Attenuator, Circulator and Polarization Controller

4. Modulation, Noise and Detection

   Light-Emitting-Diode Modulation and Circuits, Laser-Diode Modulation and Circuits, Analog-Modulation Formats, Digital-Modulation Formats, Optic Heterodyne Receivers, Thermal and Shot Noise, Signal-to-Noise Ratio, Error Rates, Modal Noise, Amplifier Noise, Laser Noise, and Jitter, Additional Noise Contributors, receiver Circuit Design

5. System Design and Fiber Optical Applications

   Analog System Design, Digital System Design, Applications of Fiber Optics

Text Book :

1. Fiber Optic Communications, Joseph. C. Palais, Pearson Education, Asia, 2002

References :

1. Fiber Optic Systems, John Powers, Irwin Publications, 1997
2. Optical Fiber Communication, Howes M.J., Morgen, D.V John Wiely

ELECTIVE-I
DSP PROCESSORS AND ARCHITECTURES

Credits: 4

Subject Code: MTEI – 1.5(b) **Max. Marks:** 70
Semester-I **Sessionals:** 30

UNIT I
INTRODUCTION TO DIGITAL SIGNAL PROCESING
Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB.

UNIT II
COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATIONS
Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT III
ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES AND EXECUTION
Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing, Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models

UNIT IV
PROGRAMMABLE DIGITAL SIGNAL PROCESSORS
Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT V
IMPLEMENTATIONS OF BASIC DSP ALGORITHMS AND FFT ALGORITHMS
The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller,
Adaptive Filters, 2-D Signal Processing, An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum

UNIT VI
INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES
Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

TEXT BOOKS:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.

REFERENCES:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M.Bhaskar, TMH, 2004.
2. Digital Signal Processing – Jonatham Stein, John Wiley, 2005.

ELECTIVE-I

WIRELESS COMMUNICATIONS AND NETWORKS

Credits : 4

Subject Code : MTEI – 1.5(c) **Max. Marks :** 70
Semester-I **Sessionals :** 30

Common with M.Tech (Radar and Microwave Engg..)(MTRM 1.5(c))

UNIT -I

WIRELESS COMMUNICATION AND SYSTEM FUNDAMENTALS: Introduction to Wireless Communication Systems, Examples of Wireless Communications, Comparisons of Common Wireless Communication Systems, Trends in Cellular Radio and Personal Communications, Cellular Concepts, Frequency Reuse, Handoff Strategies, Interference and System Capacity, Trucking and Grade Of Service, Improving Coverage & Capacity In Cellular Systems.

UNIT-II

MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION: FDMA, TDMA, SSMA (FHMA/CDMA/Hybrid Techniques) SDMA Technique (As Applicable to Wireless Communications), Packet Radio Access Protocols, CSMA Protocols, Reservation Protocols, Capture Effect in Packet Radio, Capacity of Cellular Systems.

UNIT-III

WIRELESS NETWORKING: Introduction, Differences Between Wireless and Fixed Telephone Networks, Traffic Routing in Wireless Networks, Circuit Switching, Packet Switching, The X.25 protocol**.**

UNIT-IV

Wireless Data Services, Cellular Digital Packet Data (CDPD), Advanced Radio Data Information Systems (ARDIS), RAM Mobile Data (RMD), Common Channel Signaling (CCS), Broad Band ISDN and ATM, Signaling System .No.7 (SS7), Network Services Part (NSP), SS7 User Part, Signaling Traffic in SS7, SS7 Services, Performance of SS7.

UNIT-V

MOBILE IP AND WIRELESS APPLICATION PROTOCOL: Mobile IP Operation of Mobile IP, Co-located Address, Registration, Tunneling, WAP Architecture, Overview, WML Scripts, WAP Service, WAP Session protocol, Wireless Transaction, Wireless Datagram,Infrared LAN's, Spread Spectrum LAN's, Narrowband Microwave LAN's, IEEE 802 Protocol Architecture, IEEE 802 Architecture and Services, 802. 11 Medium Access Controls, 802.11 Physical Layers.

UNIT-VI

BLUE TOOTH AND MOBILE DATA NETWORKS: Overview, Radio Specification, Baseband Specification, Links Manager Specification, Logical Link Control and Adaptation Protocol, Introduction to WLL Technology, Introduction, and Data Oriented CDPD Network, GPRS and Higher Data Rates, Short Messaging Service in GSM, Mobile Application Protocol.

TEXT BOOKS:

1. Wireless communication and Networking -William Stallings, PHI, 2003
2. Wireless Communications, Principles, Practice - Theodore, S. Rappaport, PHI, 2nd Edition, 2002.

REFERENCES:

1. Wireless Digital Communications-Karnilo feher,PHI, 1999.
2. Principles of Wireless Networks - Kavehpahlaven and P.Krishna Murthy, Pearson Education, 2002

ELECTIVE- II

EMI / EMC

Credits : 4

Subject Code : MTEI – 1.6(a) **Max. Marks :** 70

Semester – I **Sessionals:** 30

Common with M.Tech (Radar and Microwave Engineering), EMI/EMC (MTRM-1.6(a))

I. Introduction, Natural and Nuclear sources of EMI / EMC :

Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI / EMC, Natural and Nuclear sources of EMI.

II. EMI from apparatus, circuits and open area test sites :

Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive intermodulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

III. Radiated and conducted interference measurements and ESD :

Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements. ESD, Electrical fast transients / bursts, electrical surges.

IV. Grounding, shielding, bonding and EMI filters :

Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design.

V. Cables, connectors, components and EMC standards :

EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International EMC standards.

Text Books :

1. Engineering Electromagnetic Compatibility by Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi, Modules 1 – 9.

Reference :

1. Introduction to Electromagnetic Compatibility, Ny, John Wiley, 1992, by C.R. Pal.

ELECTIVE – II

ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS

Credits : 4

Subject Code : MTEI – 1.6(b) **Max. Marks :** 70

Semester – I **Sessionals:** 30

Common with M.Tech (Radar and Microwave Engineering), Artificial Intelligence and Neural Networks (MTRM-1.6(b))

Artificial Intelligence as Representation and Search

Introduction to AI, Roots and Scope of AI, Definition, Turing Test, Application Areas of AI, Predicate Calculus , Structures and Strategies for State Space Search , Heuristic Search , Control and Implementation of State Space Search

Representation and Inference

Knowledge Representation , Strong Methods for Problem Solving , Reasoning in Uncertain , Situations, Machine Learning : Symbol-Based: Framework for Symbol – Based Learning, Version Space Search, ID3 Algorithm, Un-supervised learning, Reinforcement Learning , Connectionist: Perceptron Learning, Backpropagation Learning, Competitive Learning, Hebbian Coincidence Learning, Attractor Networks

Neural Networks and Fuzzy Systems

Neural and Fuzzy machine intelligence, fuzziness as multivalence, the dynamical-systems approach to machine intelligence, intelligent behaviour as adaptive model-free estimation.

