Department of Electronics & Communication Engineering

School of Engineering & Technology

Mizoram University

(A Central University)

Aizawl- 796 004, Mizoram

COURSE STRUCTURE & SYLLABUS
FOR
MASTER OF TECHNOLOGY (M.TECH.)
PROGRAMME
IN
ELECTRONICS AND COMMUNICATION ENGINEERING

(2016)

BRANCH : ECE   Year : I   Semester :I

Sl No	Code No	Title	L	T	P	Credit	Marks
1	ECM-101	Microwave Communication System	3	1	0	4	100
2	ECM-102	MOS Modeling Techniques	3	1	0	4	100
3	ECM-103	Advanced Communication System	3	1	0	4	100
4	ECM-104	High Speed Solid State Electronics Device	3	1	0	4	100
5	ECM-105	Advanced Antenna Theory and Propagation Techniques	3	1	0	4	100
6	ECM-191	Laboratory I	0	0	3	2	100
		Total	**15**	**5**	**3**	**22**	**600**

L = Lecture, T= Tutorial, P = Practical   Total Marks = 600
Total contact hours = 15+5+3= 23 hrs per week   Total Credits = 22

BRANCH : ECE Year : I Semester : II

Sl No	Code No	Title	L	T	P	Credit	Marks
1	ECM-201	Advanced VLSI Design	3	1	0	4	100
2	ECM-202	Advanced Digital Signal Processing	3	1	0	4	100
3	ECM-203	MEMS and Nanoelectronic Devices	3	1	0	4	100
4	ECM-2XX	Elective-I	3	1	0	4	100
5	ECM-2XX	Elective-II	3	1	0	4	100
6	ECM-291	Laboratory-II	0	0	3	2	100
		Total	**15**	**5**	**3**	**22**	**600**

Total contact hours = 15+5+3= 23 hrs per week Total Credits = 22

XX => 04 to 15”
Electives (any two approved by the Department):

Code No.	Subjects
ECM-04	Optical Communication and Photonics
ECM-05	Satellite Communication
ECM-06	Image Processing and Pattern Recognition
ECM-07	Principles of Electromagnetic Compatibility
ECM-08	Advanced Microprocessor and Microcontroller
ECM-09	Advanced Information Theory and Coding Techniques
ECM-10	Microstrip Antenna Technology
ECM-11	Multimedia Communication
ECM-12	MOS AC Analysis
ECM-13	Embedded System
ECM-14	Low Power VLSI Design
ECM-15	Mobile Communication and Computing

BRANCH : ECE   Year : II   Semester : III

Sl No	Code No	Title	L	T	P	Credit	Marks
1	ECM-391	Major Project (Phase-I)	0	0	20	20	500
2	ECM-301	Seminar	0	0	3	2	100
		Total			**23**	**22**	**600**

Total contact hours = 23 hrs per week   Total Credits = 22

BRANCH : ECE   Year : IISemester : IV

Sl No	Code No	Title	L	T	P	Credit	Marks
1	ECM-491	Major Project(Phase-II)	0	0	22	22	600
		Total			**22**	**22**	**600**

Total contact hours = 22hrs per week   Total Credits = 22

Total Credits (Course): 22+22+22+22= 88

Total Marks (Course): 600+600+600+600=2400

Microwave Communication System: ECM-101

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Overview of microwave and millimeter wave vacuum tube devices, limitations of microwave vacuum tubes, gyratron vacuum tube devices, Advances in microwave and millimeter wave solid state devices, Gunn devices, oscillator using Gunn diode, and injection locked oscillators, IMPATT devices, and microwave and mm wave performance of IMPATT, Other solid state devices like Tunnel diode, BARITT and TRAPAT. 11L

Unit-II:
Review of scattering matrix, impedance matching network, Tee junction analysis in the light of scattering matrix ,couplers, power dividers, circulators, phase shifters, attenuators, sliding screw tuners, Detectors, mixers, attenuators, Cavity resonators and iris coupling, filters and Ferrite based circuits. 13L

Unit-III:
Microwave and mm wave propagation: Overview of basic radio wave propagation mechanisms, Friis transmission formula, plane earth propagation model, tropo-scatter systems, ionosphere propagation, duct propagation, microwave radio link and calculation of link budget, Effect on radio wave propagation due to rain, fog, snow, ice, atmospheric gases, Earth's magnetic field.
11L

Unit-IV:
satellite communication using Microwave: Evolution of communication satellites, satellite transponder and other subsystems, satellite link design, system noise temperature, G/T ratio, downlink design , spectrum allocation and bandwidth consideration, Multiple access techniques –FDMA, TDMA, VSAT, Earth station technology. 5L

Unit-V:
RADAR: Introduction to basic radar system, radar equation, detection of signal in noise, receiver noise & SNR, Probability of detection & false alarm, Radar cross-section of target & its fluctuation, MTI & Doppler radar, Tracking radar, Radar clutter. 8L

Text Book:

1. S.Y Liao , Microwave Devices & Circuits, Pearson Education, 3rd Ed, 2003
2. K C Gupta, Microwaves, New Age Publishers, 2005
3. M. MITRA : Satellite communications , Prentice Hall of India, 2005
4. M. I. Skolnik : Introduction to radar systems , TMH, 3rd Ed, 2008

References:

1. David M Pozar, Microwave Engineering, John Wiley & Sons, 4th Ed, 2012
2. R E Collin, Antenna & Radio wave Propagation, McGraw Hill Book Co, 1985.
3. R E Collin, Foundations for Microwave Engineering, 2ndEd,Wiley-IEEE Press, 2001.

