

**SCHEME OF TEACHING AND EXAMINATION
B.E. ELECTRONICS AND COMMUNICATION**

VII Semester

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
							Marks		
							IA	Theory / Practical	Total
1	10EC71	Computer Communication Networks	EC	4	-	3	25	100	125
2	10EC72	Optical Fiber Communication	EC	4	-	3	25	100	125
3	10EC73	Power Electronics	EC	4	-	3	25	100	125
4	10EC74	Embedded System Design	EC	4	-	3	25	100	125
5	10EC75x	Elective-II (Group B)	EC	4	-	3	25	100	125
6	10EC76x	Elective-III (Group C)	EC	4	-	3	25	100	125
7	10ECL77	VLSI Lab	EC	-	3	3	25	50	75
8	10ECL78	Power Electronics Lab	EC	-	3	3	25	50	75
TOTAL				24	06	24	200	700	900

Elective-II (Group B)

10EC751 – DSP Algorithms & Architecture
 10EC752 - Micro and Smart Systems Technology
 10EC753 – Artificial Neural Network
 10EC754 – CAD for VLSI
 10EC755 – Applied Embedded System Design*
 10EC756 – Speech Processing

Elective-III (Group C)

10EC761 - Programming in C++
 10EC762 – Real Time Systems
 10EC763 - Image Processing
 10EC764 - Radio Frequency Integrated Circuits
 10EC765 - Wavelet Transforms
 10EC766 - Modeling and Simulation of Data Networks

NOTE: 06EC757 Applied Embedded System Design has a LAB component (syllabus is different and in the Theory Examination, questions from Lab experiments will also be there)

VIII SEMESTER

SCHEME OF TEACHING AND EXAMINATION.
BE. ELECTRONICS AND COMMUNICATION

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
							Marks		
							IA	Theory / Practical	Total
1	10EC81	Wireless Communication	EC	4	-	3	25	100	125
2	10EC82	Digital Switching System	EC	4	-	3	25	100	125
3	10EC83x	Elective-IV (Group D)	EC	4	-	3	25	100	125
4	10EC84x	Elective-V (Group E)	EC	4	-	3	25	100	125
5	10ECP85	Project Work	EC	-	6	3	100	100	200
6	10ECS86	Seminar	EC	-	3	-	50	-	50
TOTAL				16	09	15	250	500	750

Elective-IV (Group-D)

10EC831 – Distributed Systems

Communication

10EC832 – Network Security

Operating Systems

10EC833 - Optical Networks

10EC834 – High Performance Computing Networks

10EC844 - Ad-hoc Wireless Networks 10EC835 – Internet Engineering

10EC845 – Optical Computing

Elective-V (Group-E)

10EE841 – Multimedia

10EC842 – Real Time

10EC843 - GSM

Text Books:

1. Sanjay Gupta, “**Virtual Instrumentation, LABVIEW**”, TMH, New Delhi, 2003
2. S. Gupta and J P Gupta, “**PC Interfacing for Data Acquisition and Process Control**”, Instrument Society of America, 1994

Reference Books:

3. Peter W Gofton , “**Understanding Serial Communication**”, Sybes International, 2000
4. Robert H. Bishop, “**Learning with Lab-View**” Prentice Hall, 2009
5. Ernest O. Doebelin and Dhanesh N Manik, “ **Measurement Systems – Application and Design**”, 5th Edn, TMH, 2007.

**VII SEMESTER
COMPUTER COMMUNICATION NETWORKS**

Subject Code	: 10EC71	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Telephone and cable networks for data transmission, Telephone networks, Dial up modem, DSL, Cable TV for data transmission. **7 Hrs**

UNIT - 2

DATA LINK CONTROL: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC. **6 Hrs**

UNIT - 3

MULTIPLE ACCESSES: Random access, Controlled access, Channelisation. **6 Hrs**

UNIT - 4

Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11 **7 Hrs**

UNIT - 5

Connecting LANs, Backbone and Virtual LANs, Connecting devices, Backbone Networks, Virtual LANs **7 Hrs**

UNIT - 6

Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6. **6 Hrs**

UNIT - 7

Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols. **6 Hrs**

UNIT - 8

Transport layer Process to process Delivery, UDP, TCP, Domain name system, Resolution. **7 Hrs**

TEXT BOOK:

1. **Data Communication and Networking**, B Forouzan, 4th Ed, TMH 2006

REFERENCE BOOKS:

4. **Computer Networks**, James F. Kurose, Keith W. Ross: Pearson education, 2nd Edition, 2003
5. **Introduction to Data communication and Networking**, Wayne Tomasi: Pearson education 2007

OPTICAL FIBER COMMUNICATION

Subject Code	: 10EC72	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

OVERVIEW OF OPTICAL FIBER COMMUNICATION: Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cutoff wave length, mode field diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers. **7 Hrs**

UNIT - 2

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS: Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion. **6 Hrs**

UNIT - 3

OPTICAL SOURCES AND DETECTORS: Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors. **6 Hrs**

UNIT - 4

FIBER COUPLERS AND CONNECTORS: Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers. **6 Hrs**

UNIT - 5

OPTICAL RECEIVER: Introduction, Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers. **6 Hrs**

UNIT - 6

ANALOG AND DIGITAL LINKS: Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics. Digital links – Introduction, point-to-point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping. **8 Hrs**

UNIT - 7

WDM CONCEPTS AND COMPONENTS: WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehender interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources. **7 Hrs**

UNIT - 8

Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.
OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides. **6 Hrs**

TEXT BOOKS:

1. "**Optical Fiber Communication**", Gerd Keiser, 4th Ed., MGH, 2008.
2. "**Optical Fiber Communications**", John M. Senior, Pearson Education. 3rd Impression, 2007.

REFERENCE BOOK:

1. **Fiber Optic Communication** - Joseph C Palais: 4th Edition, Pearson Education.

POWER ELECTRONICS

Subject Code	: 10EC73	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction, Applications of power electronics, Power semiconductor devices, Control characteristics, Types of power electronics circuits, Peripheral effects.

6 Hrs

UNIT - 2

POWER TRANSISTOR: Power BJT's, Switching characteristics, Switching limits, Base drive control, Power MOSFET's, Switching characteristics, Gate drive, IGBT's, Isolation of gate and base drives.

6 Hrs

UNIT - 3

INTRODUCTION TO THYRISTORS: Principle of operation states anode-cathode characteristics, Two transistor model. Turn-on Methods, Dynamic Turn-on and turn-off characteristics, Gate characteristics, Gate trigger circuits, di / dt and dv / dt protection, Thyristor firing circuits.

7 Hrs

UNIT - 4

CONTROLLED RECTIFIERS: Introduction, Principles of phase controlled converter operation, 1ϕ fully controlled converters, Dual converters, 1ϕ semi converters (all converters with R & RL load).

7 Hrs

UNIT - 5

Thyristor turn off methods, natural and forced commutation, self commutation, class A and class B types, Complementary commutation, auxiliary commutation, external pulse commutation, AC line commutation, numerical problems.

7 Hrs

UNIT - 6

AC VOLTAGE CONTROLLERS: Introduction, Principles of on and off control, Principles of phase control, Single phase controllers with resistive loads and Inductive loads, numerical problems. **6 Hrs**

UNIT - 7

DC CHOPPERS: Introduction, Principles of step down and step up choppers, Step down chopper with RL loads, Chopper classification, Switch mode regulators – buck, boost and buck – boost regulators. **6 Hrs**

UNIT - 8

INVERTORS: Introduction, Principles of operation, Performance parameters, 1ϕ bridge inverter, voltage control of 1ϕ invertors, current source invertors, Variable DC link inverter.

7 Hrs

TEXT BOOKS:

4. **“Power Electronics”** - M. H. Rashid 3rd edition, PHI / Pearson publisher 2004.
5. **“Power Electronics”** - M. D. Singh and Kanchandani K.B. TMH publisher, 2nd Ed. 2007.

REFERENCE BOOKS:

6. **“Power Electronics, Essentials and Applications”, L Umanand,** John Wiley India Pvt. Ltd, 2009.
7. **“Power Electronics”**, Daniel W. Hart, McGraw Hill, 2010.
8. **“Power Electronics”, V Nattarasu and R.S. Anandamurthy,** Pearson/Sanguine Pub. 2006.