Neural Dynamics

I. Activations and signals : Neurous as functions, signal monotonicity, biological activations and signals, neuron fields, neuronal dynamical systems, common signal functions, pulse-coded signal functions, Neuronal dynamics II : Activation Models : neuronal dynamical systems, additive neuronal dynamics, additive neuronal feedback, additive bivalent models, BAM Connection matrices, additive dynamic and the noise-saturation dilemma, general neuronal activations : Cohen-grossberg and multiplicative models

Synaptic Dynamics

I. Unsupervised Learning : Learning as encoding, change, and quantization, four unsupervised learning laws, probability spaces and random processes, stochastic unsupervised learning and stochastic equilibrium, signal hebbian learning, competitive learning, differential hebbian learning, differential competitive learning. Synaptic Dynamics II : Supervised learning : Supervised function estimation, supervised learning as operant conditioning, supervised learning as stochastic pattern learning with known class memberships, supervised learning as stochastic approximation, the back propagation algorithm.

Text Books:

1. "Artificial Intelligence – Structures and Strategies for Complex Problem Solving", George F. Luger, 4th Edition, Pearson Education , 2003.
2. Neural Networks & Fuzzy Systems, Bark Kosko, PHI Published in 1994.

Reference Books:

1. "Artificial Intelligence", Knight, Tata McGraw Hill
2. "Artificial Intelligence 'a Modern Approach" Russell & Norvig, second edition , Pearson Education , 2003.
3. Fundamentals of Artificial Neural Networks, Mohamad H Hassoum, PHI
4. Neural Network Design, Hagan, Demuth and Beale, Vikas Publishing House.

ELECTIVE – II

APPLICATION SPECIFIC INTEGRATED CIRCUITS (ASIC)

Credits : 4

Subject Code : MTEI – 1.6(c) **Max. Marks :** 70

Semester – I **Sessionals:** 30

Common with M.Tech (Radar and Microwave Engineering), Application Specific Integrated Circuits (MTRM-1.6(c))

1. Introduction to ASICs – Types of ASICs, Design flow, Economics of ASICs, ASIC cell libraries, CMOS Logic, CMOS design rules, Logic cells, I/O cells, cell compilers.
2. ASIC Library Design – Transistors as resistors, Transistor parasitic capacitance, Logical effort, Cell design, Programmable ASICs, Programmable ASIC logic cells, Programmable ASIC I/O cells, Programmable ASIC interconnect, Programmable ASIC design software.
3. Low-level design entry, Schematic entry, low-level design languages, PLA tools, EDIF, An overview of VHDL and verilog, Logic synthesis, Simulation.
4. ASIC construction, Floor planning and placement.
5. CMOS System Core Studies
   Dynamic Warp Processors : Introduction, The problem, the algorithm, a functional overview, detailed functional specification, structural floor plan, physical design, fabrication, Hierarchical layout and design of single chip 32 bit CPU : Introduction, Design methodology, Technology updatability and layout verification.
6. Practical Realities and Ground Rules
   Further thoughts on floor plans/layout, floor plan layout of the four bit processors, input/output (I/O) pads, "Real estate", further thoughts on system delays, ground rules for successful design, scaling of MOS circuits.

Textbook:

1. Application Specific Integrated Circuits by J.S. Smith, Addison Wesley, 1997.

Reference Books:

1. Basic VLSI Design : Systems and Circuits, Doublas A. Puckness & Kamran Eshraghian, Prentice Hall of India Private Ltd., New Delhi, 1989.
2. Principles of CMOS VLSI Design : A system perspective, N. Westle & K. Eshraghian, Addition – Wesley Pub. Co. 1985.
3. Introduction to VLSI System, C. Mead & L. Canway, Addison Wesley Pub Co. 1990.
4. The Design & Analysis of VLSI Circuits, L.A. Glassey & D.W. Dobbephl, Addison Wesley Pub Co. 1985.
5. Introduction to NMOS & VLSI System Design, A. Mukharjee, Prentice Hall, 1986.
6. VLSI Design Techniques for analog and digital circuits, R.L. Geiger, P.E. Allen & N.R. Streder, McGraw Hill Int. 1990.
7. Digital Integrated Circuits, A Design Perspective, Jan A. Rabey, Prentice Hall of India Pvt. Ltd., 1997.
8. Application specific integrated circuits, J.S. Smith, Addison Wesley, 1997.

1st SEMESTER MODEL QUESTION PAPERS

M.Tech. (Electronic Instrumentation)

1st Semester

DIGITAL SIGNAL PROCESSING

Subject Code : MTEI-1.1, MTRM-1.1 **Max Marks : 70**

(Common with M.Tech (Radar and Microwave Engineering))

Note : Answer any FIVE questions

1. A digital low-pass filter is required to meet the following specifications.
   (i) Pass band ripple ≤ 1 dB (ii) Pass band edge : 4 KHz (iii) Stop band attenuation ≥ 40 dB (iv) Stop band edge : 6 GHz (v) Sampling rate : 24 KHz
   The filter is to be designed by performing a bilinear transformation on an analog system function satisfying above specifications. Determine the order of butterworth, chebyshev and elliptic analog designs to be used to meet the specifications in the digital implementation. Determine the transfer function of the digital filter in each case. [14M]
2. (a) Explain about optimization methods for designing IIR filters and delay equalized elliptic filters. [7M]
   (b) Compare optimum FIR filters and delay equalized elliptic filters. [7M]
3. (a) Define (i) decimation (ii) interpolation and explain the process of decimation by factor 'D' [7M]
   (b) Decimating x(n) by a factor of D = 2 produces the signal $x_d(n) = x(2n)$ for all n shows that $x_d(n)$ and its transform $x_d(w)$. Do we lose any information when we decimate the sampled signal $x_s(n)$? [7M]
4. (a) Show that the linear interpolation is a second order approximation. [7M]
   (b) Explain the implementation of digital filter banks. [7M]
5. (a) Consider the ARMA process generated by the difference equation
   x(n) = 1.6x(n-1) - 0.6x (n-2) + w(n) + 0.9w(n-1) [7M]
   (i) Determine the system function of the whitening filter and its poles and zeros (ii) Determine the power density spectrum of {x(n)} [7M]
   (b) Illustrate how the whitening property of a prediction area filter and the AR modeling of a discrete time stochastic process are complementary. [7M]
6. (a) What is the role of wiener filters for filtering and prediction of signals. [6M]
   (b) Consider a signal x(n) = s(n) + w(n) where s(n) is an AR (1) Process that satisfies the difference equation. S(n) = 0.8 s(n-1) + v(n) where {v(n)} is a white noise sequence with variance $\sigma_v^2 = 0.49$ and {w(n)} is a white noise sequence with variance $\sigma_w^2 = 1$. The process {v(n)} and {w(n)} are uncorrelated (i) Determine the autocorrelation sequence $\{r_{ss}(m)\}$ and $\{r_{xx}(m)\}$. (ii) Design a wiener filter of length M = 2 to estimate {s(n)} (iii) Determine the MMSE for r = 2 [8M]
7. (a) Determine the reflection coefficient k_3 in terms of the autocorrelations $\{\psi_{xx}(m)\}$ from the scheme algorithm and compare your result with the expression for k_3 obtained from the Levinson Duebin algorithm.
   (b) Explain the Goertzel algorithm. If this algorithm fails which algorithm do you suggest ?