MOS Modeling Technique: ECM-102

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I: Semiconductors and Junctions
Introduction, Intrinsic and Extrinsic Semiconductors, equilibrium and non-equilibrium conditions, Charge Density, Transit time, Drift and Diffusion, p-n junction, small signal capacitance. 7L

Unit-II: 2-T MOS Structure
MOS Capacitor, The Flatband Voltage, Potential Balance and Charge Balance, Effect of Gate-Body Voltage on Surface Condition, Carrier Concentration, Accumulation and Depletion analysis, Inversion analysis, Charge Sheet Approximation, Small Signal Capacitance model, Small Signal Equivalent Circuit model, Static behavior and High Frequency behavior. 10L

Unit-III: 3-T MOS Structure
Structure, Contacting the Inversion Layer, Potential Balance and Charge Balance, Accumulation and Depletion analysis, Inversion analysis, The Body Effect, The V_{CB} Control point of View, Use o0f 3-T MOS Structure. 8L

Unit-IV: The 4-T MOS Structure
MOS Transistor, Transistor Regions of Operation, Complete All-Region Models, Simplified All-Region Models, Body referenced and Source Referenced Simplified All-Region Models, Complete strong Inversion Model, Body referenced and Source Referenced Complete strong Inversion Model, Weak Inversion Model, Body referenced and Source Referenced Weak Inversion Model, Moderate Inversion Model, Advantage and Disadvantages of Body referenced and Source Referenced Models. 16L

Unit-V: Small Dimension Effects
Introduction, Channel Length Modulation, Short Channel Devices, Drain Induced Barrier Lowering, Hot Carrier effects, Punchthrough, Junction Leakage, Gate Induced Drain Leakage, Tunneling Current effect, Quantum Mechanical effect, Interface Charges, Capacitance-Voltage Method, Conductance Method. 7L

Text Books:

1. Y. Tsividis and C. McAndrew, “Operation and Modeling of the MOS Transistor”, 3rd Edition, Oxford University Press.
2. E. H. Nicollian and J. R. Brews, “MOS (Metal Oxide Semiconductor) Physics and Technology”, Wiley-Interscience Publication.

References:

1. H. Ehrenreich and F. Spaepen, “Solid State Physics”, Academic Press
2. S. M. Sze, “Physics of Semiconductor Devices”, Wiley-Interscience Publication.
3. J. P. Colinge and C. A. Colinge, “Physics of Semiconductor Devices”, Kluwer Academic Publication.

Advanced Communication Systems: ECM-103

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Limitations of conventional mobile system, mobile cellular communication: introduction, concept of frequency reuse, cluster size, cellular system architecture: mobile station, base station, mobile switching centre, description of mobile radio environment: introduction to radio wave propagation, fundamentals of envelope fading, Doppler spread, time delay spread, fundamentals of antenna gain, concept of free space propagation model, Fris equation, Path loss of Non-Line – of-Sight(NLOS) and Line-of -Sight (LOS) Systems, comparison of first generation(1G), second generation (2G) and third generation (3G) wireless cellular mobile radio system. 10L

Unit-II:
The cellular concept-system design fundamentals: introduction, frequency reuse, channel assignment strategies, handoff strategies: prioritizing handoffs, practical handoff considerations, interference and system capacity: co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference, trunking and grade of service, improving coverage and capacity in cellular systems: cell splitting, sectoring, repeaters for range extension and microcell zone concept. 10L

Unit-III:
Modulation Techniques for mobile radio: linear modulation techniques: binary phase shift keying (BPSK), differential phase shift keying (DPSK), quadrature phase shift keying (QPSK), constant envelope modulation: binary frequency shift keying (BPSK), minimum shift keying (MSK), Gaussian minimum shift keying (GMSK),spread spectrum modulation techniques: pseudo-noise (PN) sequences, direct sequence spread spectrum(DS-SS), frequency hopped spread spectrum (FH-SS). 10L

Unit-IV:
Global system for mobile (GSM): mobile services, system architecture, radio interface, protocols, channel types, localization and calling, handover, security, General packet radio service (GPRS): architecture, mobility management, protocol, introduction to code division multiple access (CDMA), digital cellular standard, comparison between GSM and CDMA.
8L

Unit-V:
Wireless local area network (WLAN): applications, requirements, technology: infrared (IR) LAN: diffuse, quasi-diffuse and point-to-point IR wireless LAN, spread spectrum LAN, narrowband microwave LAN, IEEE 802.11: the Wi-Fi alliance, standards, terminology, architecture, services, medium access control: carrier sense multiple access, Bluetooth: architecture and applications. Wireless local loop (WLL): configuration, advantages, and

propagation considerations: Fresnel zone, atmospheric absorption, orthogonal frequency division multiplexing (OFDM), Multichannel multipoint distribution service (MMDS) and Local multipoint distribution service (LMDS). 10L

Text Book:

1. Jochen Schiller, Mobile Communications, Pearson Education.
2. William C.Y. Lee, Mobile cellular telecommunications: analog and digital systems, MGH.

References:

1. KamiloFeher, Wireless Digital Communications, PHI.
2. William Stallings, Wireless Communications & Networks, Pearson Education.
3. Theodore S. Rappaport, Wireless Communications Principles and Practice, Pearson Education

High Speed Solid State Devices: ECM-104

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:Important parameters governing the high speed performance of devices and circuits
Transit time of charge carriers, junction capacitances, ON-resistances and their dependence on the device geometry and size, carrier mobility, doping concentration and temperature. Contact resistance and interconnection/interlayer capacitances in the Integrated Electronics Circuits. Silicon based MOSFET and BJT circuits for high speed operation and their limitations:**-** Emitter coupled Logic (ECL) and CMOS Logic circuits with scaled down devices. SOI based devices and SOICMOS circuits for high speed low power applications. 6L

Unit-II:Materials for high speed devices and circuits
Merits of III –V binary and ternary compound semiconductors (GaAs, InP, InGaAs, AlGaAs ETC.), silicon-germanium alloys and silicon carbide for high speed devices, as compared to silicon based devices. Brief outline of the crystal structure, dopants and electrical properties such as carrier mobility, velocity versus electric field characteristics of these materials. 6L

Unit-III:Metal semiconductor Field Effect Transistors (MESFETs)
Small signal analysis, Microwave equivalent circuit, S-parameter characterizations using device physics, MESFET as an amplifier, Design of MESFET amplifier.MOS Scaling theory, Issues in scaling MOS transistors: Short channel effects. Velocity overshoot effects and the related advantages of GaAs, InP and GaN based devices for high speed operation. Sub threshold characteristics, short channel effects and the performance of scaled down devices. 7L

Unit-IV: HEMT& HBT
Hetero-junction devices, The generic Modulation Doped FET(MODFET) structure for high electron mobility realization. Principle of operation and the unique features of HEMT.InGaAs/InP HEMT structures.Operation and the benefits of hetero junction BJT for high speed applications.GaAs and InP based HBT device structure and the surface passivation for stable high gain high frequency performance,SiGe HBTs and the concept of strained layer devices.