EMBEDED SYSTEM DESIGN

Subject Code	: 10EC74	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT 1:

Introduction to Embedded System: Introducing Embedded Systems, Philosophy, Embedded Systems, Embedded Design and Development Process. **5 Hrs**

UNIT 2:

The Hardware Side: An Introduction, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Registers-A First Look, Embedded Systems-An Instruction Set View, Embedded Systems-A Register View, Register View of a Microprocessor
The Hardware Side: Storage Elements and Finite-State Machines (2 hour)
The concepts of State and Time, The State Diagram, Finite State Machines-A Theoretical Model. **8 Hrs**

UNIT 3:

Memories and the Memory Subsystem: Classifying Memory, A General Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, Terminology, A Memory Interface in Detail, SRAM Design, DRAM Design, DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Designing a Cache System, Dynamic Memory Allocation. **7 Hrs**

UNIT 4:

Embedded Systems Design and Development : System Design and Development, Life-cycle Models, Problem Solving-Five Steps to Design, The Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification, System Specifications versus System Requirements, Partitioning and Decomposing a System, Functional Design, Architectural Design, Functional Model versus Architectural Model, Prototyping, Other Considerations, Archiving the Project. **6 Hrs**

UNIT 5 & 6:

Real-Time Kernels and Operating Systems: Tasks and Things, Programs and Processes, The CPU is a resource, Threads – Lightweight and heavyweight, Sharing Resources, Foreground/Background Systems, The operating System, The real time operating system (RTOS), OS architecture, Tasks and Task control blocks, memory management revisited. **12 Hrs**

UNIT 7 & 8:

Performance Analysis and Optimization: Performance or Efficiency Measures, Complexity Analysis, The methodology, Analyzing code, Instructions in Detail, Time, etc. – A more detailed look, Response Time, Time Loading, Memory Loading, Evaluating Performance, Thoughts on Performance Optimization, Performance Optimization, Tricks of the Trade, Hardware Accelerators, Caches and Performance. **12 Hrs**

Text Book:

1. **Embedded Systems – A contemporary Design**

Tool, James K. Peckol, John Wiley India Pvt. Ltd, 2008

Reference Books:

1. **Embedded Systems: Architecture and Programming**, Raj Kamal, TMH, 2008
2. **Embedded Systems Architecture – A Comprehensive Guide for Engineers and Programmers**, Tammy Noergaard, Elsevier Publication, 2005
3. **Programming for Embedded Systems**, Dreamtech Software Team, John Wiley India Pvt. Ltd, 2008

VLSI LAB

Subject Code	: 10ECL77	IA Marks	: 25
No. of Practical Hrs/Week	: 03	Exam Hours	: 03
Total no. of Practical Hrs.	: 42	Exam Marks	: 50

(Wherever necessary Cadence/Synopsis/Menta Graphics tools must be used)

PART - A

DIGITAL DESIGN

ASIC-DIGITAL DESIGN FLOW

1. Write Verilog Code for the following circuits and their Test Bench for **verification**, observe the waveform and **synthesize** the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

1. An inverter
2. A Buffer
3. Transmission Gate
4. Basic/universal gates
5. Flip flop -RS, D, JK, MS, T
6. Serial & Parallel adder
7. 4-bit counter [Synchronous and Asynchronous counter]
8. Successive approximation register [SAR]

** An appropriate constraint should be given*

PART - B
ANALOG DESIGN

Analog Design Flow

1. Design an **Inverter** with given specifications*, completing the design flow mentioned below:
 - a. **Draw the schematic** and verify the following
 - i) DC Analysis
 - ii) Transient Analysis
 - b. **Draw the Layout** and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design
 - e. Verify & Optimize for Time, Power and Area to the given constraint***

2. Design the following circuits with given specifications*, completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii) AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.
 - i) A Single Stage differential amplifier
 - ii) Common source and Common Drain amplifier

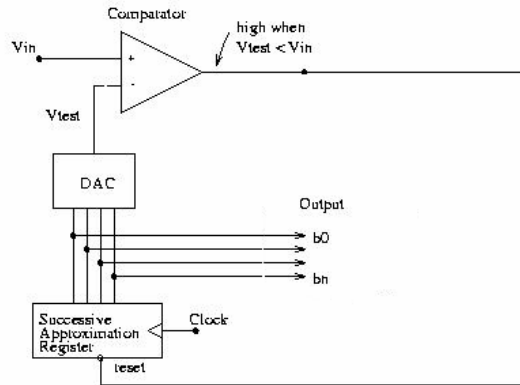
3. Design an **op-amp** with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:
 - a. Draw the schematic and verify the following
 - i) DC Analysis
 - ii). AC Analysis
 - iii) Transient Analysis
 - b. Draw the Layout and verify the DRC, ERC
 - c. Check for LVS
 - d. Extract RC and back annotate the same and verify the Design.

4. Design a **4 bit R-2R based DAC** for the given specification and completing the design flow mentioned using given op-amp in the library**.
 - a. Draw the schematic and verify the following

- i) DC Analysis
- ii) AC Analysis
- iii) Transient Analysis
- b. Draw the Layout and verify the DRC, ERC
- c. Check for LVS
- d. Extract RC and back annotate the same and verify the Design.

5. For the **SAR based ADC** mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW.

[Specifications to GDS-II]



- * Appropriate specification should be given.
- ** Applicable Library should be added & information should be given to the Designer.
- *** An appropriate constraint should be given

POWER ELECTRONICS LAB

Subject Code	: 10ECL78	IA Marks	: 25
No. of Practical Hrs/Week:	03	Exam Hours	: 03
Total no. of Practical Hrs. :	42	Exam Marks	: 50

Any five converter circuits experiment from the below list **must be** simulated using the **spice-simulator**.

- Static characteristics of SCR and DIAC.
- Static characteristics of MOSFET and IGBT.
- Controlled HWR and FWR using RC triggering circuit
- SCR turn off using i) LC circuit ii) Auxiliary Commutation
- UJT firing circuit for HWR and FWR circuits.
- Generation of firing signals for thyristors/ triacs using digital circuits / microprocessor.
- AC voltage controller using triac – diac combination.
- Single phase Fully Controlled Bridge Converter with R and R-L loads.
- Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
- Speed control of a separately excited DC motor.
- Speed control of universal motor.
- Speed control of stepper motor.
- Parallel / series inverter.

Note: Experiments to be conducted with isolation transformer and low voltage.

DSP ALGORITHMS AND ARCHITECTURE

Subject Code	: 10EC751	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: 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. **6 Hrs**

UNIT - 2

ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL-PROCESSORS: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing. **7 Hrs**

UNIT - 3

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Introduction,

Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS320C54xx., Memory Space of TMS320C54xx Processors, Program Control. **6 Hrs**

UNIT - 4

Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor. **7 Hrs**

UNIT - 5

IMPLEMENTATION OF BASIC DSP ALGORITHMS: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case). **7 Hrs**

UNIT - 6

IMPLEMENTATION OF FFT ALGORITHMS: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS320C54xx. **6 Hrs**

UNIT - 7

INTERFACING MEMORY AND PARALLEL I/O PERIPHERALS TO DSP DEVICES: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA). **6 Hrs**

UNIT - 8

INTERFACING AND APPLICATIONS OF DSP PROCESSOR: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System. **7 Hrs**

TEXT BOOK:

4. **“Digital Signal Processing”**, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

REFERENCE BOOKS:

1. **Digital Signal Processing: A practical approach**, Ifeachor E. C., Jervis B. W Pearson-Education, PHI/ 2002
2. **“Digital Signal Processors”**, B Venkataramani and M Bhaskar TMH, 2nd, 2010
3. **“Architectures for Digital Signal Processing”**, Peter Pirsch John Wiley, 2008

MICRO AND SMART SYSTEMS TECHNOLOGY

Subject Code	: 10MS752	IA Marks	: 25
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 52	Exam Marks	: 10
			0

UNIT - 1

INTRODUCTION TO MICRO AND SMART SYSTEMS:

- What are smart-material systems? Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products.
- What are microsystems? Feynman's vision. Micromachined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects. Applications areas. Commercial products.

6 Hrs

UNIT - 2

MICRO AND SMART DEVICES AND SYSTEMS: PRINCIPLES AND MATERIALS:

- Definitions and salient features of sensors, actuators, and systems.
- Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conductometric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor.
- Actuators: silicon micro-mirror arrays, piezo-electric based inkjet print-head, electrostatic comb-drive and micromotor, magnetic micro relay, shape-memory-alloy based actuator, electro-thermal actuator.
- Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin.

7 Hrs

UNIT - 3

MICROMANUFACTURING AND MATERIAL PROCESSING:

- Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization.
- Silicon micromachining: surface, bulk, moulding, bonding based process flows.
- Thick-film processing:
- Smart material processing:
- Processing of other materials: ceramics, polymers and metals
- Emerging trends.

7 Hrs

UNIT - 4

MODELING:

- a. Scaling issues.
- b. Elastic deformation and stress analysis of beams and plates. Residual stresses and stress gradients. Thermal loading. Heat transfer issues. Basic fluids issues.
- c. Electrostatics. Coupled electromechanics. Electromagnetic actuation. Capillary electro-phoresis. Piezoresistive modeling. Piezoelectric modeling. Magnetostrictive actuators.