8. Describe the following [14M]
   (i) Convolves
   (ii) Channel vocoder
   (iii) TDM to FEM translate

Model Question Paper
M.Tech. (Electronics Instrumentation)
1st Semester
MICROPROCESSOR SYSTEMS

Subject Code : MTEI-1.2& MTRM-1.2 **Max. Marks : 70**

(Common with M.Tech (Radar and Microwave Engineering))
Note : Answer any Five Questions

1. Draw the architectural block diagram of Intel 8051 microcontroller and explain the function of each block. [14]

2. (a) Draw the programming model of Intel 8086 and explain the function of registers and flags. [10]
   (b) Which instruction places the E-flags on the stock in the Pentium-IV microprocessor. [4]

3. (a) Explain the programming addressing modes and two stack memory addressing modes. [10]
   (b) Explain how LOOPE instruction operates [4]

4. (a) Explain how do you interface a 8259 A programmable intercept controller to 8086 microprocessor. [10]
   (b) Describe the differences between a protected mode and real mode intercept [4]

5. Describe how a direct memory access controller device an be connected to a 80686 system and describe how a DMA data transfer takes place [14]

6. (a) Explain with a block diagram how a co-processor can be connected to an 8086 operating in a maximum mode [10]
   (b) What ways are a standard microprocessor and a co-processor different from each other. [4]

7. Draw a 8-bit LED display interfaced to the 8086 microprocessor through an 82C55 PIA and explain the operation with the help of programming modes[14].

8. Write notes on any two of the following
   (a) RISC processor [7]
   (b) 8251 [7]
   (c) Interrupts used in 8086 [7]
   (d) differences between 8086 and 8088 [7]

Modal Question Paper
M.Tech. (Electronic Instrumentation)
1st Semester
TRANSDUCERS AND SIGNAL CONDITIONERS
Subject Code : MTEI-1.3 **Max Marks : 70**

Note : Answer any FIVE questions

1. (a) Define sensitivity of an instrument and explain zero drift and scale-factor drift in relation with sensitivity of an instrument. [7]
   (b) What are the factors influence the linearity of an electromechanical instrument and how it can be overcome. [7]

2. (a) How a mathematical model of a system differs from the physical model. With an example explain how a non-electrical system can be modeled. [7]
   (b) Obtain mathematical model of a first order RC high pass system subjected to the step excitation ? [7]

3. (a) Explain operation of magnetostrictive transducer for the measurement any one of the physical quantity. [7]
   (b) With digital methods how torque can be measured. [7]

4. (a) Explain the basic principle of measurement of sound suing different transducers ? [7]
   (b) Explain any of of the above method for measurement of sound in detail ? [7]

5. (a) What are the important parameters to be considered for the choice of selecting a transducer. [4]
   (b) Derive an expression for measurement of force using Piezo-electric transducer? [10]

6. (a) Explain any method to find the angular displacement with neat sketches? [7]
   (b) Explain how an angular displacement can be made with synchros and also derive an expression governing the angular displacement. [7]

7. (a) What are the advantages of Laser Doppler anemometer compared to ht wire anemometer? [3]
   (b) How to active the flow measurement using Doppler shift principle? [5]
   (c) In magnetic flow meter how flow level related with magnetic circuit elements? [6]

8. (a) What is the basic principle of measurement of vibrations and what are the quantities involved in the measurement of vibrations? [7]
   (b) With neat sketches explain the operation of seismograph? [7]

Modal Question Paper
M.Tech. (Electronic Instrumentation)
1st Semester
VLSI

Subject Code : MTEI-1.4 Max Marks : 70

Note : Answer any FIVE questions

1. a. Explain different processes involved in the fabrication of CMOS transistor with necessary cross sectional diagrams. (7)
   b. Discuss the body effect and latch up phenomena related to CMOS structures and suggest remedies for these problems. (7)
2. a. Determine the pull up and pull down ration for an NMOS inverting logic coupled by pass transistors. (7)
   b. Explain the sheet resistance, standard unit of capacitance and delay related to NMOS and CMOS technologies. (7)
3. a. Explain about inverter delays and estimate the rise time, fall time of a CMOS inverter delay. (7)
   b. Discuss the following forms of CMOS logic. (7)
      i. Pseudo NMOS logic
      ii. Dynamic CMOS logic and
      III. C^2 MOS logic
4. a. Give the organization of layout of typical standard cell. (7)
   b. Explain in detail the limits on logic levels and supply voltage due to noise in the scaling of devices. (7)
5. a. Explain how a flip flop is realized using NMOS and CMOS. (7)
   b. Explain the design of a 4 bit shift register. (7)
6. a. Explain the need for testing in CMOS chip fabrication. Compare chip level testing and system level testing. Give different test design strategies. (8)
   b. Give the cross section of one transistor DRAM cell built with trench capacitor and explain its working. (6)
7. a. Give a neat schematic of typical PAL structure and explain the different ways of programming. (7)
   b. What are VLSI CAD tools ? Explain design capture tools. (7)
8. Write short notes on the following.
   a. Stick diagrams. (4)
   b. Testing of combinational circuits. (6)
   c. Sub system design tools. (4)

Modal Question Paper
M.Tech (Electronic Instrumentation)
1st Semester
Elective-I : OPTICAL FIBERS AND APPLICATIONS
Subject Code : MTEI-1.5(a) & MTRM-1.5(a) Max Marks : 70

(Common with M.Tech (Radar and Microwave Engineering))