10L

Unit-V:Nanoelectronic Devices
Quantum electron transport through nanostructure devices, Landauer formula, Aharonov-Bohm effect, Density matrix, Quantum kinetic equation, Wigner transformation, Quantum Boltzman equation, Quantum wells, Quantum wires and quantum dots, Envelope function, Excitons in quantum wells, Si / Ge strained heterostructures, Modulation doping, Tunneling transport, Resonant tunneling devices, High field transport in quantum structures, Hot electron transistors, Ballistic injection devices. Velocity modulation and quantum interference transistors, Quantum

wire transistors, Quantum dot devices, Spintronics: Introduction, Overview, History &Background, Generation of Spin Polarization Theories of spin Injection, spin relaxation and spin dephasing, Spintronic devices and applications, spin filters, spin diodes, spin transistors. 19L

Text Books:

1. Klimov Vector, Semiconductor & Metal Nano crystal.
2. Waser Rainer, Nanoelectronics and IT.
3. David Awschalom,Spin Electronics
4. Karl Goser, JanDienstuhlm, Nanoelectronics&Nanosystems: From Transistor to Molecular & Quantum Devices.

References:

1. Rizzi, Microwave Engineering-Passive Circuits, PHI.
2. Roy &Mitra, Microwave semiconductor Devices, PHI.
3. Srivastava& Gupta, Microwave Devices and Circuit Design, PHI
4. Lonescu& Banerjee, Emerging Nano Electronics: Life with after CMOS.
5. Liao, Microwave Devices and Circuits, PHI.

Advanced Antenna Theory and Propagation Techniques: ECM-105

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I

Concept of radiation of electromagnetic waves; Retarded Vector Potential and other auxiliary potential fuctions; Duality Principles, Review of antenna parameters: Radiation Pattern, Beam Width; Radiation Resistance and efficiency; Directivity and Gain; Impedance, VSWR, Polarization; Effective height and Receive Aperture; Noise Temperature of Antenna. 4L

Unit-II

Linear Antennas: Radiation characteristics of a Hertzian dipole and loop antennas, Thin linear antennas of different length, Monopole antenna, Sleeve monopole, Effect of ground on antenna characteristics. 6L

Unit-III

Array Antenna: Uniform Linear Array: End fire and Broad side; Phased array; Concept of pattern Multiplication; Array antenna synthesis using Schelkunoff's polynomial method; Different side lobe minimization techniques in array structure, Characteristics and properties of : Travelling Wave Antenna, Helical Antenna, Folded Dipole, Yagi-Uda Array, Log periodic Antenna, Microstrip Patch Antenna. 10L

Unit-IV

Aperture Antennas: Principle of analysis of aperture antenna with electric and magnetic sources, Radiation characteristic analysis of rectangular and circular aperture antennas: uniform and dominant mode field distribution.

Horn antenna: Analysis of radiation characteristics of sectoral and pyramidal horn antennas, Design of Optimum Horn Antenna.

Reflector Antennas: Radiation characteristics of parabolic and corner reflectors, Design of parabolic reflector antennas and feed systems, Design issues of Cassegrain antenna. 18L

Unit-V

Methods of Propagation: Ground Wave Propagation, Sky wave Propagation; Ionospheric Layers; Virtual Height, Critical Frequency, MUF, Skip distance, Sporadic Reflections. Space wave propagation: Tropospheric Scatter, Duct propagation, Optical and radio horizon.

Friss transmission formula, SNR of a Radio Link, LOS link design, Physical (Medium) effects on Radio wave Propagation: Absorption, Refraction and Radio Horizon, Diffraction, Multipath Propagation and fading, Noise, Doppler effect. 10L

Text Books:

1. J.D Kraus, R. J. Marhefka and A. Khan, Antennas and Wave Propagation, McGraw Hill, 4^{th} edition,2010
2. C.A Balanis, Antenna theory: Analysis and design, , John Wiley and Sons, New York,1982
3. G. S. N Raju, Antenna and Wave Propagation, Pearson Education, 2009

References:

1. R.Garg, P.Bhartia, I.Bhal, A.Ittipiboon.,Micrstrip antenna Design Handbook, Artech House, London 2001.
2. Jordan E.C. &Balmain K.G, Electromagnetic Waves & Radiating systems, PHI,2^{nd} Ed, 1988.
3. K.D Prasad; Antenna & Wave Propagation, SatyaPrakashan, New Delhi, 3rd Edition, 2003.
4. R.S Elliot, Antenna Theory and Design, John Wiley –IEEE Press, Revised Edition, 2003.

Laboratory-I: ECM-191

Credits: 2(3P)
Total Hours: 36
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

<u>Microwave and Antenna Engineering:</u>

1. Experiments using Doppler RADAR Trainer
2. Designing microstrip antennas of various geometries.
3. Experiments related to impedance matching in microwave test bench.
4. Experiments employing different dielectrics in microwave test bench.
5. Design and experiments on Yagi antennas at variable frequencies.
6. Design and experiments on Log-Periodic antennas at variable frequencies.
7. Testing of horn antenna for optimum performances.

<u>Communication Systems:</u>

8. Experiments on digital TDM techniques.
9. Experiments on digital FDM techniques.
10. Study of Advanced Mobile System Standard GSM
11. Study of Advanced Mobile System Standard CDMA
12. Experiments and design of advanced digital communication circuits using MATLAB.
13. Experiments on different multiple access techniques using MATLAB.