6 Hrs

UNIT - 5

COMPUTER-AIDED SIMULATION AND DESIGN:

Background to the finite element method. Coupled-domain simulations using Matlab. Commercial software.

6 Hrs

UNIT - 6

ELECTRONICS, CIRCUITS AND CONTROL:

Carrier concentrations, semiconductor diodes, transistors, MOSFET amplifiers, operational amplifiers. Basic Op-Amp circuits. Charge-measuring circuits. Examples from microsystems. Transfer function, state-space modeling, stability, PID controllers, and model order reduction. Examples from smart systems and micromachined accelerometer or a thermal cyler.

7 Hrs

UNIT - 7

INTEGRATION AND PACKAGING OF MICROELECTRO MECHANICAL SYSTEMS:

Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low-temperature-cofired-ceramic (LTCC) multi-chip-module technology. Microsystem packaging examples.

7 Hrs

UNIT - 8

CASE STUDIES:

BEL pressure sensor, thermal cyler for DNA amplification, and active vibration control of a beam.

6 Hrs

UNIT - 9

Mini-projects and class-demonstrations (not for Examination)

- a) CAD lab (coupled field simulation of electrostatic-elastic actuation with fluid effect)

- b) BEL pressure sensor
- c) Thermal-cycler for PCR
- d) Active control of a cantilever beam

TEXT BOOKS AND A CD-SUPPLEMENT:

- 1. **MEMS & Microsystems: Design and Manufacture**, Tai-Ran Tsu, Tata Mc-Graw-Hill.
- 2. **“Micro and Smart Systems”** by Dr. A.K.Aatre, Prof. Ananth Suresh, Prof.K.J.Vinoy, Prof. S. Gopalakrishna,, Prof. K.N.Bhat.,John Wiley Publications.

REFERENCE BOOKS:

- 2. Animations of working principles, process flows and processing techniques, A CD-supplement with Matlab codes, photographs and movie clips of processing machinery and working devices.
- 3. **Laboratory hardware kits for** (i) BEL pressure sensor, (ii) thermal-cycler and (iii) active control of a cantilever beam.
- 1. **Microsystems Design**, S. D. Senturia, 2001, Kluwer Academic Publishers, Boston, USA. ISBN 0-7923-7246-8.
- 2. **Analysis and Design Principles of MEMS Devices**, Minhang Bao, Elsevier, Amsterdam, The Netherlands, ISBN 0-444-51616-6.
- 3. **Design and Development Methodologies**, Smart Material Systems and MEMS: V. Varadan, K. J. Vinoy, S. Gopalakrishnan, Wiley.
- 4. **MEMS-** Nitaigour Premchand Mahalik, TMH 2007

ARTIFICIAL NEURAL NETWORKS

Subject Code	: 10EC753	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction, history, structure and function of single neuron, neural net architectures, neural learning, use of neural networks. **6 Hrs**

UNIT - 2

Supervised learning, single layer networks, perceptions, linear separability, perceptions training algorithm, guarantees of success, modifications. **7 Hrs**

UNIT - 3

Multiclass networks-I, multilevel discrimination, preliminaries, back propagation, setting parameter values, theoretical results. **7 Hrs**

UNIT - 4

Accelerating learning process, application, mandaline, adaptive multilayer networks. **6 Hrs**

UNIT - 5

Prediction networks, radial basis functions, polynomial networks, regularization, unsupervised learning, winner take all networks. **6 Hrs**

UNIT - 6

Learning vector quantizing, counter propagation networks, adaptive resonance theorem, topologically organized networks, distance based learning, neo-cognition. **7 Hrs**

UNIT - 7

Associative models, hop field networks, brain state networks, Boltzmann machines, hetero associations. **6 Hrs**

UNIT - 8

Optimization using hop filed networks, simulated annealing, random search, evolutionary computation. **7 Hrs**

TEXT BOOK:

1. **Elements of Artificial Neural Networks**, Kishan Mehrotra, C. K. Mohan, Sanjay Ranka, Penram, 1997.

REFERENCE BOOKS:

1. **Artificial Neural Networks**, R. Schalkoff, MGH, 1997.
2. **Introduction to Artificial Neural Systems**, J. Zurada, Jaico, 2003.
3. **Neural Networks**, Haykins, Pearson Edu., 1999.

CAD FOR VLSI

Subject Code	: 10EC754	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT – 1&2

INTRODUCTION TO VLSI METHODOLOGIES: VLSI Physical Design Automation - Design and Fabrication of VLSI Devices - Fabrication process and its impact on Physical Design. **12 Hrs**

UNIT – 3&4

A QUICK TOUR OF VLSI DESIGN AUTOMATION TOOLS: Data structures and Basic Algorithms, Algorithmic Graph theory and computational complexity, Tractable and Intractable problems. **14 Hrs**

UNIT – 5&6

GENERAL PURPOSE METHODS FOR COMBINATIONAL OPTIMIZATION: partitioning, floor planning and pin assignment, placement, routing. **14 Hrs**

UNIT – 7&8

SIMULATION-LOGIC SYNTHESIS: Verification-High level synthesis - Compaction. Physical Design Automation of FPGAs, MCMS-VHDL-Verilog-Implementation of Simple circuits using VHDL and Verilog. **12 Hrs**

REFERENCE BOOKS:

1. **“Algorithms for VLSI Physical Design Automation”**, N. A. Shervani, 1999.
2. **“Algorithms for VLSI Design Automation”**, S. H. Gerez, 1998.

APPLIED EMBEDDED SYSTEM DESIGN

Subject Code	: 10EC755	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

PART-A

Unit 1. Introduction to the Embedded Systems:

An embedded System, Processor embedded into a system (A). Embedded Hardware Units and devices in a system, Embedded software in a system, Examples of embedded systems, Embedded system-on-chip (SoC) and use of VLSI circuits design technology (A), Complex systems design and processors, Design process in embedded system, Formalism of system design, Design process and design examples, Classification of embedded systems. Skills required for an embedded system designer. **5**

Hours

Unit 2. 8051 and Advanced Processor Architecture:

8051 Architecture, Real world interfacing, Introduction to advanced architecture
Processor and memory architecture, Instruction level parallelism, Performance metrics
Memory types and addresses, Processor selection, Memory selection
5 Hours

Unit 3. Devices and Communication Buses for Devices Network:

Devices and Communication buses for Networks, Serial communication devices
Parallel port devices, Sophisticated interfacing features in device ports, Wireless communication devices, Timer and counting devices, Watchdog timers, Real time clocks
Parallel bus device protocols – parallel communication network using the ISA, PCI, PCI-X and advanced buses, Wireless and mobile system protocols.
6 Hours

Unit 4. Device drivers and interrupts servicing mechanism:

Port or device access without interrupt servicing mechanism, Interrupt service routine, thread and device driver concept, Interrupt sources, Interrupt servicing (handling) mechanism

Multiple interrupts, Context and the periods for context-switching, interrupt latency and
Deadline Classification of processors interrupt service mechanism from context saving angle
Direct memory access, Device driver programming, Parallel port device drivers in a system
Serial port device drivers in a system, Timer devices and devices interrupts
8 Hours

PART-B

Unit 5. Programming concepts and embedded programming in C, C++ and Java:

Software programming in assembly language (ALP) and in high level language 'C'

'C' programming elements: header and source files and preprocessor directives

Program elements : macros and functions, Program elements: data types, data structures,

modifiers, statements, loops and pointers, Objected oriented programming

Embedded programming in Java, Optimisation of Memory needs.

5 Hours

Unit 6. Program modeling concepts in single and multiprocessor systems software – development process:

Program models, Data flow graph models, State machine programming models for event

controlled programs, Modeling of multiprocessor systems, UML modeling
5 Hours

Unit 7. Real time operating systems – I: Inter process communication and synchronization of processes, Task and Threads):

Multiple processes in an application, Multiple threads in an applications, Task

Tasks and states, Tasks and data, Clear cut distinction between Functions, ISRs and Tasks by

their Characteristics, Concept of semaphores, Shared data, Inter process communications

Signals, Semaphores, Message queues, Mailboxes, Pipes, Sockets,
Remote procedure calls
(RPCs).

8 Hours

Unit 8. Real time operating systems:

Operating system service, Process management, Timer
functions, Event functions,
Memory management, Device, file and IO subsystems management
Interrupt routines in RTOS environment and handling of interrupt
source calls by RTOS
Introduction to Real Time Operating System, Basic design using a
Real Time Operating
System, RTOS Task Scheduling Models, Latency, Response Times,
Deadline as Performance
Metric, OS security issues, IEEE Standard POSIX 1003.1b Functions
for Standardisation of
RTOS and Inter Process Communication Functions, Types of Real
Time Operating Systems
RTOS μ C/OS-II, RTOS Vx Works.