Note : Answer any FIVE questions

1.	a)	Discuss the properties and characteristics of Optical fibers	7
	b)	Explain the difference between a step-index fiber and a graded index fiber. What are the advantages of using graded index core in a fiber?	7
2.	a)	Explain the principle of operation of LED. Enumerate the characteristics of LED	7
	b)	Discuss the operation of an Avalanche Photodiode. Explain the factors that limit the time response of Avalanche photodiode.	7
3.	a)	Explain the operation of a LASER.	6
	b)	Explain the following properties of LASER : i) Line Width ii) Beam Divergence angle	8
4.	a)	With neat diagrams explain the various types of splicing and source couplings used in optical fibers.	7
	b)	Explain the principle of operation of i) Optical fiber isolator ii) Optical attenuator	7
5.	a)	What is system risk time?. Explain how does it limit an optical fiber communication link.	7
	b)	Explain quantum limit.A certain optical fiber link at 850 nm requires maximum bit error rate(BER) = 10^{-9} . Find the quantum current at a data rate of 10 Mb/Sec. (Assume h= 6.626 X 10^{-34} J-Sec)	7
6	a)	Draw the block diagram of an optical receiver and give the noise equivalent circuit of the voltage amplifier.	6
	b)	Explain the principle of operations of Photo detectors and photo multipliers.	8
7	a)	What is multiplexing?. Explain in detail the Wavelength division multiplexing.	7
	b)	Explain various network topologies in multiplexing fiber optic sensors.	7
8		Write short notes on: a) PIN photo diodes b) Fiber Bragg Gratings c) Digital System design.	14

Model Question Paper

M.Tech. (Electronic Instrumentation)

I – Semester

Elective-II : EMI / EMC

Subject Code : MTEI – 1.6(a) & MTRM – 1.6(a) **Max. Marks :** 70

Common for M.Tech (Radar and Microwave Engineering)

Note : Answer any FIVE questions.

1 (a). List out the mechanisms in which EMI propagates from source to receiver and briefly explain the Electromagnetic spectrum and it's utilization. [7]

(b). List out sources of EMI in detail. [7]

2 (a). What is meant by ESD. Explain effects of lightening discharge on transmission lines. [7]

(b). Draw an ESD equivalent circuit and explain Electromagnetic pulse and it's impact. [7]

3 (a). Draw an equivalent circuit of relay / switching circuit and explain the characteristics of Electromagnetic noise produced by switches. [7]

(b). How do you explain phenomenon of crosstalk in transmission lines and list out materials to be used and materials to be avoided for reducing passive intermodulation.[7]

4 (a). Compare radiated interference test facilities in detail. [7]

(b) Explain the precautions to be taken in open area test site measurements. [7]

5 (a). Explain the conducted EM noise on power supply lines and conducted EMI from equipment and how do you eliminate them. [7]

(b). Describe different types of grounding techniques with suitable examples. [7]

6 (a). Define shielding effectiveness and explain different methods of shielding and design methodologies. [7]

(b). Describe characteristics of EMI filters. [7]

7 (a). Describe the characteristics of cables, connectors and compensators in EMC design. [7]

(b). Briefly discuss isolation transformers and optoisolators. [7]

8 . Write short notes on. [14]

(a) EMC Standards (b) Electrical bonding

(c) Electrical surges (d) Statistical EMI / EMC modules.

ELECTRONIC INSTRUMENTATION TECHNIQUES

Credits: 4

Subject Code: MTEI – 2.1 **Exam Marks:** 70

Semester-II **Sessionals:** 30

Principles and Design of Electronic Instruments : Digital voltmeters, Electronic counters, Frequency synthesizers, Wave analysers, Spectrum analysers, Sweep waveform generators and pulse generators, Lock-in amplifiers, Q-meters, High frequency impedance bridges, Ground loops, Electromagnetic and static pick-up, Interference, Shielding and grounding, Floating voltage measurements; Common signals and their effects.

Oscilloscopes: Sweep generators, Sweep modes, Storage oscilloscopes types, Erasing methods, Sampling oscilloscopes synchronous and random sampling, Time domain reflectomertry, Logic state analysers and their applications.

Display System : Liquid crystal, Solid state CRT, Displays,

Recorders : Servo magnetic, U-V recorders, X-Y plotters. Computer based automated test instruments.

Text Book :

1. B.M. Oliver and J.M. Cage, ELECTRONIC MEASUREMENTS AND INSTRUMENTATION Kogakusha-McGraw Hill.

Reference :

1. Manufacturer's Literature.

DATA ACQUISITION SYSTEM

Credits: 4

Subject Code : MTEI – 2.2 **Exam Marks :** 70

Semester-II **Sessionals:** 30

Data Acquisition system : Introduction, Principles and design.

Digital to Analog converters (DACs) : Parallel R-2R, Weighted resistor, inverted ladder and serial (ADCs).

Analog to Digital Converters (ADCs) : Paralleled feedback, Successive approximation, Ramp comparison, Dual slope integration, Voltage to frequency, Voltage to time, Logarithmic types of ADCs, Accuracy analysis, Dynamic and static error analysis of the above, Typical study of monolithic DACs and ADCs.

Text Books

1. H. Schmid 'ELECTRONIC ANALOG-DIGITAL CONVERSION' McGraw Hill
2. D.G. Hoeschele 'A to D and D to A conversion techniques' Wiley
3. B.S. Sopnde Data Converters – Tata McGraw Hill
4. Analog Devices – Handbook.

References

1. E.R. Hanateck, User's Handbook of D/A and A/D converters – Wiley.
2. Datel / Intersil – Data acquisition systems.

LINEAR AND DIGITAL SYSTEMS DESIGN

Credits : 4

Subject Code : MTEI – 2.3 **Exam Marks :** 70

Semester-II **Sessionals :** 30

Principles and applications of operational amplifiers as summers, Integrators controlled current voltage sources, Function generators, Logarithmic amplifiers, Anti logarithmic amplifiers, Instrumentation amplifiers, Sample and hold circuits, Comparators, Multivibrators, Window discriminators, Analog multipliers, Modulator circuits, Four quadrant multipliers, Squaring and square rooting, phase sensitive detector circuits, analog switches, multiplexers, Phase locked loops, broad band amplifiers, Precision rectifiers, IC voltage regulators, switched mode regulators and active filter circuits, 555, 566 * 8038 ICs and their applications, Line drivers, Receivers for MODEMS, Isolation amplifiers.

Text Books

1. A.B. Grebene 'Analog IC design' – Van Nostrand
2. G.B. Clayton 'Applications of Linear ICs' – Max Millan (India)
3. Toetze & Schenk 'Advanced electronic Circuits' John Wiley

Review of combinational logic design : Logic design with MSI and LSI; Multiplexers and Demultiplexers; Arithmetic units; Carry look-ahead adders; Decimal and BCD adders / subtractors; Tabular design; Read only memory methods; programmable logic array methods. Analysis and synthesis of sequential circuits : Algorithmic state machine (ASM) methods; Map entered variable and synthesis of random logic. Fault detection and error correction in combinational and sequential circuits ; two level multi level multi level fault detection methods. Test generation; redundance techniques. Introduction to computer aided design of digital circuits.