Advanced VLSI Design: ECM-201

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I: MOS Transistor and CMOS

Introduction, VLSI Design Flow, MOS Transistor, Regions of Operation, Ideal and Non-ideal I-V Characteristics, C-V Characteristics, Body Effect, Channel Length Modulation, Tunneling, Scaling of MOS Circuits, Scaling Factors, MOS Inverter, CMOS Inverter, DC Characteristics, Switching Characteristics, Noise Margins. 10L

Unit-II: CMOS based Digital Circuit Design

CMOS Logic: The NAND gate, The NOR gate, Combinational Logic, Dynamic Logic Circuit, Pass Transistors, Transmission Gates, Adders, Subtractors, Comparators, Multiplexers, Latches and Flip Flops, Complex CMOS Logic Gates, Clocked CMOS Logic, PE Logic, Domino Logic, NP logic. 10L

Unit-III: CMOS based Analog Circuit Design

Passive Components, Sheet Resistance, Analog MOS Transistor Model, Low Frequency Small Signal Model, High Frequency Small Signal Model, MOS Current Source, MOS Voltage Source, Current Mirror using nMOS, Current Mirror using pMOS, Voltage Dividers, MOS amplifiers: Common Source Amplifier, Common Gate Amplifier, Operational Amplifiers: Differential Amplifier Stage, Common Source Stage, Buffer Stage. 10L

Unit-IV: Programmable Logic and Layout Design

Design Methodologies, Full Custom,Semi Custom, Standard Cells and Gate Arrays, basics of PAL and PLA, Programmable Logic Devices (PLD), FPGA, Layout Design: Design Rules, MOSIS Scalable CMOS Design Rules, Micron Design Rules, Design Rule Checking, Circuit Extraction. 10L

Unit-V: Circuit Characterization and Performance Estimation

Delay Estimation: RC Delay, Linear Delay, Parasitic Delay, Power Dissipation: Static power, Dynamic power, Low Power Design, Dynamic Power Reduction, Static Power Reduction, Interconnect: Resistance, Capacitance, Crosstalk. 8L

Text Books:

1. Neil H. E. Weste, David Harris and Ayan Banerjee, “CMOS VLSI Design” Pearson Publication.
2. K. Eshraghian, D. A. Pucknell and S. Eshraghian, “Essential of VLSI Circuits and Systems”, PHI Publication

References:

1. Geiger, Allen andStrader, "VLSI Design Technology for Analog & Digital Circuits", McGraw Hill Publication.
2. P. P. Sahu, "VLSI Design", McGraw Hill Publication.
3. J. M. Rabaey, "Digital Integrated Circuits", PHI Publication
4. Baker, Li and Boyce, "CMOS Circuit Design, Layout and Simulation", PHI Publication

Advanced Digital Signal Processing: ECM-202

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I: Introduction
Discrete-Time Signals and Systems, Convolution, Z-transform, DFT, FFT, Filter design techniques- FIR, IIR. 10L

Unit-II:Multirate DSP
Decimation, interpolation, sampling rate conversion, implementation of sampling rate conversion, applications of Multirate Signal processing. 8L

Unit-III:Non-Parametric Methods of Power Spectral Estimation
Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods, Comparison of all Non-Parametric methods.
8L

Unit-IV:Parametric Methods of Power Spectrum Estimation
Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms. 10L

Unit-V: Adaptive filters
Introduction, Examples of Adaptive filtering, adaptive filter based on steepest decent algorithm, limitations of steepest decent algorithm, LMS adaptation algorithm, comparison of LMS with steepest decent algorithm, normalized LMS filter, Minimum Mean Square Error Criterion, Recursive Least Square Algorithm. 12L

Text Books:

1. John G. Proakis and Dimitris G. Manolakis, Digital Signal Processing, 3/e, PHI.
2. S K Mitra, Digital Signal Processing, 3/e, TMH.
3. Simon Haykin, Adaptive Filters Thory, PHI.
4. A V Oppenheim and R.W Schafer, Discrete-Time Signal Processing, 3/e, Pearson.
5. Emmanual C. Ifeachoret. Al., Digital Signal Processing : A Practical approach, PHI

References:

1. L.R. Rabiner and B.Gold, Theory and Application of Digital Signal Processing., PHI
2. S. Salivahanan, A. Vallavaraj and C. Gnanapriya, Digital Signal Processing, TMH.
3. P. Ramesh Babu, Digital Signal Processing, 2/e, Scitech, 13th Reprint, 2004.
4. A NagoorKani, Digial Signal Processing, 2e, TMH

MEMS and Nanoelectronic Devices: ECM-203

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
MEMS: an introduction to microsensors, microactuators, microelectronics fabrication, micromachining, mechanical MEMS, thermal MEMS, MOEMs magnetic MEMs, RF MEMS, nanotechnology, modeling and simulation. 8L

Unit-II:
Micromachining: introduction, photolithography, structural and sacrificial materials, thin film deposition, thin film development processes: low pressure chemical vapour deposition (LPCVD), plasma enhanced chemical vapor deposition (PECVD), impurity doping: diffusion, ion implantation, etching: wet etching, dry etching, problems with bulk micromachining, surface micromachining: processes, wafer bonding, anodic bonding and fusion bonding. 10L

Unit-III:
System modeling and properties of material: system types, basic modeling elements in mechanical system: spring, damper element, mass/inertia element, basic modeling elements in electrical systems, basic modeling element in fluid systems, basic modeling elements in thermal systems, translational pure system with spring, damper and mass, rotational pure mechanical system with spring, damper and mass, properties of materials, relation between Young's modulus, bulk modulus, shear modulus and Poisson's ratio. 12L

Unit-IV:
Mechanical sensors and actuators: sensing, actuation, principles of sensing and actuation: beam and cantilever, piezoelectricity, electrostatic: ultrasonic transduces: micromachined: types and features, structures, material used, principle of operation, modeling approaches. 8L

Unit-V:
Nanodevices and technology: introduction, nanotechnology materials, fullerenes: doping, carbon nanotubes: single walled carbon nanotubes, multi walled carbon nanotubes, chiral vector and chiral angle, structure of carbon nanotubes, development: laser ablation technique, arc discharge method, chemical vapor deposition, applications: quantum wire, transistors, biomedical applications and properties of carbon nanotubes. 10L

Text Books:

1. N. P. Mahalik, MEMS, Tata MGH Education.
2. T. R. Hsu,MEMS& Microsystems Design and Manufacture,Tata MGH Publishing

References:

1. T. Pradeep, NANAO: The Essentials, Understanding Nanoscience and Nanotechnology,MGH
2. C. Liu, Foundations of MEMS, Prentice Hall
3. N. Maluf, An Introduction to MEMS Engineering, Artech House Pub.