10 Hours

TEXTBOOK

Embedded System Architecture & Programming by Raj Kamal, TMH,
2008 (latest edition).

REFERENCE BOOKS

12. **Introduction to Embedded System Design – A certified Hardware / Software** by Bank Vahid, John Wikey & Sons, 2002.
13. **An embedded Software Primer** by David E Simon, Pearson Edition 1999.

Lab Work:(Part of the theory class)

5. Write C prog to initialise the I/O ports and interface the following:
 - a. LED / LCD Display
 - b. Stepper Motor
 - c. Elevator

- d. Dot – matrix Printer.
6. Write C Prog using ADC/DAC to perform various conversions.
7. Write C Prog for delay using in-built timer.
8. Write C prog for serial-communication using in-built 8251.
9. Write C prog for Scheduling algorithms like FIFO, SJF and Round-Robin
10. Implement Real-Time deadline algorithms.
11. Write C Prog. to control I/O devices (hard disk, speaker, etc).
12. Write C Prog to test the functions of Semaphore, Mutex, Lock etc.
13. Write C Prog to communicate between processes using Pipe, Send() & Recev(), IPC().
14. Write C Prog to perform matrix multiplication using pthreads.

Embedded Systems : Architecture, Programming, and Design,
Raj Kamal, 2nd Edn. TMH, 2008.

REFERENCE BOOKS:

1. **Embedded System Design – A certified Hardware / Software Introduction**, Frank Vahid, John Wikey & Sons, 2002.
2. **An embedded Software Primer** by David E Simon, Pearson Edition 1999.

SPEECH PROCESSING

Subject Code	: 10EC756	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

PRODUCTION AND CLASSIFICATION OF SPEECH SOUNDS:

Introduction, mechanism of speech production. Acoustic phonetics: vowels, diphthongs, semivowels, nasals, fricatives, stops and affricates. **6 Hrs**

UNIT - 2

TIME-DOMAIN METHODS FOR SPEECH PROCESSING:

time dependent processing of speech, short-time energy and average magnitude, short-time average zero crossing rate. **6 Hrs**

UNIT - 3

Speech vs. silence detection, pitch period estimation using parallel processing approach, short-time autocorrelation function. **7 Hrs**

UNIT - 4

Brief Applications of temporal processing of speech signals in synthesis, enhancement, hearing applications and clear speech. **7 Hrs**

UNIT - 5

FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING: Introduction, definitions and properties: Fourier transforms interpretation and linear filter interpretation, sampling rates in time and frequency. **7 Hrs**

UNIT - 6

Filter bank summation and overlap add methods for short-time synthesis of speech, sinusoidal and harmonic plus noise method of analysis/synthesis. **6 Hrs**

UNIT - 7

HOMOMORPHIC SPEECH PROCESSING: Introduction, homomorphic system for convolution, the complex cepstrum of speech, homomorphic vocoder. **6 Hrs**

UNIT - 8

APPLICATIONS OF SPEECH PROCESSING: Brief applications of speech processing in voice response systems hearing aid design and recognition systems. **7 Hrs**

TEXT BOOK:

1. **Digital Processing of Speech Signals**, L. R. Rabiner and R. W. Schafer, Pearson Education Asia, 2004.

REFERENCE BOOKS:

15. **Discrete Time Speech Signal Processing**, T. F. Quatieri, Pearson Education Asia, 2004.

16. **Speech and Audio Signal Processing: Processing and Perception of Speech and Music**, B. Gold and N. Morgan, John Wiley India Pvt. Ltd, 2004.

**ELECTIVE-3 (GROUP-C)
PROGRAMMING IN C++**

Subject Code	: 10EC761	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

C++, AN OVERVIEW: Getting started, the C++ program, Preprocessor Directives, The Built-In Array Data Type, Dynamic Memory Allocation and Pointers, An Object – based Design, An Object-Oriented Design, An Exception – based Design, An array. **7 Hrs**

UNIT - 2

THE BASIC LANGUAGE: Literal Constant, Variables, Pointer Type, String Types, const Qualifier, Reference Types, the bool type, Enumeration types, Array types. The vector container type. **6 Hrs**

UNIT - 3

OPERATORS: Arithmetic Operators, Equality, Relational and Logical operators, Assignment operators, Increment and Decrement operator, The conditional Operator, Bitwise operator, bitset operations. Statements: if, switch, for Loop, while, break, goto, continue statements. **7 Hrs**

UNIT - 4

FUNCTIONS: Prototype, Argument passing, Recursion and linear function. **6 Hrs**

UNIT - 5

EXCEPTION HANDLING: Throwing an Exception, Catching an exception, Exception Specification and Exceptions and Design Issues. **7 Hrs**

UNIT - 6

CLASSES: Definition, Class Objects, Class Initialization, Class constructor, The class destructor, Class Object Arrays and Vectors. **7 Hrs**

UNIT - 7

Overload Operators, Operators ++ and --, Operators new and delete.

6 Hrs

UNIT - 8

Multiple Inheritances, public, private & protected inheritance, Class scope under Inheritance.

6 Hrs

TEXT BOOK:

1. **C++ Primer**, S. B. Lippman & J. Lajoie, 3rd Edition, Addison Wesley, 2000.

REFERENCE BOOKS:

1. **C++ Program Design: An Introduction to Programming and Object- Oriented Design**. Cohoon and Davidson, 3rd Edn. TMH publication. 2004.
2. **Object Oriented Programming using C++**, R. Lafore, Galgotia Publications, 2004.

REAL-TIME SYSTEMS

Subject Code	: 10EC762	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO REAL-TIME SYSTEMS: Historical background, RTS Definition, Classification of Real-time Systems, Time constraints, Classification of Programs.

6 Hrs

UNIT - 2

CONCEPTS OF COMPUTER CONTROL: Introduction, Sequence Control, Loop control, Supervisory control, Centralised computer control, Distributed system, Human-computer interface, Benefits of computer control systems.

6 Hrs

UNIT - 3

COMPUTER HARDWARE REQUIREMENTS FOR RTS: Introduction, General purpose computer, Single chip microcontroller, Specialized processors, Process-related Interfaces, Data transfer techniques, Communications, Standard Interface. **7 Hrs**

UNIT - 4

LANGUAGES FOR REAL-TIME APPLICATIONS: Introduction, Syntax layout and readability, Declaration and Initialization of Variables and Constants, Modularity and Variables, Compilation, Data types, Control Structure, Exception Handling, Low-level facilities, Co routines, Interrupts and Device handling, Concurrency, Real-time support, Overview of real-time languages. **7 Hrs**

UNIT - 5 & 6

OPERATING SYSTEMS: Introduction, Real-time multi-tasking OS, Scheduling strategies, Priority Structures, Task management, Scheduler and real-time clock interrupt handles, Memory Management, Code sharing, Resource control, Task co-operation and communication, Mutual exclusion, Data transfer, Liveness, Minimum OS kernel, Examples. **14 Hrs**

UNIT - 7

DESIGN OF RTSS – GENERAL INTRODUCTION: Introduction, Specification documentation, Preliminary design, Single-program approach, Foreground/background, Multi-tasking approach, Mutual exclusion, Monitors. **6 Hrs**

UNIT - 8

RTS DEVELOPMENT METHODOLOGIES: Introduction, Yourdon Methodology, Requirement definition for Drying Oven, Ward and Mellor Method, Hatley and Pirbhai Method. **6 Hrs**

TEXT BOOKS:

4. **Real - Time Computer Control- An Introduction**, Stuart Bennet, 2nd Edn. Pearson Education. 2005.

REFERENCE BOOKS:

1. **Real-Time Systems Design and Analysis**, Phillip. A. Laplante, second edition, PHI, 2005.
2. **Real-Time Systems Development**, Rob Williams, Elsevier. 2006.
3. **Embedded Systems**, Raj Kamal, Tata Mc Graw Hill, India, 2005.