Text Book

1. S.C. Lee 'Digital system design' – Prentice Hall, May 2003 (Prescribed)

References

1. W.N. Carr ' MOS / LST Design and applications' McGraw Hill
2. M.A. Bruer and A.D. Fridman 'Diagnosis and reliable design of digital systems' Computer science press, 1976.
3. ZVI Kohavi 'Switching and Finite automata theory TMH 1976
4. Frederick J. Hill, Gerald R. Peterson 'Computer Aided Logical Design with emphasis on VLSI – 1933 (John Wiley)

BIO-MEDICAL INSTRUMENTATION

Credits : 4

Subject Code : MTEI – 2.4 **Exam Marks :** 70

Semester-II **Sessionals :** 30

Chapter – I : Sources of Bioelectric potentials and Electrodes

Resisting and Action Potentials, Propagation of Action Potentials, The Bioelectric Potentials

Electrode theory, Bio Potential Electrodes, Biochemical Transducers

Chapter – II : The Cardiovascular System and Cardiovascular Measurements,

The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristics of Blood Flow, Heart Sounds

Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiac output, Plethysmography, Measurement of Heart Sounds,

Chapter – III : Patient Care & Monitory and Measurements in Respiratory System

The elements of Intensive Care Monitory, Diagnosis, Calibration and repairability of Patient Monitoring equipment, other instrumentation for monitoring patients, pace makers, defibrillators

The Physiology of respiratory system, tests and instrumentation for mechanics of breathing, respiratory theory equipment

Chapter – IV : Bio telemetry and Instrumentation for the clinical laboratory Introduction to biotelemetry, physiological parameters adaptable to biotelemetry, the components of biotelemetry system, implantable units, applications of telemetry in patient care

The blood, tests on blood cells, chemical test, automation of chemical tests

Chapter – V : X – ray and radioisotope instrumentation and electrical safety of medical equipment.

Generation of Ionizing radiation, instrumentation for diagnostic X – rays, special techniques, instrumentation for the medical use of radioisotopes, radiation therapy.

Physiological effects of electrical current, shock Hazards from electrical equipment, Methods of accident prevention

TEXT BOOK :

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A. Pfeiffer – Pearson education.

ELECTIVE III

PROCESS CONTROL INSTRUMENTATION

Credits: 4

Subject Code : MTEI – 2.5(a) **Exam Marks :** 70

II – Semester **Sessionals:** 30

ELECTIVE III

REMOTE SENSING AND IMAGE SENSORS

Credits : 4

Subject Code : MTEI – 2.5(b) **Exam Marks :** 70

Semester-II **Sessionals :** 30

Unit-I Basics of Remote Sensing

- Principles of Remote sensing, History of Remote sensing, Remote sensing in India,
- Electromagnetic Radiation and Electromagnetic Spectrum, EMR quantities: Nomenclature and Units
- Thermal Emission of Radiation, Radiation Principles (Plank's Law, Stephen Boltezman law), Interaction of EMR with the Earth Surface (Wien's displacement law, Kirchoffs Law)
- Spectral signature, Reflectance characteristics of Earths cover types, Remote sensing systems.

Unit - II

Platforms and sensors

Platforms, Remote sensing sensors, resolutions Across track and along the track scanning, Optical sensors,

- Thermal scanners
- Microwave sensing radar
- satellite missions
- Landsat series, SPOT series, IRS satellite series, IKNOS,

Unit-III Microwave Remote Sensing

- Airborne and Space borne radar systems basic instrumentation.
- System parameters - Wave length, Polarization, Resolutions, Radar geometry.
- Target parameters - Back scattering, Point target, Volume scattering, Penetration, Reflection, Bragg resonance, Cross swath variation. Speckie radiometric calibration.
- Radar - Grametry - Introduction, Mosaicing Stereoscope.
- Application : Geology, Forestry, Land use, Soils etc. Future trends and Research

Unit-IV Thermal Imaging system

- Thermal Imaging System: Introduction - IR region of the Electromagnetic spectrum, Atmospheric transmission, Kinetic and radiant temperature, Thermal properties of materials, Emissivity, Radiant temperature. Thermal conductivity. Thermal capacity, thermal inertia, Apparent thermal inertia, Thermal diffusivity.
- IR - radiometers, Airborne and Satellite TTR scanner system
- Characteristics of IR images
  i) Scanner distortion, ii) image irregularities, iii) Film density and recorded iv)Temperature ranges
- Effects of weather on images
  i) Clouds, ii) Surface winds, iii) Penetration of smoke plumes
- Interpretation of thermal imagery
- Advantages of Thermal imagery

Unit-V

- Meteorological satellites
- Meteorological satellite characteristics and their orbits, TIROS, NIMBUS, NOAA, TIROS N, SEASAT, GOES, METEOSAT, INSAT
- Measurement of Earth and Atmospheric energy and Radiation budget parameters from satellites

Text books

1. Imaging Radar for Resource Survey: Remote Sensing Applications, 3, W Travelt, Chapman & Hall
2. Remote Sensing: The quantitative approach, P.H. Swain and S.M. Davis, McGraw Hill
3. Floyd, F. Sabins, Jr: Remote Sensing Principles and Interpretation, Freeman and Co. San Franscisco, 1978
4. Applied Remote Sensing C.P.L.O., Longman Scientific and Technical Publishers.
5. Introduction to Environmental Remote Sensing, E.C. Barrett & L.F Curtis, Chapman and Hall, London
6. Fundamentals of remote sensing, George Joseph, Universities Press

ELECTIVE III

GLOBAL POSITIONING SYSTEM AND APPLICATIONS

Credits: 4

Subject Code : MTEI – 2.5(c) **Exam Marks :** 70

Semester-II **Sessionals :** 30

Common with M.Tech (R&M) Global Positioning System and Applications (MTRM-2.4)

Unit I

Overview of GPS :

Basic concept, system architecture, space segment, user segment, GPS aided Geo-augmented navigation (GAGAN) architecture.

Unit II

GPS Signals

Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

Unit III

GPS coordinate frames, Time references : Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS time.

Unit IV

GPS orbits and satellite position determination : GPS orbital parameters, description of receiver independent exchange format (RINEX) – Observation data and navigation message data parameters, GPS position determination.

Unit V

GPS Errors :

GPS error sources – clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver.

Textbook :

1. G S RAO, **Global Navigation Satellite Systems,** McGraw-Hill Publications, New Delhi, 2010

Reference Books :

1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, 'GPS – Theory and Practice', Springer – Wien, New York (2001).
2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).