Optical Fiber Communication and photonics: ECM-204

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Introduction to optical fiber communication and systems: principles and operation, advantages and disadvantages of fiber communication, chronology of developments, prospects and trends, elements of optical communication system: transmitters, transmission channels and receivers, merits and demerits.Optical Fibers–Core and cladding,Optical sources: light emitting diodes LEDsandSemiconductor Lasers and Optical detectors: photodiode. 10L

Unit-II:
Optical amplication: introduction, optical amplifiers, semiconductor laser amplifiers: structure, theory, performance characteristics:reflectivity, fiber amplifiers: some potential system applications: a power amplifier at the transmitter, an optical repeater and a preamplifier at the receiver. rare earth doped fiber amplifiers; energy level diagram, Raman and Brillouin fiber amplifiers: illustration of the forward and backward pumping capability. 10L

Unit-III:
Integrated optics: planar waveguides: structure, principle of operation, ridge guide, and diffused channel embedded strip guide and rib guide, some integrated optical devices: passive Y-junction beam splitter, an electro-optic Y-junction switch, electro-optically switched directional coupler, optoelectronic integration and basics of optical computation. 10L

Unit-IV:
Optical fiber systems: intensity modulation/ direct detection: introduction, the optical transmitter circuit: source limitations, LED drive circuits, laser drive circuits, analog systems: direct intensity modulation, subcarrier intensity modulation:subcarrier double sideband modulation,subcarrierfrequencymodulation,subcarrier phase modulation and pulse analog techniques, advanced multiplexing strategies: wavelength division multiplexing. 10L

Unit-V:
Applications and future developments of optical communication: introduction, public network applications: trunk network, junction networks, local area networks: fiber distributed data interface (FDDI). 8L

Text Books:

1. John. Senior, Optical fiber communications: principles and practice, PHI.
2. Walker, Optical Engineering Fundamentals, PHI.
3. Gerd Keiser, Optical fiber communications, McGraw Hill, 3rd edition

References:

1. Mynbaev&Scheiner, Fiber optic communication technology, Pearson.
2. R. P. Khare, Fiber optic and optoelectronics, Oxford University press.
3. John Gowar, Optical Communication Systems, PHI.
4. Selverajan, Kar&Srinivas, Optical fiber comm.: principle & system, TMH.

Satellite Communication: ECM-205

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Introduction to satellite communication: brief history and overview of satellite communication, orbital mechanics, communication subsystem, telemetry, command and ranging subsystem, attitude control subsystem, electrical power subsystem.

12L

Unit-II:
Satellite transponder and link design: transponder model, channelisation, frequency plan, basic transmission theory, system noise temperature and satellite link design: G/T ration for earth stations, design of uplink and downlink, atmospheric and ionosphere effects on satellite link.

8L

Unit-III:
Earth station: description, earth station antenna, low noise amplifier, up converter, down converter, monitoring and control, VSAT. 8L

Unit-IV:
Satellite mobile communication: GEO, MEO, LEO system, routing, localization and handover, personal communication system (PCS), satellite PCS, Third generation Mobile system

8L

Unit-V:
Satellite Links & GPS Fundamental: Satellite links: direct broadcast satellite receiving system, earth station design, analog and digital transmission of voice and TV signals, bandwidth compression, principles of FDMA, TDMA, CDMA, SPADE, DMAS, Global positioning system: basic principles of position fixing with GPS, errors in position fixing, DGPS, WAAS, GPS application.

12L

Text Books:

1. Pratt, BostianandAllnutt, Satellite Communication, Wiley.
2. Jochen Schiller, Mobile Communications, Pearson Education.

References:

1. Theodore S. Rappaport, Wireless communications: principles and practice, Pearson.
2. D. C. Agarwal, Satellite communication, Khanna publishers

Image Processing and Pattern Recognition: ECM-206

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Enhancement, restoration, Image analysis and reconstruction, image data compression, two dimensional systems, linear systems and shift invariance, Fourier transform, Z-transform, Block matrices and Kronecker products, Random signals. 10L

Unit-II:
Introduction, light, luminance, brightness and contrast, MTF of the visual system, visibility, function, monochrome vision models, color matching and reproduction, color vision Model, Image sampling and quantization, two dimensional sampling theory, reconstruction of images from its samples, Nyquist rate, aliasing, sampling theorem, Practical limits in sampling reconstruction, Image & visual quantization. 12L

Unit-III:
Two dimensional orthogonal and unitary transforms, properties of unitary transforms, one dimensional DFT, cosine, sineHarmrd and Haar transforms. 8L

UNIT IV:
Point operations, contrast stretching, clipping and thresholding, digital negative intensity level slicing, bit extraction, Histogram modeling, histogram equalization, modification, spatial operations, smoothing techniques, Magnificent and interpolation, Transform Operations, Color image enhancement. 10L

UNIT V:
Spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection. 8L

Text Books:

1. Anil K. Jain, Fundamentals of Digital Image Processing , Prentice Hall
2. Rafel C. Gonzalez and Paul Wintz, Digital Image Processing, Addison Wesley
3. William K. Pratt, Digital Image Processing, John Wiley and Sons

References:

1. RosenfieldAzriel& K. Avinash, Digital Image Processing , Academic Press

Principles of Electromagnetic Compatibility: ECM-207

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Introduction to causes of Electromagnetic interference (EMI), sources of conducted interference and its characteristics, design practice for minimizing conducted interference, sources of radiated interference and its characteristics. 8L

Unit-II:
Interference coupling by conduction and radiation, definition of grounding and bonding, fundamental grounding concepts, different grounding, design guidelines, different bonding methods, guidelines for good bonds. 10L

Unit-III:
Shielding effectiveness of solid materials, multiple solid shields, thin film shielding, shield seams, different non- solid shielding, cable and connector shielding. 10L

Unit-IV:
Filter characteristics, filter design, power line filters, noise reduction circuits, special filters, gaskets, fingers, conductive coating, types of coating. 10L

Unit-V:
Equipment design: transmitters, receivers, antenna systems, power supplies, control devices, digital circuits, introduction to industrial and governmentsspecification, concepts of EMC test and procedures. 10L

Text Books

1. Bernhard Keiser, Principles of Electromagnetic compatability, Artech publication, 1983
2. C. R. Paul and S. A. Nasar, Introduction to Electromagnetic Fields, 2nd ed., McGraw-Hill, New York, 1987

References:

1. C. R. Paul, Electromagnetics for Engineers, Wiley, Hoboken, NJ, 2004.
2. E. C. Jordan and K. G. Balmain, Electromagnetic Waves and Radiating Systems, 2nd ed.,Prentice-Hall, Englewood Cliffs, NJ, 1968.