IMAGE PROCESSING

Subject Code	: 10EC763	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

DIGITAL IMAGE FUNDAMENTALS: What is Digital Image Processing. fundamental Steps in Digital Image Processing, Components of an Image processing system, elements of Visual Perception. **6 Hrs**

UNIT - 2

Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations. **6 Hrs**

UNIT - 3

IMAGE TRANSFORMS: Two-dimensional orthogonal & unitary transforms, properties of unitary transforms, two dimensional discrete Fourier transform. **7 Hrs**

UNIT - 4

Discrete cosine transform, sine transform, Hadamard transform, Haar transform, Slant transform, KL transform. **7 Hrs**

UNIT - 5

IMAGE ENHANCEMENT: Image Enhancement in Spatial domain, Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations. **7 Hrs**

UNIT - 6

Basics of Spatial Filtering Image enhancement in the Frequency Domain filters, Smoothing Frequency Domain filters, Sharpening Frequency Domain filters, homomorphic filtering. **6 Hrs**

UNIT - 7

Model of image degradation/restoration process, noise models, Restoration in the Presence of Noise, Only-Spatial Filtering Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, inverse filtering, minimum mean square error (Weiner) Filtering, **7 Hrs**

UNIT - 8

Color Fundamentals. Color Models, Pseudo color Image Processing., processing basics of full color image processing

6 Hrs

TEXT BOOK:

1. **“Digital Image Processing”**, Rafael C.Gonzalez, Richard E. Woods, etl , TMH , 2nd Edition 2010.

REFERENCE BOOKS:

1. **“Fundamentals of Digital Image Processing”**, Anil K. Jain, Pearson Education, 2001.
2. **“Digital Image Processing and Analysis”**, B. Chanda and D. Dutta Majumdar, PHI, 2003.

RADIO FREQUENCY INTEGRATED CIRCUITS

Subject Code	: 10EC764	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

OVERVIEW OF WIRELESS PRINCIPLES: A brief history of wireless systems, Noncellular wireless applications, Shannon, Modulations & Alphabet Soup, Propagation. **3 Hrs**

PASSIVE RLC NETWORKS: Introduction, Parallel RLC Tank, Series RLC Networks, Other RLC networks, RLC Networks as impedance Transformers. **4 Hrs**

UNIT - 2

CHARACTERISTICS OF PASSIVE IC COMPONENTS: Introduction, Interconnect at radio frequencies: Skin effect, resistors, Capacitors, Inductors, Transformers, Interconnect options at high frequency. **6 Hrs**

UNIT - 3

A REVIEW OF MOS DEVICE PHYSICS: Introduction, A little history, FETs, MOSFET physics, The long – channels approximation, operation in weak inversion (sub threshold), MOS device physics in the short – channel regime, Other effects. **3 Hrs**

DISTRIBUTED SYSTEMS: Introduction, Link between lumped and distributed regimes driving-point impedance of iterated structures, Transmission lines in more detail, Behavior of Finite – length transmission lines, summary of transmission line equations, artificial lines. **4 Hrs**

UNIT - 4

THE SMITH CHART AND S-PARAMETERS: Introduction, The smith chart, S-parameters, Band Width Estimation Techniques, Introduction, The method of open – circuit time constant, The method of short circuit time constant, Risetime, Delay and bandwidth. **6 Hrs**

UNIT - 5

HIGH FREQUENCY AMPLIFIER DESIGN: Introduction, Zeros as bandwidth Enhancers, The shunt –series amplifier, Bandwidth Enhancement with f_T Doublers, Tuned amplifiers, Neutralization and unilateralization, Cascaded amplifiers, AM – PM conversion. **7 Hrs**

UNIT - 6

VOLTAGE REFERENCES AND BIASING: Introduction, Review of diode behavior, Diodes and bipolar transistors in CMOS technology, Supply –independent bias circuits, Bandgap voltage reference, Constant g_m bias. **Noise:** Introduction, Thermal noise, Shot noise, Flicker noise, Popcorn noise, Classical two- port noise theory, Examples of noise calculations, A handy rule of thumb, Typical noise performance. **6 Hrs**

UNIT - 7

LOW NOISE AMPLIFIER DESIGN: Introduction, Derivation of intrinsic MOSFET two-port noise parameters, LNA topologies: Power match versus noise match, Power-constrained noise optimization, Design examples, linearity and large signal performance, Spurious – free Dynamic range. **Mixers:** Introduction, Mixer fundamental, Nonlinear systems as linear mixers. **7 Hrs**

UNIT - 8

Multiplier – based mixers, Sub sampling mixers, Diode ring mixers, RF power amplifiers, Introduction, general considerations, Class A, AB, B and C power amplifier, Class D amplifiers, Class E amplifiers Class F amplifiers, Modulation of power amplifiers, summary of PA characteristics, RF PA design examples, additional design considerations, Design summery. **7 Hrs**

TEXT BOOK:

1. **The design of CMOS radio-frequency integrated circuit**, Thomas H. Lee, 2nd edition Cambridge, 2004.

REFERENCE BOOK:

1. **Design of Analog CMOS integrated circuit**, Behzad Razavi, Tata Mc Graw Hill, 2005.

WAVELET TRANSFORMS

Subject Code	: 10EC765	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

CONTINUOUS WAVELET TRANSFORM: Introduction, C-T wavelets, Definition of CWT, The CWT as a correlation. Constant Q-Factor Filtering Interpolation and time frequency resolution, the CWT as an operator, inverse CWT. **6 Hrs**

UNIT - 2

INTRODUCTION TO DISCRETE WAVELET TRANSFORM AND ORTHOGONAL WAVELET DECOMPOSITION: Introduction. Approximation of vectors in nested linear vector spaces, (i) example of approximating vectors in nested subspaces of a finite dimensional linear vector space, (ii) Example of approximating vectors in nested subspaces of an infinite dimensional linear vector space. Example MRA. (i) Bases for the approximations subspaces and Harr scaling function, (ii) Bases for detail subspaces and Haar wavelet. **7 Hrs**

UNIT - 3

MRA, ORTHO NORMAL WAVELETS AND THEIR RELATIONSHIP TO FILTER BANKS: Introduction, Formal definition of an MRA. Construction of a general orthonormal MRA, (i) scaling function and subspaces, (ii) Implication of dilation equation and orthogonality, a wavelet basis for MRA. (i) Two scale relations for (t), (ii) Basis for the detail subspace (iii) Direct sum decomposition, Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal. **7 Hrs**

UNIT - 4

EXAMPLES OF WAVELETS: Examples of orthogonal basis generating wavelets, (i) Daubechies D_4 scaling function and wavelet. (ii) band limited wavelets, Interpreting orthonormal MRAs for Discrete time MRA, (iii) Basis functions for DTWT. **6 Hrs**

UNIT - 5

ALTERNATIVE WAVELET REPRESENTATIONS: Introduction, Bi-orthogonal wavelet bases, Filtering relationship for bi-orthogonal filters, Examples of bi-orthogonal scaling functions and wavelets. 2-D wavelets.

6 Hrs

UNIT - 6

Non - separable multidimensional wavelets, wavelet packets. Wavelets Transform and Data Compression: Introduction, transform coding, DTWT for image compression (i) Image compression using DTWT and run-length encoding.

7 Hrs

UNIT - 7

(i) Embedded tree image coding (ii) compression with JPEG audio compression (iii) Audio masking, (iv) Wavelet based audio coding.

6 Hrs

UNIT - 8

CONSTRUCTION OF SIMPLE WAVELETS: Construction of simple wavelets like Harr and DB1. Other Applications of Wavelet Transforms: Introduction, wavelet de-noising, speckle removal, edge detection and object isolation, Image fusions, Object detection by wavelet transforms of projections.

7 Hrs

TEXT BOOK:

6. **Wavelet transforms- Introduction to theory and applications**, Raghuvver M.Rao and Ajit S. Bapardikar, Person Education, 2000.

REFERENCE BOOKS:

3. **Wavelet transforms**, Prasad and Iyengar, John Wiley India Pvt. Ltd, 2007.
4. **Wave-let and filter banks**, Gilbert Strang and Nguyen Wellesley Cambridge press, 1996
5. **Insight into WAVELETS from theory to practice**, K.P. Soman and K.L. Ramchandran, Eastern Economy Edition, 2008

MODELING AND SIMULATION OF DATA NETWORKS

Subject Code	: 10EC766	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT – 1&2

DELAY MODELS IN DATA NETWORKS: Queuing Models, M/M/1, M/M/m, M/M/□, M/M/m/m and other Markov System, M/G/1 System, Networks of Transmission Lines, Time Reversibility, Networks of Queues.

12 Hrs

UNIT – 3&4

MULTI-ACCESS COMMUNICATION: Slotted Multi-access and the Aloha System, Splitting Algorithms, Carrier Sensing, Multi-access Reservations, Packet Radio Networks.

12 Hrs

UNIT – 5&6

ROUTING IN DATA NETWORKS: Introduction, Network Algorithms and Shortest Path Routing, Broadcasting Routing Information: Coping with Link Failures, Flow models, Optimal Routing, and Topological Design, Characterization of Optimal Routing, Feasible Direction Methods for Optimal Routing, Projection Methods for Optimum Routing, Routing in the Codex Network.