ELECTIVE IV

NANOTECHNOLOGY AND APPLICATIONS

Credits: 4

Subject Code: MTEI – 2.6(a) **Exam Marks:** 70

Semester-II **Sessionals:** 30

Unit 1 : Introduction to Nanotechnology

Essence of Nanotechnology, Nano in daily life, Brief account of nano applications, Properties of nano materials, Metal nano clusters, Semiconductor nano particles.

Unit 2 : Nano Materials

Nano composites, Nanofying electronics, Sensing the environment, Mechanising the micro world, Energy and cleaner environment with nano technology.

Unit 3 : Carbon Nano Structures

Introduction, Carbon molecules, Carbon clusters, Carbon nanotubes, Applications of carbon nanotubes.

Unit 4 : Diagnosing Personal Health and Medical Applications

Lab on a chip, Super X-ray vision, Mapping the genes, Understanding how pharmaceutical company develops drugs, Delivering a new drug the Nanotech way, Cooking cancer with nano cells, Biomimetics.

Unit 5 : Biological Materials

Introduction, Biological building blocks, Nucleic acids, Biological nanostructures.

Textbooks

1. Nanotechnology by Richard Booker, Earl Boysen, Wiley Publishing Inc., 2006.
2. Introduction to Nanotechnology by Charles P. Poole Jr., Frank J. Owens, John Wiley & Sons Publications, 2003.

ELECTIVE IV

MICROCONTROLLERS AND EMBEDDED SYSTEMS

Credits: 4

Subject Code : MTEI – 2.6(b) **Exam Marks :** 70

Semester-II **Sessionals :** 30

Common with M.Tech (R&M) Microcontrollers and Embedded Systems(MTRM-2.6(b))

1. Introduction
   Embedded systems overview, Design challenge, Processor Technology, IC Technology, Design Technology, Trade-offs.
2. Custom single-purpose processors: Hardware
   Introduction, Combinational logic, Sequential logic, Custom single-purpose processor Design , RT-level custom single-purpose processor design, Optimizing custom single-purpose processors.
3. General purpose processors : Software
   Introduction, Basic Architecture, Operation, Programmer's view, Development environment, Application-Specific Instruction-set Processors, Selecting a Microprocessor.
4. Memory:
   Introduction, Memory types, Memory Hierarchy and cache, Advanced Memory Interfacing : Communication Basics, Memory Access, I/O addressing, Interrupts, DMA, Arbitration, Multilevel Architecture, Protocols.
5. Microcontrollers:
   Review 8051 Microcontroller Architecture & Programming.
   Peripherals:
   Timers, Counters and Watchdog Timers, UART, Pulse width Modulators, LCD controllers, Stepper Motor Controllers, Analog to Digital converters, Real-Time clocks.
6. An Exemplary Embedded Systems using Microcontrollers: Digital Camera Introduction, Specifications, Design.
7. State Machine and Concurrent process models:
   Introduction, Models Vs. Languages, Text Vs. Graphics:
   Textual Languages Vs. Graphical Languages, an Example, A Basic State Machine Model, FSM, FSM with Datapath Model: FSMD, Using State Machines, Concurrent Process Model, Communication among Processes.

Text Books:

1. Embedded System Design: A Unified Hardware/Software Introduction By Frank vahid / Tony Givargis
   John wiley & sons
2. The 8051 Microcontroller & Embedded Systems By
   Muhammad Ali Mazidi & Janice Gillispie Mazidi PHI

References:

1. Embedded Systems Architecture, Programming and Design By Raj Kamal TMH
2. Embedded Software Priner By Simon.
3. The 8051 Microcontroller: Architecture, Programming & Applications. By Kenneth J.Ayala Penram International. 2nd edn.

ELECTIVE IV

DIGITAL IMAGE PROCESSING

Credits : 4

Subject Code : MTEI – 2.6(c) **Exam Marks :** 70

Semester-II **Sessionals :** 30

Common with M.Tech (R&M), Digital Image Processing (MTRM-2.6(c))

1. Digital Image Fundamentals
   An image model – sampling & quantization – basic relation between pixels : imaging geomentry.

2. Image Transforms
   Properties of 2-D fourier transforms, FFT algorithm and other separable image transforms, Walsh transforms, Hadamard, Cosine, Haar, Slant Transforms, RL Transforms and their properties.

3. Image Enhancement & Restoration
   Spatial domain methods, Frequency domain methods, Histogram Modification technique, Neighbourhood averaging, Median filtering, Low pass filtering, Averaging of Multiple Images, Image sharpening by differenctiation, High pass Filtering, Degradation model for Continuous functions, Discrete Formulation, Diagonalization of Circulant and Block – Circulant Matrices, Effects of Diagonalization, Constrained and unconstrained Restorations Inverse filtering, Wiener Filter, Constrained least Square Restoration.

4. Image Encoding
   Objective an subjective Fidelity Criteria, the encoding process, the Mapping, the Quantizer and the Coder, Contour Encoding, Run length Encoding, Image Encoding relative to a Fidelity Criterion, Differential Pulse Code Modulation, Transform Encoding.

5. Image Compression
   Fundamentals, Image compression models, error free compression, lossy compression, image compression standards.

6. Image Segmentation
   The detection of Discontinuities, Point Line and Edge Detections, Gradient Operators, Combined Detection, Thresholding.

7. Image Representation
   Representation Schemes, Chain Codes, Polygon Approximation, Boundary Descriptors, Simple Descriptors, Shape Numbers, Fourier Descriptors.

8. Image Construction from Projections
   Radon Transforms, Convolution/filterback Projection.

Textbooks

1. Gonzalez RC & Woods RE, Digital Image Processing, Addison Wesley Publishing Company.
2. Jain AK, Fundamentals of Digital Image Processing, PHI
3. Rosefeld & Kak AC, Digital Picture Processing Academic Press Inc.

2nd SEMESTER MODEL QUESTION PAPERS

M.Tech. (Electronics Instrumentation)

2nd Semester

ELECTRONIC INSTRUMENTATION TECHNIQUES

Subject Code : MTEI-2.1 **Max. Marks : 70**

Answer any Five Questions

All Questions Carry Equal Marks

1. (a) Explain the operation of a frequency synthesizer with the help of a functional block diagram.
   (b) Explain the principle of digital voltmeter with the help of a block schematic diagram. Explain the difference between a 4-digital and 3 ½ digit DVM.

2. (a) Draw the block diagram of a Q-meter and explain its operation. Show different arrangements in the circuit for (i) small impedances and (ii) large impedances.
   (b) A coil was tested using Q-meter and the following readings were obtained. At a frequency of 3 MHz, the value of capacitance to give a maximum voltage across the variable capacitor was 251 pF while at 6 MHz frequency it was 50 pF. Calculate the self-capacitance of the coil.

