M.Tech (R&M), B.Tech+M.Tech(5/6 and 6/6), Two Year (Four Semesters)

Scheme to be valid with effect from the admitted batch of 2019 – 2020

I SEMESTER

Subject Code	Name of the Subject	Periods/Week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTRM-1.1	Digital Signal processing	3	-	70	30	100	3
MTRM-1.2	Microwave components and networks	3	-	70	30	100	3
MTRM-1.3	Elective – I Optical fiber and Communications/ Nano Technologies and Applications/ Modern RADAR Systems	3	-	70	30	100	3
MTRM-1.4	Elective – II EMI/EMC / Artificial intelligence and neural networks/Microprocessor Systems	3	-	70	30	100	3
MTRM-1.5	Research Methodology & IPR	3	-	70	30	100	2
MTRM-1.6	Audit Course	3	-	70	30	100	0
MTRM-1.7	Antenna LAB-I	-	3	-	100	100	2
MTRM-1.8	Signal Processing LAB	-	3	-	100	100	2
	Total	18	06	420	380	800	18

II SEMESTER

Subject Code	Name of the Subject	Periods/Week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTRM-2.1	RF and Microwave Engineering	3	-	70	30	100	3
MTRM-2.2	GPS and Applications	3	-	70	30	100	3
MTRM-2.3	Elective – III Cellular and Mobile Communications/ Stealth technologies/ Application Specific Integrated Circuits (ASIC)	3	-	70	30	100	3
MTRM-2.4	Elective – IV Micro controllers and Embedded Systems/Digital Image Processing/ Wireless communications and networks	3	-	70	30	100	3
MTRM-2.5	Audit Course	3	-	70	30	100	0
MTRM-2.6	Antenna LAB-II		3	-	100	100	2
MTRM-2.7	Microwave Engineering LAB	-	3	-	100	100	2
MTRM-2.8	Mini Project With Seminar	-	3	-	100	100	2
	Total	15	9	350	450	800	18

III SEMESTER

Subject Code	Name of the Subject	Periods/Week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTRM-3.1	Elective – V Phased Array Radar/ DSP processor and Architecture/ Remote Sensing and Sensors	3	-	70	30	100	3
MTRM-3.2	Open Elective Computer and Communications Networks /Business Analytics/Industrial Safety/ Operational Research/Cost Management of Engineering Projects	3	-	70	30	100	3
MTRM-3.3	Dissertation- I / Industrial Project	-	-	-	100	100	10
	Total	6	-	140	160	300	16

IV SEMESTER

Subject Code	Name of the Subject	Periods/Week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTRM-4.1	Dissertation- II	-	-	70	30	100	16
	Total	-	-	70	30	100	16

Note:

1. **At the end of 3rd semester 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 the thesis Guide of their respective colleges.**
2. **At the end of the 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.**

Audit Course 1 & 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

DIGITAL SIGNAL PROCESSING

Credits: 3

Subject Code: MTRM – 1.1 **Max. Marks:** 70

Semester-I **Sessionals:** 30

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

Text 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

MICROWAVE COMPONENTS AND NETWORKS

Credits: 3

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

Semester-I **Sessionals:** 30

1. Introduction to microwaves and applications, advantages of microwaves, EM spectrum domain, electric and magnetic fields static electric and magnetic fields, time varying electric and magnetic fields, electromagnetic field equations, Maxwell's equations for time-varying fields, meaning of Maxwell's equations, characteristics of free space, power flow by microwaves, expression for propagation constant of a microwave in conductive medium, microwave applications, relation between dB, dBm, dBw.
2. Microwave Tubes

Limitation of conventional tubes, microwave tubes, velocity modulation, method of producing the velocity modulation, principle of operation of two cavity klystron, reflex klystron principle of operation, velocity modulation in reflex klystron, applegate diagram with gap voltage for a reflex klystron. Principle of operation of magnetron, hull cutoff condition, advantages of slow wave devices, principle of operation of TWT.

3. Microwave Semiconductor Devices

Microwave bipolar transistor, FET, Principle of Operation and application of tunnel diode, Principle of operation of gunn diode, application of gunn diode advantages of gunn diode, principle of operation of PIN diode, applications of PIN diode.

4. Scattering Matrix Parameters of microwave networks

Definition of scattering matrix, characteristics of S-matrix, scattering matrix of a two-port network, salient features of S-matrix, salient features of multiport network, losses in microwave circuits, return loss, insertion loss, transmission loss, reflection loss, impedance matrix, short circuit admittance parameters of a -network, S-matrix of series element in the transmission line, S-matrix for E-plane Tee junction, S-matrix for H-plane Tee junctions, S-matrix for directional coupler.