14 Hrs

UNIT – 7&8

FLOW CONTROL: Introduction, Window Flow Control, Rate Control Schemes, Overview of Flow Control in Practice, Rate Adjustment Algorithms.

14 Hrs

REFERENCE BOOKS:

1. **"Data Networks"** Dimitri Bertsekas and Robert Gallager, 2nd edition, Prentice Hall of India, 2003.

2. **“High-Speed Networks and Internets”** William Stallings, Pearson Education (Asia) Pte. Ltd, 2004.
3. **“High Performance Communication Networks”** J. Walrand and P. Varaya, 2nd edition, Harcourt India Pvt. Ltd. & Morgan Kaufman, 2000.

VIII SEMESTER

WIRELESS COMMUNICATION

Subject Code	: 10EC81	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Introduction to wireless telecommunication systems and Networks, History and Evolution Different generations of wireless cellular networks 1G, 2g,3G and 4G networks.

6 Hrs

UNIT - 2

Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components, Cellular component identification Call establishment.

7 Hrs

UNIT - 3

Wireless network architecture and operation, Cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security.

7 Hrs

UNIT - 4

GSM and TDMA techniques, GSM system overview, GSM Network and system Architecture, GSM channel concepts, GSM identifiers

6 Hrs

UNIT - 5

GSM system operation, Traffic cases, Cal handoff, Roaming, GSM protocol architecture. TDMA systems.

6 Hrs

UNIT - 6

CDMA technology, CDMA overview, CDMA channel concept CDMA operations.

6 Hrs

UNIT - 7

Wireless Modulation techniques and Hardware, Characteristics of air interface, Path loss models, wireless coding techniques, Digital modulation techniques, OFDM, UWB radio techniques, Diversity techniques, Typical GSM Hardware. **7 Hrs**

UNIT - 8

Introduction to wireless LAN 802.11X technologies, Evolution of Wireless LAN Introduction to 802.15X technologies in PAN Application and architecture Bluetooth Introduction to Broadband wireless MAN, 802.16X technologies. **7 Hrs**

TEXT BOOK:

1. **Wireless Telecom Systems and networks**, Mullet: Thomson Learning 2006.

REFERENCE BOOKS:

1. **Mobile Cellular Telecommunication**, Lee W.C.Y, MGH, 2nd, 2009.
2. **Wireless communication** - D P Agrawal: 2nd Edition Thomson learning 2007.
3. **Fundamentals of Wireless Communication**, David Tse, Pramod Viswanath, Cambridge 2005.
4. S. S. Manvi, M. S. Kakkasageri, **“Wireles and Mobile Network concepts and protocols”**, John Wiley India Pvt. Ltd, 1st edition, 2010.
5. **“Wireless Communication – Principles & Practice”**, T.S. Rappaport, PHI 2001.

DIGITAL SWITCHING SYSTEMS

Subject Code	: 10EC82	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Developments of telecommunications, Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, Power levels, Four wire circuits, Digital transmission, FDM, TDM, PDH and SDH, Transmission performance.

7 Hrs

UNIT - 2

EVOLUTION OF SWITCHING SYSTEMS: Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching, Digital switching systems.

6 Hrs

DIGITAL SWITCHING SYSTEMS: Fundamentals : Purpose of analysis, Basic central office linkages, Outside plant versus inside plant, Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, Basic call processing.

7 Hrs

UNIT - 3

TELECOMMUNICATIONS TRAFFIC: Introduction, Unit of traffic, Congestion, Traffic measurement, Mathematical model, lost call systems, Queuing systems.

6 Hrs

UNIT - 4

SWITCHING SYSTEMS: Introduction, Single stage networks, Gradings, Link Systems, GOS of Linked systems.

6 Hrs

UNIT - 5

TIME DIVISION SWITCHING: Introduction, space and time switching, Time switching networks, Synchronisation.

6 Hrs

UNIT - 6

SWITCHING SYSTEM SOFTWARE: Introduction, Scope, Basic software architecture, Operating systems, Database Management, Concept of generic program, Software architecture for level 1 control, Software architecture for level 2 control, Software architecture for level 3 control, Digital switching system software classification, Call models, Connect sequence, Software linkages during call, Call features, Feature flow diagram, Feature interaction. **7 hrs**

UNIT - 7

MAINTENANCE OF DIGITAL SWITCHING SYSTEM: Introduction, Scope, Software maintenance, Interface of a typical digital switching system central office, System outage and its impact on digital switching system reliability, Impact of software patches on digital switching system maintainability, Embedded patcher concept, Growth of digital switching system central office, Generic program upgrade, A methodology for proper maintenance of digital switching system, Effect of firmware deployment on digital switching system, Firmware-software coupling, Switching system maintainability metrics, Upgrade process success rate, Number of patches applied per year, Diagnostic resolution rate, Reported critical and major faults corrected, A strategy improving software quality, Program for software process improvement, Software processes improvement, Software processes, Metrics, Defect analysis, Defect analysis. **7 Hrs**

UNIT - 8

A GENERIC DIGITAL SWITCHING SYSTEM MODEL: Introduction, Scope, Hardware architecture, Software architecture, Recovery strategy, Simple call through a digital system, Common characteristics of digital switching systems. Analysis report. Reliability analysis. **6 Hrs**

TEXT BOOKS:

1. **Telecommunication and Switching, Traffic and Networks** - J E Flood: Pearson Education, 2002.
2. **Digital Switching Systems**, Syed R. Ali, TMH Ed 2002.

REFERENCE BOOK:

1. **Digital Telephony** - John C Bellamy: Wiley India India Pvt. Ltd, 3rd Ed, 2008.

ELECTIVE –4 (GROUP D)
DISTRIBUTED SYSTEM

Subject Code	: 10EC831	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

CHARACTERIZATION OF DISTRIBUTED SYSTEMS: Introduction, Examples of distributed systems, Resource sharing and the web, Challenges.

7 Hrs

UNIT - 2

SYSTEM MODELS: Introduction, Architectural models, Fundamental mode.

6 Hrs

UNIT - 3

INTERPROCESS COMMUNICATION: Introduction, The API for the internet protocols, External data representation and marshalling, Client-server communication, Group communication.

7 Hrs

UNIT - 4

DISTRIBUTED OBJECTS AND REMOTE INVOCATION: Introduction, Communication between distributed objects, Remote procedure call, Events and notifications.

6 Hrs

UNIT - 5

SECURITY: Introduction, Overview of security technique cryptographic algorithms, Digital signature, Cryptography pragmatics.

7 Hrs

UNIT - 6

TIME & GLOBAL STATES: Introduction, Clocks, Events, Process states, Synchronizing physical clocks, Global states, Distributed debugging.

7 Hrs

UNIT - 7

COORDINATION AND AGREEMENT: Distributed mutual exclusion, Elections, Multicast communication.

6 Hrs

UNIT - 8

CORBA CASE STUDY: Introduction, CORBA RMI, CORBA Services.

6 Hrs

TEXT BOOK:

5. **“Distributed Systems, Concepts & Design”**, George Coulouris, Jean Dollimore, Tim Kindberg, fourth edition, 2006. Pearson education.

REFERENCE BOOK:

7. **“Distributed System Architecture, a Middleware Approach”** Arno puder, Kay Romer, Frank Pilhofer, Morgan Kaufmann publishers.

NETWORK SECURITY

Subject Code	: 10EC832	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

Services, mechanisms and attacks, The OSI security architecture, A model for network security.

6 Hrs

UNIT - 2

SYMMETRIC CIPHERS: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Simplified DES, Data encryption standard (DES), The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.

7 Hrs

UNIT - 3

Principles of Public-Key Cryptasystems, The RSA algorithm, Key Management, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Authentication functions, Hash Functions. **6 Hrs**

UNIT - 4

Digital signatures, Authentication Protocols, Digital Signature Standard. **7 Hrs**

UNIT - 5

Web Security Consideration, Security socket layer (SSL) and Transport layer security, Secure Electronic Transaction. **6 Hrs**

UNIT - 6

Intruders, Intrusion Detection, Password Management. **6 Hrs**

UNIT - 7

MALICIOUS SOFTWARE: Viruses and Related Threats, Virus Countermeasures. **7 Hrs**

UNIT - 8

Firewalls Design Principles, Trusted Systems. **6 Hrs**

TEXT BOOK:

1. **Cryptography and Network Security**, William Stallng, Pearson Education, 2003.

REFERENCE BOOKS:

1. **Cryptography and Network Security**, Behrouz A. Forouzan, TMH, 2007.
2. **Cryptography and Network Security**, Atul Kahate, TMH, 2003.