3. (a) With the help of a block diagram, explain the operation of a function generator. In what way does it differ from a signal generator?
   (b) Explain the need for frequency synthesizer. Explain with the help of a functional block diagram any type of frequency synthesizer.

4. (a) How do you differentiate between a spectrum analyzer, wave analyzer and a distortion analyzer.
   (b) Give the block diagram of a logic state analyzer and explain its operation. State its applications.

5. (a) With the help of a neat circuit diagram, explain the operation of a time base generator. Describe the various weep modes.
   (b) Write briefly about interference, shielding and grounding.

6. (a) Explain the principle of operation of magnetic tape recorder with special emphasis an recording head, reproducing head and tape transport mechanism.
   (b) Explain the principle of UV recorder.

7. (a) What are LEDs and LCDs? Explain in detail.
   (b) Write briefly about various displays.

8. Write short notes on the following.
   (a) Sampling oscilloscope
   (b) Lock-in-amplifier
   (c) Computer based automated test instruments.

Model Question Paper

M.Tech. (Electronics Instrumentation)

2nd Semester

DATA ACQUISITION SYSTEM

Subject Code : MTEI-2.2 **Max. Marks : 70**

Answer any Five Questions

All Questions Carry Equal Marks

1. a) Draw the circuit diagram of a weighted resistor network D/A converter for a digital word 1100 and explain its operation.
   b) With the help of block schematic diagrams, suggest the data acquisition systems for the following and justify.
      i) Signals of strength < 1 mV

ii) Signals of strength > 100 mV

2. a) Discuss the various DAS configurations presently in use. Compare the performance and limitations of each.

   b) Compare the performance of parallel DACs to serial DACs.

3. a) Explain the significance of different binary codes used in A to D and D to A converters.

   b) Write all the important specifications of D to A converter and explain DACs role in the construction of A to D converters?

4. a) What are the advantages of dual-slope ADC over single-slope ADC?

   b) The sampling rate of a sampled analog signal presented to the input of a successive approximation ADC is 5KHz. The flip-flops in the converter have a maximum guaranteed toggling rate of 2 MHz. What is the best possible resolution of the converter?

5. Bring out the different factors that see a limit on the accuracy of an ADC. Explain how static accuracy analysis is carried out for an ADC, with the help of error budget estimates. Illustrate your answer with an example.

6. a) Counter ramp A/D converters can be easily designed for high accuracy. Discuss/

   b) A 10-bit binary data is available in parallel form with binary '0' corresponding to 0V and binary 1 as 5 V. Design a suitable D/A converter. Assume any other data that may be required in the design. Draw the complete circuit diagram.

7. a) Give reasons for the following:

      i) The dual slope A/D converter can be designed so that it is unaffected by hum and noise related to power – supply frequency.

      ii) Digital display of measurement data is unsuitable if the data undergo small variations continuously.

   b) State the advantages of monolithic ADCs and DACs.

8. Write short notes on the following:

   a) Inverted ladder type DAC
   b) Logarithmic ADC
   c) Voltage to frequency conversion type ADC.

Model Question Paper
M.Tech. (Electronics Instrumentation)
2nd Semester

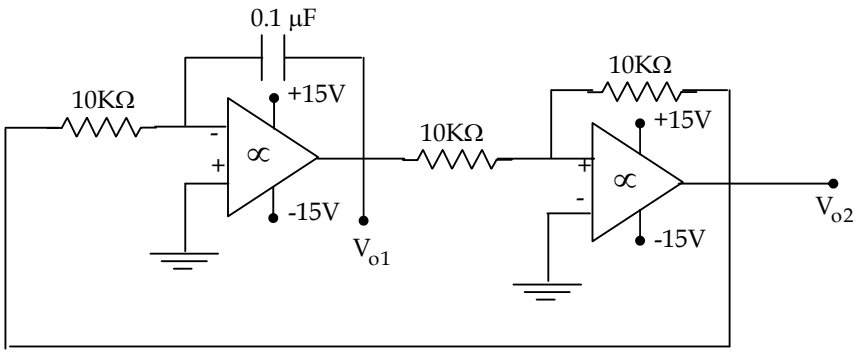
LINEAR AND DIGITAL SYSTEMS DESIGN

Subject Code : MTEI-2.3 **Max. Marks : 70**

Answer any Five Questions
All Questions Carry Equal Marks

1. (a) Distinguish between balancing and compensating of an operational amplifier. Explain the universal balancing circuit with neat circuit diagram. Explain also dominant pole frequency compensating technique with neat circuit diagram and frequency response characteristics?

   (b) For the circuit shown in figure, sketch the waveforms seen at V_{01} and V_{02}. Assume output saturation voltages of operational amplifiers are ± 15V.



2. (a) Design a Schmitt trigger circuit using an operational amplifier to set UTP = 4V and LTP = -2V. Use supply voltages of ± 15V. Explain its operation with the help of its transfer characteristics.

   (b) Design an astable multivibrator using 555 timer to get an output wave at 10 kHz square waveform with 30% duty cycle. Show the circuit diagram with all component values and explain its operation with waveforms. Discuss the limitations on the choice of passive components in your design.

3. (a) Explain the principle of operation of phase locked loop (PLL). Design PLL circuit using 565 IC to get (i) free running frequency = 4.5 kHz, (ii) lock range = 2 kHz, (iii) capture range = 100 Hz, (iv) power supply voltages = ± 10V. Explain its operation justifying your design.

   (b) Design a voltage regulator circuit using μA 723 IC to get an output voltage of 10V and load current of 1.0Amp. Give the specifications of the series pass transistor used.

4. (a) Draw the circuit diagram of a precision rectifier using operational amplifier and explain its operation with waveforms. Determine its sensitivity. Compare its band width with that of a passive rectifier.

   (b) Draw the schematic diagram of a transconductance type four quadrant analog multiplier and explain its operation. Explain with neat block schematic diagrams its application as (i) squaring and square rooting, (ii) balanced modulator and (iii) phase sensitive detector.

5. (a) What is a priority encoder? Realize a 4 to 2 line priority encoder using minimum number of NAND gates.

   (b) Giving the necessary Boolean expressions, develop the block schematic diagram of a 4-bit carry look-ahead adder.

(c) Show the functional block diagram of a BCD adder and explain its operation with examples.

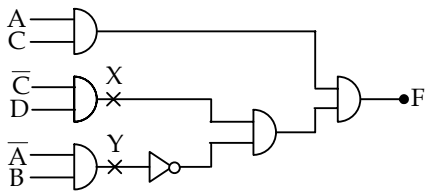
6. (a) Design a synchronous counter using JK flip-flop with the following binary sequence
101 – 110 – 111 – 011 – 001 – 100 – 010 – 101

(b) Obtain the complete structure of ROM for BCD to seven-segment display decoder application. The outputs of the ROM should control the display device.