Advanced Microprocessor and Microcontroller: ECM-208

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern::
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Evolution of microprocessors, Introduction to Intel 8086/8088 microprocessor architecture.Concepts of pipelining, parallel and co-processing.Concept of segmentation and computation of physical addresses.The maximum and minimum mode of operation of Intel 8086 processor. 10 L

Unit-II:
Intel 8086 Architecture, Addressing Modes, Instruction sets: Data Movement, Arithmetic and Logic operations. Program control, hardware specifications, memory and basic I/O interfaces, Interrupts, Direct memory access and DMA controlled I/O, Bus Interface, Arithmetic Co-processor, MMX and SIMD technologies of x86 family. 10 L

Unit-III:
Intel 80286: Real-time process control, The Protected mode operation via selectors and descriptors anditsup gradation for 32 bit of 80386 and 80486 processors. 8 L

Unit-IV:
Overview of the new 64 bit architecture and Multi core operations along with the multi-threading technologies; Other high end microprocessors, Motorola, AMD, Power PC, etc. 8 L

Unit-V:
Evolution of microcontrollers, overview of the Intel 8051family. Intel 8051: Important features & Architectural block. Memory organization and External memory interfacing. Instruction sets and Programming technique. I/O programming., Addressing modes and Port StructureIntroduction to PIC microcontroller, Architecture and memory organization, Instruction sets & programming technique 12L

Text Books:

1. Barry B Bray,Intel Microprocessors (8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium-II, Pentium-III, and Pentium 4) Architecture, Programming and Interfacing, PHI, 2006
2. A.P. Mathur, Introduction to Microprocessors, 3rd Ed., Tata McGraw Hill.
3. M. Mazidi, and J.Mazidi,The 8051 Microcontroller and Embedded Systems, Pearson Education

References:

1. R.S. Gaonkar, Microprocessor Architecture Programming Applications with the 8085/8080A, 3rd Ed., PHI.
2. Kenneth L., Short Microprocessors and Programmed Logic, PHI
3. D. Ibrahim, Microcontroller Projects in C for 8051,Newnes
4. John Iovine, PIC Microcontroller Project Book, McGraw Hill

Advanced Information Theory and Coding Techniques : ECM-209

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I: Information theory

Uncertainty and information**,** Mathematical model of information, average information, mutual information, entropy and its properties, Conditional entropy, Joint Entropy, Markov statistical model for information sources, Entropy and information rate of Markov sources. 8L

Unit-II: Channel model and channel coding

Discrete Memory less Channel (DMC), Lossless channel, Binary Symmetric channel, Noiseless channel, information rate, capacity of discrete memory less channel, source coding theorem, channel capacity theorem, Shannon Hartley theorem, Shannon limit, Kraft's inequality, Shannon-Fano coding, Huffman coding. 8L

Unit-III: Linear Block Code and Cyclic Code

Linear Block Code: matrix description of linear block codes, generator matrix, parity check matrix, Hamming code, syndrome decoding, error correction using syndrome decoding.
Cyclic Code: Definition, polynomials, generator and parity check matrix of cyclic codes, systematic form of generator matrix, encoders for cyclic codes, syndrome computation and error detection. 8L

Unit-IV: Linear algebra and BCH codes

Linear algebra: Sets, groups, rings and fields, Galois Field GF(2^3), GF(2^4), GF(2^5), primitive field elements, minimal polynomials, solution of equation in Galois Field GF(2^3), GF(2^4), GF(2^5). BCH codes: Description, Decoding BCH codes, Implementation of error correction, Error detection of Binary BCH codes. 12L

Unit-V: Convolution codes

Convolution encoder representation (connection representation, state diagram, tree diagram, trellis diagram), Encoding, Maximum likelihood decoding of convolution codes, Viterbi decoding of convolution codes, Concept of coded modulation (Trellis Code Modulation), design rule of TCM, TCM decoder. 12L

Text Books:

1. S. Haykin , Communication System, Wiley India.
2. H. Taub and D.L.Schilling, Principles of Communication Systems, TMH .
3. Gravano, An Introduction to Error control codes, OUP
4. Shu Lin & Costello, Jr. D.J., Error Control Coding: Fundamentals and Applications, PHI.
5. B. Sklar and P.K.Ray, Digital Communication Fundamentals and Applications, Pearson

References:

1. Ranjan Bose, Information theory Coding and Cryptography, TMH.
2. Jorge Castiñeira Moreira & Patrick Guy Farrell, Essentials of Error-Control Coding, Willy.
3. Jones, Information & Coding Theory, -Springer
4. Wells, Applied Coding and Information Theory –Pearson
5. Peterson and Weldon, Error Correcting Codes, MIT Press, 1972.

Microstrip Antenna Technology: ECM-210

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I: Introduction to microstrip radiators

Definition of patch type radiator, advantages and disadvantages of microstrip antennas, applications, Different geometries of patch, Radiation characteristics andexcitationtechniques, Different optimization techniques for improvement of microstrip radiators. 10L

Unit-II: Rectangular and Circular microstrip patch antennas

Introduction, Full wave analysis, cavity model, CAD model, Resonant frequency and input impedance, Effect of width of a rectangular patch on its characteristics, Effect of feed location, Gain and bandwidth enhancement techniques. 10L

Unit-III: Broad banding techniques of microstrip antenna

Effects of substrate parameters on band width, Selection of suitable patch shape and feeding techniques, Application of stacked patch, co-planar parasitic elements, Other broad banding techniques. 10L

Unit-IV: Circularly polarized microstrip antennas and techniques

Singly fed circularly polarized microstrip antennas, Rectangular and circular type- circularly polarized microstrip antennas, Dual orthogonal feed-circularly polarized microstrip antennas.