OPTICAL NETWORKS

Subject Code	: 10EC833	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION TO OPTICAL NETWORKS: Telecommunication networks, First generation optical networks, Multiplexing techniques, Second generation optical networks, System and network evolution. Non linear effects SPM, CPM, four wave mixing, Solitons. **7 Hrs**

UNIT - 2

COMPONENTS: Couplers, isolators and Circulators, Multiplexes and filters Optical amplifiers. **6 Hrs**

UNIT - 3

Transmitters, detectors, Switches, Wavelength converters. **6 Hrs**

UNIT - 4

TRANSMISSION SYSTEM ENGINEERING: System model, Power penalty, Transmitter, receiver, optical amplifiers, Crosstalk, Dispersion, Overall design Consideration. **7 Hrs**

UNIT - 5

FIRST GENERATION NETWORKS: SONET/SDH, Computer interconnects, Mans, Layered architecture for SONET and second generation networks. **6 Hrs**

UNIT - 6

WAVELENGTH ROUTING NETWORKS: Optical layer, Node design, Network design and operation, routing and wavelength assignment architectural variations. **6 Hrs**

UNIT - 7

VIRTUAL TOPOLOGY DESIGN: Virtual topology design problem, Combines SONET/WDM network design, an ILP formulation, Regular virtual topologies, Control and management, Network management configuration management, Performance management, fault management.

7 Hrs

UNIT - 8

ACCESS NETWORKS: Network architecture overview, present and future access networks, HFC, FTTC, Optical access networks Deployment considerations, Photonic packet switching, OTDM, Multiplexing and demultiplexing Synchronisation.

7 Hrs

TEXT BOOK:

3. **Optical networks: A practical perspective** Kumar Sivarajan and Rajiv Ramaswamy: Morgan Kauffman 1998.

REFERENCE BOOKS:

14. **Optical Communication Networks:** Biswajit Mukherjee: TMG 1998.
15. **Optical Networks,** Ulysees Black: Pearson education 2007.

HIGH PERFORMANCE COMPUTER NETWORKS

Subject Code	: 10EC834	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

History of Communication Networks, Networking principles, Future networks Internet, Pure TAM Network, Cable Network, Wireless.

6 Hrs

UNIT - 2

NETWORK SERVICES AND LAYERED ARCHITECTURE: Applications, Traffic characterization and quality of services, Network

services, High performance networks, Network Elements., Layered applications, Open data network model, Network architectures, Network bottlenecks. **7 Hrs**

UNIT - 3

INTERNET AND TCP/IP NETWORKS: Multicast IP, Mobile IP, TCP and UDP, Applications, FTP, SMTP. Internet success and limitations, Performance of TCP/IP Networks, Performance of circuit switched networks. **7 Hrs**

UNIT - 4

SONET, DWDM, FTH, DSL, Intelligent networks CATV. **6 Hrs**

UNIT - 5

ATM: Main features of ATM, Addressing, signaling and Routing, ATM header structure, ATM AAL, Internetworking with ATM. **6 Hrs**

UNIT - 6

WIRELESS NETWORKS: Link level design, Channel Access, Network design, Wireless networks today, Future networks, ad hoc networks, High speed Digital cellular, Home RF and Bluetooth. **7 Hrs**

UNIT - 7

Control of networks, Objectives and methods of control, Circuit switched networks, Datagram Networks Network economics, Derived demand for network services, ISPs, subscriber demand model, Empirical model. **7 Hrs**

UNIT - 8

OPTICAL NETWORKS: WDM systems, Optical cross connects, Optical LANs, Optical paths and networks. **6 Hrs**

TEXT BOOK:

5. **High Performance Communication Networks**, Warland and Varaiya: Morgan Kauffman/ Elsvier 2nd Edition 2000.

REFERENCE BOOKS:

1. **High-Speed Networks and Internet: Performance and Quality of service**, William Stallings, Pearson Edu., 2001.
2. **Building High-Speed Networks**, Tere Parnell, TMGH, 2000.

INTERNET ENGINEERING

Subject Code	: 10EC835	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

INTRODUCTION: Communication model, Communication software, and communication protocol: Representation, Development methods, Protocol engineering process. **NETWORK REFERENCE MODEL:** Layered architecture, Network services and interfaces, protocol functions, OSI model, TCP/IP protocol suite, Application protocols. **7 Hrs**

UNIT - 2

PROTOCOL SPECIFICATION: Communication service specification, Protocol entity specification, Interface specifications, Interactions, Multimedia protocol specifications, Internet protocol specifications. **6 Hrs**

UNIT - 3

SPECIFICATION AND DESCRIPTION LANGUAGE (SDL): A protocol specification language: SDL. **6 Hrs**

UNIT - 4

Examples of SDL based protocol specifications, Other protocol specification languages. Protocol Verification And Validation, Protocol verification, Verification of a protocol using finite state machines. **7 Hrs**

UNIT - 5

Protocol validation, Protocol design errors, and protocol validation approaches, SDL based protocol verification, SDL based protocol validation. **6 Hrs**

UNIT - 6

PROTOCOL CONFORMANCE TESTING: Conformance testing methodology and framework, Conformance test architectures, Test sequence generation methods, Distribute architecture by local methods, Conformance testing with TTCN, Conformance testing of RIP, Multimedia applications testing, SDL based tools for conformance testing. **7 Hrs**

UNIT - 7

PROTOCOL PERFORMANCE TESTING: SDL based performance testing of TCP, OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using bridge, Scalability testing. **7 Hrs**

UNIT - 8

PROTOCOL SYNTHESIS: Synthesis methods, interactive synthesis algorithms, automatic synthesis algorithm, automatic synthesis of SDL from MSC protocol re synthesis. **6 Hrs**

TEXT BOOK:

3. **Communication Protocol Engineering**, P. Venkatarm and S. S. Manvi, PHI, 2004.

REFERENCES BOOKS:

1. **The Internet and its Protocols**, Adrian Farrel, Elsevier, 2006.
2. **TCP/IP Protocol Stack**, B A Forouzan, TMH, 2006.

ELECTIVE –5 (GROUP E)**MULTIMEDIA COMMUNICATIONS**

Subject Code	: 10EC841	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MULTIMEDIA COMMUNICATIONS: Introduction, multimedia information representation, multimedia networks, multimedia applications,

media types, communication modes, network types, multipoint conferencing, network QoS application QoS. **6 Hrs**

UNIT - 2

MULTIMEDIA INFORMATION REPRESENTATION: Introduction, digital principles, text, images, audio, video. **7 Hrs**

UNIT - 3

TEXT AND IMAGE COMPRESSION: Introduction, compression principles, text compression, image compression. **6 Hrs**

UNIT - 4

AUDIO AND VIDEO COMPRESSION: Introduction, audio compression, DPCM, ADPCM, APC, LPC, video compression, video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, and MPEG-4. **7 Hrs**

UNIT - 5

MULTIMEDIA INFORMATION NETWORKS: Introduction, LANs, Ethernet, Token ring, Bridges, FDDI High-speed LANs, LAN protocol. **6 Hrs**

UNIT - 6

THE INTERNET: Introduction, IP Datagrams, Fragmentation, IP Address, ARP and RARP, QoS Support, IPv8. **7 Hrs**

UNIT - 7

BROADBAND ATM NETWORKS: Introduction, Cell format, Switch and Protocol Architecture ATM LANs. **6 Hrs**

UNIT - 8

TRANSPORT PROTOCOL: Introduction, TCP/IP, TCP, UDP, RTP and RTCP. **7 Hrs**

TEXT BOOK:

1. **Multimedia Communications: Applications, Networks, Protocols and Standards**, Fred Halsall, Pearson Education, Asia, Second Indian reprint 2002.

REFERENCE BOOKS:

1. **Multimedia Information Networking**, Nalin K. Sharda, PHI, 2003.
2. **“Multimedia Fundamentals: Vol 1 - Media Coding and Content Processing”**, Ralf Steinmetz, Klara Narstedt, Pearson Education, 2004.
3. **“Multimedia Systems Design”**, Prabhat K. Andleigh, Kiran Thakrar, PHI, 2004.

REAL TIME OPERATING SYSTEMS

Subject Code	: 10EC842	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT 1

Introduction to Real-Time Embedded Systems: Brief history of Real Time Systems, A brief history of Embedded Systems. **6 Hrs**

UNIT 2

System Resources: Resource Analysis, Real-Time Service Utility, Scheduling Classes, The Cyclic Executive, Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies, Real-Time OS, Thread Safe Reentrant Functions. **7 Hrs**

UNIT 3

Processing: Preemptive Fixed-Priority Policy, Feasibility, Rate Monotonic least upper bound, Necessary and Sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies. **6 Hrs**

UNIT 4

I/O Resources:

Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture.