5. Microwave Passive components

Rrectangular waveguides resonator isolator, types of attenuators, fixed attenuators, step attenuators, variable attenuators, salient features of directional coupler, parameters of directional coupler, coupling factor, directivity, applications of directional coupler.

6. Microwave Integrated Circuits

Salient features of MICs, types of electronic circuits, monolithic microwave integrated circuits (MMICs), film integrated circuit, advantages of MMICs, Basic materials used in MMIC fabrication, examples, characteristics and properties of substrate, conductor, dielectric and resistive materials, MMIC fabrication techniques, diffusion and ion implantation, oxidation and film deposition, epitaxial growth, lithography, etching and photo resist, deposition methods, steps involved in the fabrication of MOSFET

7. Microwave measurements

Measurement of VSWR, attenuation and frequency.

Textbooks

1. "Microwave and Radar Engineering" by Gottapu Sasi Bhushana Rao, ISBN – 978813179944 Pearson Education, 2013.
2. "Microwave Engineering" by Prof. GSN Raju, IK International Publishers, 2007

References Books

1. "Microwave Engineering" by P.A. Rizzi, PHI, 1999.
2. "Microwave Engineering : Non-reciprocal active and passive circuits" by Joseph Helszajin, McGraw Hill, 1992.

ELECTIVE I

OPTICAL FIBERS AND APPLICATIONS

Credits : 3

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

Semester-I **Sessionals :** 30

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

NANOTECHNOLOGY AND APPLICATIONS

Credits : 3

Subject Code : MTRM – 1.3 **Exam Marks :** 70

Semester-I **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 I

MODERN RADAR SYSTEMS

Credits : 3

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

Semester-I **Sessionals :** 30

Fundamentals of Surveillance Radar and Design :

Bandwidth considerations, prf, Unambiguious range and velocity, Pulse length and Sampling, Radar Cross-section and Clutter.

Tracking Radar :

Tracking and Search Radars, Antenna beam shapes required, Radar guidance, Frequency agility, Importance of Monopulse Radar.

Radar waveform design :

Bandwidth and pulse duration requirements, Range and Doppler accuracy uncertainty relation, pulse compression and phase coding.

Principles of Secondary Surveillance Radar :

Radar studies of the atmosphere, OHR and Radar jamming, EC, ECC measures and stealth applications.

Text Books :

1. "Microwave and Radar Engineering" by Gottapu Sasi Bhushana Rao, ISBN – 978813179944 Pearson Education 2013.

2. “Understanding of Radar Systems”, Simon Kingsley and Shaun Quegan, McGraw Hill, 1993.

3. Radar Handbook by Skolnik.

ELECTIVE –II

EMI / EMC

Credits : 3

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

Semester-I **Sessionals :** 30

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: 3

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

Semester-I **Sessionals:** 30

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 Book:

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 199

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

MICROPROCESSOR SYSTEMS

Credits : 3

Subject Code : MTRM –1. 4 **Max. Marks :** 70

Semester-I **Sessionals :** 30

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, McGraw 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.

RESEARCHMETHODOLOGY AND IPR

Credits: 2

Subject Code: MTRM – 1.5 **Exam Marks:** 70

Semester-I **Sessional:** 30

AUDIT COURSE

Credits: 0

Subject Code: MTRM – 1.6 **Exam Marks:** 70

Semester-I **Sessional:** 30

ANTENNA LAB-I

Credits: 2

Subject Code: MTRM – 1.7 **Exam Marks:** 70

Sessional: 30

SIGNAL PROCESSING LAB

Credits: 2

Subject Code: MTRM – 1.8 **Exam Marks: 100**

Semester-I

RF AND MICROWAVE ENGINEERING

Credits : 3

Subject Code : MTRM – 2.1 **Max. Marks :** 70

Semester-II **Sessionals :** 30

Chapter 1 : Introduction to RF and Microwave concepts and applications

Introduction, Reasons for using RF/Microwaves, RF/Microwave applications, Radio frequency waves, RF and Microwave circuit design, The unchanging fundamentals versus the ever-evolving structure, General active circuit block diagrams.

Chapter 2 : RF Electronics Concepts

Introduction, RF/Microwaves versus DC or low AC signals, EM spectrum, Wave length and frequency, Introduction to component basics, Resonant circuits, Analysis of a simple circuit in phasor domain, Impedance transformers, RF impedance matching, Three element matching.

Chapter 3 : Smith Chart and its Applications

Introduction, A valuable graphical aid the smith chart, Derivation of smith chart, Description of two types of smith charts, Smith charts circular scales, Smith charts radial scales, The normalized impedance-admittance (ZY) smith chart introduction, Applications of the smith chart, Distributed circuit applications, Lumped element circuit applications.