8L

Unit-V: Applications of defected ground structures (DGS) in microstrip patch antennas

Effects of conventional ground planes on characteristics of microstrip antennas, Different geometries of defects, Applications of DGS: minimization of Cross-polarization, frequency reconfiguration, Mutual coupling reductions, gain and bandwidth enhancement. 10 L

Text Books:

1. R. Garg, P.Bhartia, I. Bhal, A. Ittipiboon, Microstrip Antenna Design Handbook, Artech House, 2001
2. D. Guha, Y. M. M Antar, Microstrip and Printed Antennas: New Trends, Techniques and Applications, Wiley, 2012
3. J. R. James, P.S. Hall, Handbook of Microstrip Antenna, Peter Peregrinous Ltd, UK, 1979
4. J.D Kraus, R. J. Marhefka and A. Khan, Antennas and Wave Propagation, MGH, 2010

References:

1. G. Kumar, K.P. Ray, Broad band microstrip Antennas, Artech House, 2003.
2. K.L. Wong, Compact and Broadband Microstrip Antennas, Wiley,2002
3. C.A Balanis, Antenna theory: Analysis and design, , John Wiley and Sons, New York,1982

Multimedia Communication: ECM-211

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Introduction of Multimedia, multimedia tools, Audio & Video Response of Human Organs, Fundamentals of multimedia, Digital Audio: Audio synthesis, FM synthesis, Digital signal processing. 8L

Unit-II:
Digital video: Fundamentals of picture frame and interlacing, RGB Color representation, VGA and SVGA standards, Graphics Devices: Monitor display configuration, Basics of Graphics Accelerator Card and itsimportance.display devices-CRT, LCD, Plasma Panel display, Comparison, Mixing video and graphics, Digital Video Camera, Zooming.

10L

Unit-III:
Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive color concepts - RGB color model - YIQ color model - CMY color model - HSV color model - HLS color model; Color selection.

10L

Unit-IV:
Digital Video Compression: Compression Models, Lossy Compression - JPEG and Motion JPEG, MPEG 1, MPEG 2, MPEG 4, Distortion Measures -Transform Coding -JPEG -Wavelet Coding -Sub-band Coding - JPEG2000 - Progressive Image Coding Lossless Compression - Bi-Level -Reflected Gray Codes - Predictive Coding –GIF-Lossless JPEG , Compression Standards, TWAIN Architecture

10L

Unit-V:
Magnetic Media Technology, RAID-Level-0 To 5, Optical Media, WORM optical drives, Hierarchical Storage Management, Cache Management for storage systems.
Multimedia transmission: Issues, Properties of Multimedia data, Architecture of Internet Multimedia Communication- Protocol Stack-Requirements and Design challenges of multimedia communications- Multimedia distribution models-Unicasting, Broadcasting and Multicasting., Transmission time, quality maintenance, Noise reduction, transmission techniques: ISDN, ISDB, OFDM, COFDM.

10L

Text Books:
1. Multimedia Techniques.
2. Ganzalez& Woods, Digital Image Processing, Pearson Education.

3. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Introduction to Multimedia Communications Applications, Middleware, Networking", John Wiley and Sons, 2006.
4. Donald Hearn & M. Paulin Baker, "*Computer Graphic*s", Pearson Education, 3nd Edition, 2003.

References:

1. Multimedia Techniques and Applications.
2. Rogers & Adams, The mathematical element of Computer Graphics, MGH.
3. Peter Shirley, Michael Ashikhmin and Steve Marschner, "*Fundamentals of Computer Graphics"*, 3rd Edition, 2009

MOS AC Analysis: ECM-212

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I: MOS Transistor in Dynamic Operation
Introduction, quasi-static operation, terminal currents in quasi-static operation, intrinsic charges in quasi-static operation: strong inversion, moderate inversion, weak inversion, all region models, depletion, accumulation, transit time, limitations of the quasi-static operation, non-quasi-static analysis, extrinsic parasitic: extrinsic capacitances, extrinsic resistances, simplified equivalent circuit of MOS transistor. 10L

Unit-II: Small Signal Modeling for Low Frequency
Introduction, Model for the intrinsic part: small signal model for drain to source current, source conductance, small signal model for gate and body current, complete model for the intrinsic part, strong inversion, weak inversion, moderate inversion, all region models. 10L

Unit-III: Small Signal Modeling for Medium Frequency
Introduction, Intrinsic capacitances, Small signal equivalent circuit for intrinsic part of MOS transistor, strong inversion, weak inversion, moderate inversion, all region models, depletion, accumulation, extrinsic transistor capacitances. 8L

Unit-IV: Small Signal Modeling for High Frequency
Introduction, complete quasi-static model for intrinsic part, small signal equivalent circuit topologies, evaluation of capacitances: strong inversion, moderate inversion, weak inversion, all region models, y-parameter models, non-quasi-static models, model comparison. 10L

Unit-V: Modeling for Circuit Simulation
Introduction, Types of models, models for device simulation, device models for circuit simulation, attributes of good compact models, Common MOSFET models for circuit simulation, BSIM model, EKV model, PSP model, SPICE circuit simulation: Types of analysis, Models and model parameters, SPICE programming examples. 10L

Text Books:

1. Y. Tsividis and C. McAndrew, “Operation and Modeling of the MOS Transistor”, 3rd Edition, Oxford University Press.
2. Geiger, Allen &Strader, VLSI Design Tech. for Analog & Digital Circuits, MGH.
3. E. H. Nicollian and J. R. Brews, “MOS (Metal Oxide Semiconductor) Physics and Technology”, Wiley-Interscience Publication.

References:

1. H. Ehrenreich and F. Spaepen, “Solid State Physics”, Academic Press
2. S. M. Sze, “Physics of Semiconductor Devices”, Wiley-Interscience Publication.
3. J. P. Colinge and C. A. Colinge, “Physics of Semiconductor Devices”, Kluwer Academic Publication.