7. (a) Design and realize a PLA circuit with four inputs X_1, X_2, X_3 and X_4 and seven outputs p_1, p_2, m_1, m_2, m_3, m_4 and m_5 that receives BCD code words and generates the corresponding Hamming code words.

(b) Design a six state R-Y-B phase sequence detector using ASM charts. Inputs are R, Y and B. If the sequence is R-Y-B output $Z_1 = 1$ and $Z_2 = 0$ and if the sequence is R-B-Y then the output $Z_1 = 0$ and $Z_2 = 1$. Assume suitable data.

8. (a) Construct a fault detection experiment to detect the following faults in the circuit shown below. (i) S-a-0 at X, (ii) S-a-1 at X, (iii) S-a-0 at Y and (iv) S-a-1 at Y.



(b) Using "Quadded logic" desing a single fault tolerant circuit to realize the function F(AB) = A′B′ + AB.

Model Question Paper
M.Tech. (Electronics Instrumentation)
2nd Semester
BIO-MEDICAL INSTRUMENTATION

Subject Code : MTEI-2.4 **Max. Marks : 70**

Note : Answer any Five Questions

1.	(a)	What are the resting and action potentials and explain in detail.	(7)
	(b)	Describe ECG and EEG waveforms.	(7)
2.	(a)	What are the different types of Bio-electrodes and describe at least two of them.	(7)
	(b)	Describe bio-chemical transducer in detail.	(7)
3.	(a)	Describe the function of the heart with a neat diagram.	(7)
	(b)	What is blood pressure and how do you measure it.	(7)
4.	(a)	Draw ECG set-up and explain measurement mechanism.	(7)
	(b)	Describe plethysmography and measurement of heart sounds in detail.	(7)
5.	(a)	Explain patient-monitoring displays in detail.	(7)
	(b)	Point out ICU equipment and describe them in briefly.	(7)
6.	(a)	Describe two types of defibrillators.	(7)
	(b)	Draw the block diagram of bio-telemetry transmitter and receiver and explain.	(7)
7.	(a)	Describe instrumentation for diagnostic x-rays.	(7)
	(b)	What are radiation therapy and explain in detail.	(7)
8.		Write short notes on	(14)
	(a)	Heart pacemakers	
	(b)	Bio-materials	
	(c)	Measurement of blood flow	

Model Question Paper
M.Tech. (Electronics Instrumentation)
2nd Semester

Elective III : GPS AND APPLICATIONS

Subject Code : MTEI-2.5(c) & MTRM-2.4 **Max. Marks : 70**

(Common with M.Tech(Radar and Microwave Engineering))

Answer any Five Questions

1. (a) Describe the GPS Seattleite constellation with a neat diagram. (7)
   (b) How GPS aided Geo-augmented navigation (GAGAN) improves the GPS signal performance. (7)

2. Explain with a neat block diagram, the signal structure of L1 and L2 frequencies with the corresponding C/A, P- code and Navigation message (14)

3. (a) What are the important satellite orbital parameters that are used in the Satellite position computation in ECEF coordinate system (8)
   (b) What is WGS 84 system and how it is related to the GPS position computation (6)

4. (a) What is RINEX format (6)
   (b) Describe the Navigation message and Observation data files (8)

5. What are errors that are limiting the GPS system performance (7)
   (b) Describe ionospheric error with its contribution to the pseudorange estimation (7)

6. Explain with the relevant Equations, how the ionospheric error is eliminated in a two frequency GPS receiver (14)

7. (a) What is the difference between the Geo centric and Geodetic coordinate systems? (7)
   (b) Compare the GALILEO signal structure with the GPS signal structure (7)

8. Write any two of the following (14)
   (a) GPS time (b) Antispoofing (c) Selective Availability

Model Question Paper
M.Tech. (Electronics Instrumentation)
2nd Semester

Elective IV : MICROCONTROLLERS AND EMBEDDED SYSTEMS

Subject Code : MTEI-2.6(b) & MTRM-2.6(b) **Max. Marks : 70**

(Common with M.Tech (Radar and Microwave Engineering))

Answer any Five Questions

1. (a) List and define the three main characteristics of embedded systems that distinguish such systems from other computing system. (2)

   (b) List and define the three IC technologies. What are the benefit of using each of the three different IC technologies. (4)

   (c) What is a Single-Purpose Processor? Design a custom Single-Purpose Processor? Explain with an example. (8)

2. (a) Explain the software development process of an embedded system. (7)

   (b) Enumerate the similarities and differences between a Microcontroller and Digital Signal Processor. (7)

3. (a) Given a 100MHz Crystal-Controlled Oscillator and a 32-bit and any number of 16-bit terminal counters. Design a relative clock that outputs the date and time down to milliseconds. You can ignore leap years. Draw a diagram and indicate terminal-count values for all counters. (9)

   (b) A watchdog timer uses two cascaded 16-bit up-counters is connected to an 11.981MHz oscillator . A time out should occur if the function watchdog-reset is not called within 5 minutes. What value should be loaded into the up-counter pair when the function is called. (5)

4. (a) Explain the cache impact on system performance with an example. (7)

   (b) Given the following three cache designs, find the one with best performance by calculating the average cost of access. Show all calculations.

      i. 4 Kbyte, 8-way set-associative cache with a 6% miss rate cache hit costs one cycle, cache miss cost 12 cycles.

      ii. 8 Kbyte, 4-way set-associative cache with a 4% miss rate cache hit costs two cycle, cache miss cost 12 cycles.

      iii. 16 Kbyte, 2-way set-associative cache with a 2% miss rate cache hit costs three cycle, cache miss cost 12 cycles. (7)

5. (a) Draw the timing diagram for a bus protocol that is handshaked non-addressed and transfers 8-bits of data over a 4-bit data bus. (7)

   (b) Explain the benefits an interrupt address table over fixed and vector interrupt methods. (7)

6. List the modifications made in Implementation: 2 (Microcontroller and CCDPP) and Implementation: 3 Microcontroller and CCDPP/ Fixed –Point DCT and discuss why each was beneficial in terms of performance. (14)

7. (a) Define the following terms: (7)

   (i) Finite-state machines concurrent processor,

   (ii) Real-time systems, and

   (iii) Real-time operating systems.

   (b) List three requirements of real-time systems and briefly describe each. Give examples of actual Real-time systems to support your arguments. (7)

8. Write notes on the following.

   (a) Common Memory Types. (7)

   (b) Stepper Motor Controllers. (7)