Memory:

Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash filesystems. **7 Hrs**

UNIT 5

Multiresource Services:

Blocking, Deadlock and livelock, Critical sections to protect shared resources, priority inversion.

Soft Real-Time Services:

Missed Deadlines, QoS, Alternatives to rate monotonic policy, Mixed hard and soft real-time services. **7 Hrs**

UNIT 6

Embedded System Components:

Firmware components, RTOS system software mechanisms, Software application components.

Debugging Components:

Exceptions assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace ports, Power-On self test and diagnostics, External test equipment, Application-level debugging.

7 Hrs

UNIT 7

Performance Tuning:

Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software, Path length, Efficiency, and Call frequency, Fundamental optimizations. **6 Hrs**

UNIT 8

High availability and Reliability Design:

Reliability and Availability, Similarities and differences, Reliability, Reliable software, Available software, Design trade offs, Hierarchical applications for Fail-safe design.

Design of RTOS – PIC microcontroller. (Chap 13 of book Myke Predko)

7 Hrs

References:

1. **“Real-Time Embedded Systems and Components”**, Sam Siewert, Cengage Learning India Edition, 2007.
2. **“Programming and Customizing the PIC microcontroller”**, Myke Predko, 3rd Ed, TMH, 2008

GSM

Subject Code	: 10EC843	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

GSM ARCHITECTURE AND INTERFACES: Introduction, GSM frequency bands, GSM PLMN, Objectives of a GSM PLMN, GSM PLMN Services, GSM Subsystems, GSM Subsystems entities, GSM interfaces, The radio interface (MS to BSC), A_{bits} interface (BTS to BSC), A interface (BSC to MSC), Interfaces between other GSM entities, Mapping of GSM layers onto OSI layers. **6 Hrs**

UNIT - 2

RADIO LINK FEATURES IN GSM SYSTEMS: Introduction, Radio link measurements, Radio link features of GSM, Dynamic power control, Discontinuous transmission (DTX), SFH, Future techniques to reduce interface in GSM, Channel borrowing, Smart antenna. **7 Hrs**

UNIT - 3

GSM LOGICAL CHANNELS AND FRAME STRUCTURE: Introduction, GSM logical channels, Allowed logical channel combinations, TCH multi frame for TCH/H, CCH multi frame, GSM frame structure, GSM bursts, Normal burst, Synchronization burst, Frequency correction channel burst, Access burst, Data encryption in GSM, Mobility management, Location registration, Mobile identification. **7 Hrs**

UNIT - 4

SPEECH CODING IN GSM: Introduction, Speech coding methods, Speech code attributes, Transmission bit rate, Delay, Complexity, Quality, LPAS, ITU-T standards, Bit rate, Waveform coding, Time domain waveform coding, Frequency domain waveform coding, Vocoders, Full-rate vocoder, Half-rate vocoder. **MESSAGES, SERVICES, AND CALL FLOWS IN GSM:** Introduction, GSM PLMN services. **7 Hrs**

UNIT - 5

GSM messages, MS-BS interface, BS to MSC messages on the A interface, MSC to VLR and HLR, GSM call setup by an MS, Mobile-Terminated call, Call release, Handover. Data services, Introduction, Data interworking, GSM data services, Interconnection for switched data, Group 3 fax, Packet data on the signaling channel, User-to-user signaling, SMS, GSM GPRS.

6 Hrs

UNIT - 6

PRIVACY AND SECURITY IN GSM: Introduction, Wireless security requirements, Privacy of communications, Authentication requirements, System lifetime requirements, Physical requirements, SIM cards, Security algorithms for GSM, Token-based authentication, Token-based registration, Token-based challenge.

6 Hrs

UNIT - 7

PLANNING AND DESIGN OF A GSM WIRELESS NETWORK: Introduction, Tele traffic models, Call model, Topology model, Mobility in cellular / PCS networks, Application of a fluid flow model, Planning of a wireless network, Radio design for a cellular / PCS network, Radio link design, Coverage planning, Design of a wireless system, Service requirements, Constraints for hardware implementation, Propagation path loss, System requirements, Spectral efficiency of a wireless system, Receiver sensitivity and link budget, Selection of modulation scheme, Design of TDMA frame, Relationship between delay spread and symbol rate, Design example for a GSM system.

7 Hrs

UNIT - 8

MANAGEMENT OF GSM NETWORKS: Introduction, Traditional approaches to NM, TMN, TMN layers, TMN nodes, TMN interface, TMN management services, Management requirements for wireless networks, Management of radio resources, Personal mobility management, Terminal mobility, Service mobility management, Platform-centered management, SNMP, OSI systems management, NM interface and functionality, NMS functionality, OMC functionality, Management of GSM network, TMN applications, GSM information model, GSM containment tree, Future work items.

7 Hrs

TEXT BOOK:

1. **“Principles of Applications of GSM”**, Vijay K. Garg & Joseph E. Wilkes, Pearson education/ PHI, 1999.

REFERENCE BOOKS:

1. **GSM: Evolution towards 3rd Generation Systems**, (Editor), Z. Zvonar Peter Jung, Karl Kammerlander Springer; 1st edition 1998
2. **GSM & UMTS: The Creation of Global Mobile Communication**, **Friedhelm Hillebrand**, John Wiley & Sons; 2001.

ADHOC WIRELESS NETWORKS

Subject Code	: 10EC844	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

AD HOC NETWORKS: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet. **6 Hrs**

UNIT - 2

MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols. **7 Hrs**

UNIT - 3

Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols. **6 Hrs**

UNIT - 4

ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol. **7 Hrs**

UNIT - 5

Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols.

6 Hrs

UNIT - 6**TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS**

NETWORKS: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks.

7 Hrs

UNIT - 7

SECURITY: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning.

6 Hrs

UNIT - 8**QUALITY OF SERVICE IN AD HOC WIRELESS NETWORKS:**

Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions.

7 Hrs

TEXT BOOK:

3. **“Ad hoc wireless Networks”**, C. Siva Ram Murthy & B. S. Manoj, Pearson Education, 2nd Edition, reprint 2005.

REFERENCE BOOKS:

1. **“Ad hoc wireless Networks”**, Ozan K. Tonguz and Gianguigi Ferrari, Wiley
2. **“Ad hoc wireless Networking”**, Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic publishers.

OPTICAL COMPUTING

Subject Code	: 10EC845	IA Marks	: 25
No. of Lecture Hrs/Week	: 04	Exam Hours	: 03
Total no. of Lecture Hrs.	: 52	Exam Marks	: 100

UNIT - 1

MATHEMATICAL AND DIGITAL IMAGE FUNDAMENTALS: Introduction, Fourier Transform, discrete Fourier transform, basic diffraction theory, Fourier transform property of lens, sampling and quantization, image enhancement, image restoration. **7 Hrs**

UNIT - 2

LINER OPTICAL PROCESSING: Introduction, photographic film, spatial filtering using binary filters, holography, inverse filtering, Deblurring. **6 Hrs**

UNIT - 3

ANALOG OPTICAL ARITHMETIC: Introduction, Halftone processing, nonlinear optical processing, Arithmetic operations. **6 Hrs**

UNIT - 4

RECOGNITION USING ANALOG OPTICAL SYSTEMS: Introduction, Matched filter, Joint transform correlation, Phase-only filter, Amplitude modulated recognition filters, Generalized correlation filter, Mellin transform based correlation. **7 Hrs**

UNIT - 5

DIGITAL OPTICAL COMPUTING DEVICES: Introduction, Nonlinear devices, Integrated optics, Threshold devices, Spatial high modulators, Theta modulation devices. **6 Hrs**

UNIT - 6

SHADOW-CASTING AND SYMBOLIC SUBSTITUTION: Introduction, Shadow casting system and design algorithm, POSC logic operations, POSC multiprocessor, Parallel ALU using POSC, Sequential ALU using POSC, POSC image processing, Symbolic substitutions, Optical implementation of symbolic substitution, Limitations and challenges. **7 Hrs**

UNIT - 7

OPTICAL MATRIX PROCESSING: Introduction, Multiplication, Multiplication using convolution, Matrix operations, Cellular logic architecture, Programmable logic array. **6 Hrs**

UNIT - 8

ARTIFICIAL INTELLIGENT COMPUTATIONS: Introduction, Neural networks, Associative memory, Optical implementations, Interconnections, Artificial Intelligence. **7 Hrs**

TEXT BOOK:

2. **“Optical Computing An Introduction”**, Mohammed A. Karim, John Wiley & Sons, 1992.

REFERENCE BOOKS:

1. **Optical Signal Processing** by Vanderlugt John willy & sons NY 1992.
2. **Signal Processing in Optics** - Bradly G Boore Oxford University Press 1998.