Embedded System: ECM-213

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Introduction to Real Time Embedded Systems, Embedded Systems Components, Memory, Digital Signal Processors, General Purpose Processors, Embedded Processors and Memory-Interfacing. 12L

Unit-II:
Embedded Systems I/O: Interfacing bus, Protocols, Timers, Interrupts, DMA,USB and IrDA, Analog Interfacing. 8L

Unit-III:
Design of Embedded Processors: Field Programmable Gate Arrays and Applications, Introduction to Hardware Description Languages. 8L

Unit-IV:
Embedded Communications: Serial communication devices, Parallel device ports, Wireless devices, watchdog timer and real time clock, networked embedded systems. 8L

Unit-V:
Embedded System Software and Software Engineering issues: Introduction to Real-Time Systems, Real-Time Task Scheduling, Concepts in Real-Time Operating Systems, Commercial Real-Time Operating Systems, Introduction to Software Engineering, Requirements Analysis and Specification, Modeling Timing Constraints, Software Design. 12L

Text Books:

1. Tammy Noergaard, Newnes, Embedded Systems Architechture- A Comprehensive Guide for Engineers and Programmers, Elsevier.
2. Rajib Mall, Real Time Systems, PHI.
3. Raj Kamal, Embedded Systems-Architecture, Programming and Design, TMGH

References:

1. Simon,An Embedded System Primer, PHI
2. Vahid Frank, Givargis, Tony, Embedded System Design.
3. Heath Steve, Embedded System Design

Low Power VLSI Design: ECM-214

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:

Introduction to Low Power VLSI Design, Need for Low Power, CMOS Leakage Current, Tunneling Effect, Static Current, Basic Principles of Low Power Design, Probabilistic Power Analysis, Random Logic Signal, Probability and Frequency, Power Analysis Techniques, Signal Entropy. 16L

Unit-II

Transistor and Gate Sizing, Pin Ordering, Network Restructuring and reorganization, Adjustable Threshold Voltages, Logic Signal Gating, Logic Encoding. 10L

Unit-III

Power Reduction in Clock Network, CMOS Floating Node, Low Power Bus, Delay Balancing, CMOS Static Power and Dynamic Power. 8L

Unit-1V

Switching Activity Reduction, Parallel Voltage reduction, Operator Reduction, Adiabatic Computation, Pass Transistor Logic. 8L

Unit-V

Low Power Circuit Design Style, Software Power Estimation, Co Design. 6L

Text Books:

1. Gary Yeap, Practical Low Power Digital VLSI Design
2. Kaushik Roy, Sharat C. Prasad, Low Power CMOS VLSI Circuit Design, Wiley.

References:

1. J. B. Kuo and J. B. Lou, Low Voltage CMOS VLSI Circuits, Wiley-Interscience
2. J. M. Rabaey, Low Power Design Methodologies, Springer
3. K. S. Yeap and K. Roy, Low Voltage Low Power Subsystem, MGH

Mobile Communication and Computing: ECM-215

Credits: 4(3L, 1T)
Total Hours: 48
Full Marks: 100 (Internal: 40 Marks, End Semester Examination: 60 Marks)
End semester mark distribution pattern:
Total 8 nos. of questions: {Q. 1 (a-f) 6 x 2(Mark) (Compulsory) + Any four (4) from Q.2-8 x 12(Marks)} = 60.

Unit-I:
Modulation Techniques for mobile radio: linear modulation techniques: quadrature phase shift keying (QPSK), constant envelope modulation: minimum shift keying (MSK), Gaussian minimum shift keying (GMSK), spread spectrum modulation techniques: pseudo-noise (PN) sequences, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum (FH-SS). 12L

Unit-II
The cellular concept-system design fundamentals: channel assignment strategies, handoff strategies: prioritizing handoffs, practical handoff considerations, improving coverage and capacity in cellular systems: cell splitting, sectoring, repeaters for range extension and microcell zone concept.Global system for mobile (GSM): mobile services, system architecture, radio interface, protocols, channel types, localization and calling, handover, security,introduction to code division multiple access (CDMA), digital cellular standard, comparison between GSM and CDMA. 12L

Unit-III
Mobile Computing: wireless data services: the applications of mobile computing networks: classification of mobile data networks, Cellular digital packet data (CDPD) system: architecture and features, General packet radio service (GPRS): architecture, mobility management, protocol. 10L

Unit-1V
Mobile network layer: mobile IP: goals, assumptions and requirements, entities and terminology, IP packet delivery, agent discovery, registration, tunneling and encapsulation, optimizations. 6L

Unit-V
Mobile Transport layer: traditional TCP: congestion control, slow start, fast retransmit/fast recovery, implications of mobility, classical TCP improvements: indirect TCP, snooping TCP, mobile TCP, fast retransmit/fast recovery, transmission/time-out freezing. 8L

Text Books:
3. Jochen Schiller, Mobile Communications, Pearson Education.
4. William Lee, Mobile cellular telecommunications: analog and digital systems, MGH.

References:

1. KamiloFeher, Wireless Digital Communications, PHI.
2. William Stallings, Wireless Communications & Networks, Pearson Education.
3. T. S. Rappaport, Wireless Communications Principles and Practice, Pearson Education

Laboratory-II: ECM-291

Credits: 2(3P)
Total Hours: 36
Full Marks: 50 (Sessional: 25 Marks, End Semester Examination: 25 Marks)
(Mark distribution : 15- practical, 5- viva-voce, 5- report/record book)

List of Experiments:

<u>Digital Signal Processing:</u>

1. Experiments and design of FIR filters.
2. Experiments and design of IIR filters.
3. Design of RC coupled amplifier for given bandwidth and gain.

<u>Device Modeling:</u>

4. C-V analysis of Nano MOS Devices
5. I-V analysis of Nano MOS Devices
6. AC analysis of Nano MOS devices

<u>VLSI Design:</u>

7. Layout and Verification of CMOS NAND gate
8. Layout and Verification of CMOS NOR gate
9. Design of 8 : 3 Encoder and 3 : 8 Decoder using HDL
10. Design of 8 : 1 Multiplexer and 1 : 8 Demultiplexer using HDL
11. Design 4 bit Binary Counter using HDL
12. Design of 4 bit Binary Counter using HDL
13. Design Johnson Counter using HDL
14. Design of a Shift Register of Serial-in-Serial-out using HDL
15. Design of FSM using HDL