Chapter 4 : RF and Microwave Amplifiers Small and Large Signal Design

Introduction, Types of amplifiers, Small signal amplifiers, Design of different types of amplifiers, Multistage small signal amplifier design.

Introduction, High-power amplifiers, Large signal amplifier design, Microwave power combining/dividing techniques, Signal distortion due to inter modulation products, Multistage amplifiers, Large signal design

Chapter 5 : Radio Frequency and Microwave Oscillator Design

Introduction, Oscillator versus amplifier design, Oscillation conditions, Design of transistor oscillators, Generator-tuning networks.

Text Book :

1. “Radio Frequency and Microwave Electronics”, by Mathew M. Radmanesh, Person Education Inc., New Delhi

Reference

1. “Microwave Engineering, Active and Non-reciprocal Circuits”, by Joseph Helszain, McGraw Hill International Edition, 1992

GLOBAL POSITIONING SYSTEM AND APPLICATIONS

Credits : 3

Subject Code : MTRM – 2.2 **Max. Marks :** 70

Semester-II **Sessionals :** 30

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.

Textbooks :

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-III
CELLULAR AND MOBILE COMMUNICATIONS

Credits : 3

Subject Code : MTRM – 2.3 **Max. Marks :** 70
Semester-II **Sessionals :** 30

Unit-1: Introduction to wireless communications , examples of wireless communication system , the Cellular concept and system design fundamentals, Frequency reuse, Channel assignment strategies, Handoff strategies , Interference and system capacity , Trunk and grade services , Methods for improving coverage and capacity in cellular system.

Unit-2: Multiple access techniques for wireless communications FDMA , TDMA, Spread spectrum techniques , SDMA , Packet Radio , CSMA , Capacity of cellular CDMA with multiple cells and capacity of SDMA.

Unit-3: Wireless systems and standards , AMPS , IS-94, GSM traffic, Examples of GSM cell , Frame structure of GSM cell, details of forward and reverse CDMA channels.

Unit-4: Personal access communication systems , Personal Mobile satellite communications , Integrating GEO, LEO, MEO Satellite and terrestrial mobile systems , Rake receiver and Advanced Rake receiver,

Unit-5: Mobile Radio propagation , Large scale path loss , Reflection , Diffraction , Scattering , Outdoor and Indoor propagation models , Small signal fading and multi path , measurement of small scale path loss , parameters of multi path channels , fading due to multi path , fading effect due to Doppler spread , small scale fading models , equalization , Diversity .

Text Book :

1. Mobile Cellular Communication by Gottapu Sasibhushana Rao, PEARSONInternational, 2012.

Recommended Books:

1. Wireless Communications Principles and Practice , Second Edition , THEODORE S.REPPAPORT .
2. Wireless Digital Communications , DR. KAMILO FEHER .
3. Electronic Communication system , WAYNE TOMASI.
4. Wireless Communications , SANJY SHARMA.

ELECTIVE-III
STEALTH TECHNOLOGIES

Credits : 4

Subject Code : MTRM – 2.3 **Max. Marks :** 70

Semester-II **Sessionals :** 30

Unit 1 : Introduction to Stealth Systems

Introduction, Introduction to low probability of intercept systems, A little history of stealth systems, Basic LPI equations, Introduction to radar cross-section, Introduction to signature balance

Unit 2 : Interceptability Parameters and Analysis

Interceptability parameters, Interceptability analysis, Example mode interceptability, Footprint calculation

Unit 3 : Stealth Waveforms

Waveform criteria, Frequency diversity, Power management, Pulse compression, Discrete phase codes, Hybrid waveforms, Noise propagation in pulse compressors

Unit 4 : Stealth Antennas and Radomes

Introduction, Antenna parameters, Single radiators, Antenna arrays, Electronically scanned arrays, Antenna scattering, Low RCS radomes

Unit 5 : Signal Processing for Stealth

Introduction to stealth signal processing, Air target search, acquisition, track, Terrain following/terrain avoidance, Doppler beam sharpening, Synthetic aperture radar (SAR) mapping, Ground MTI and MTT

Textbook

Introduction to RF Stealth by David Lynch, Jr., Scitech Publishing Inc., 2003., www.scitechpub.com

ELECTIVE-III

APPLICATION SPECIFIC INTEGRATED CIRCUITS (ASIC)

Credits: 3

Subject Code: MTRM – 2.3 **Max. Marks:** 70

Semester-II **Sessionals:** 30

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.

Textbooks

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., 997.
8. Application specific integrated circuits, J.S. Smith, Addison Wesley, 1997.

ELECTIVE-IV
MICRO CONTROLLERS AND EMBEDDED SYSTEMS

Credits: 3

Subject Code: MTRM – 2.4 **Exam Marks:** 70
Semester-II **Sessionals:** 30

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 ByFrank vahid / Tony Givargis John wiley & sons
2. The 8051 Microcontroller & Embedded Systems ByMuhammad 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 .Ayala Penram International. 2nd edn.

ELECTIVE-IV
DIGITAL IMAGE PROCESSING

Credits : 3

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

Semester-II **Sessionals :** 30

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.

ELECTIVE-IV

WIRELESS COMMUNICATIONS AND NETWORKS

Credits : 3

Subject Code : MTRM – 2.4 **Max. Marks :** 70
Semester-II **Sessionals :** 30

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

AUDIT COURSE

Credits: 0

Subject Code: MTRM – 2.5 **Exam Marks:** 70

Semester-II **Sessional:** 30

ANTENNA LAB-II

Credits:2

Subject Code: MTRM– 2.6 **Exam Marks:10**0

Semester-II

MICROWAVE ENGINEERING LAB

Credits:2

Subject Code: MTRM – 2.7 **Exam Marks:10**0

Semester-II

ELECTIVE-V
PHASED ARRAY RADARS

Credits : 3

Subject Code : MTRM – 3.1 **Max. Marks :** 70

Semester-III **Sessionals :** 30

Phased Arrays in Radar and Communication Systems :

System requirements for radar and communication antennas, Array characterization for radar and communication systems, Fundamental results from array theory, Array size determination, Time-delay compression.

Pattern characteristics of Linear and Planar Arrays :

Array analysis, characteristics of linear and planer arrays, Scanning to end- fire, Thinned arrays

Pattern Synthesis for Linear and Planar Arrays :

Linear arrays and planar arrays with separable distributions, circular planar arrays and adaptive arrays.

Electronic Scanning Radar Systems :

Frequency and phase scanning, Phase design techniques.

Text Books :

1. Phased Array Antenna Hand Book – Robert J. Mailloux, Artech House, Boston, London, 1994.

2. Radar Engineering Hand Book – Skolnic, McGraw Hill, 1970

Reference Book:

1. Electronic Scanning Radar Systems Design Hand Book – Peter J. Kahrilas, Artech House, 1976.

ELECTIVE-V
DSP PROCESSORS AND ARCHITECTURES

Credits: 3

Subject Code: MTRM –3.1 **Max. Marks:** 70
Semester-III **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-V
REMOTE SENSING AND SENSORS

Credits : 3

Subject Code : MTRM – 3.1 **Max. Marks :** 70

Semester-III **Sessionals :** 30

Unit-I Basics of Remote Sensing

a) 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

Meteoros Meteorological satellite characteristics and their orbits, TIROS, NIMBUS, NOAA, logical TIROS N, SEASAT, GOES, METEOSAT, INSAT Measurement of Earth and satellite 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

OPEN ELECTIVE
COMPUTER AND COMMUNICATION NETWORKS

Credits : 3

Subject Code : MTRM – 3.2 **Max. Marks :** 70

Semester-III **Sessionals :** 30

1. Introduction to Computer Networks, OSI Reference Model: A Layered Approach,Intro toTCP/IP Protocol Suite.
2. Transmission Media and Digital Signaling, Analog vs. Digital Transmission, Nyquist And Shannon Limits, Digital or Analog Data to Digital Signals.
3. Wireless Communication, Advances in cellular, personal communications systems (PCS), global system for mobile communications (GSM), wireless LANs - applications, satellites, and fixed wireless networks.
4. Error Detection and CRC Polynomial Codes. Data Link Control, Stop & Wait, SlidingWindow ARQ, Go-back-N, Selective Reject.
5. Data Link Layer Protocols and Multiplexing, HDLC, LAP-B, ARPANET DLC, Frequency and Time Division Multiplexing.
6. Circuit Switching and Packet Switching, Digital Switching Concepts, Packet Switching Principles, Virtual Circuits and Datagrams, X.25, Frame and Cell Relay, ATM.

Text Book:

1. William Stallings, “Wireless Communications and Networks”, Prentice Hall, 2004
2. Stallings, William Data and Computer Communications, 8th Edition PrenticeHall, 2007,

Reference Books:

1. T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, PrenticeHall, 2002.
2. J R. Prasad, W. Mohr, and W. Konhauser (Editors), "Third Generation Mobile Communication Systems", Artech House Publishers, 2000.
3. W.C.Y. Lee, "Mobile Communication Engineering, Theory and Applications", Second Edition, McGraw-Hill, 1998.