COURSE CONTENTS

MDT-101 INDUSTRIAL DESIGN OF ELECTRONIC EQUIPMENTS:

Introduction to Industrial Design: Design overview, the design process, product design methodology, anatomy of design process.

Aesthetics: Elements of design, principles of design,.

Ergonomics: An overview, ergonomic issues in designing electronic products, design of controls, design of display. Ergonomics & Aesthetics consideration for development of control panel.

Control panel layouts: Engineering considerations, layout of components, control mountings, structural design, control cabinets fabrication.

Computer Aided design: Fundamental concept of FEM (Finite Element Analysis Methods), surface modeling, techniques for rendering and shading.

Manufacturing process: Translation of product concepts to manufacturing process.

LAB SESSION (Laboratory-2):

Mini Project: An exercise in product design and development: Designs, drawings, prototype of simple products, use of software packages for model drawing.

RECOMMENDED BOOKS:

- **Jack Arabian**, Computer Integrated Electronics Manufacturing and Testing Marcel Dekker USA.
- **Paul D Grnio**, Materials and Processes in Manufacturing Temple Black, Ronald Kloliser.
- **C.H. Flurschiem**, Industrial Design in Engineering Design Council London and Springer Verlog, 1993.
- **Timoshenko,** Mechanics of Materials, CBS196
- **A.K. Chitale, R.C. Gupta,** Product design and manufacturing, Prentice, Hall of India.

MDT-102 ELECTROMAGNETIC COMPATIBILITY of ELECTRONIC EQUIPMENTS

Introduction to EMI/EMC: Introduction to electromagnetic interference and compatibility, EMI/EMC standards, sources, coupling, EMI/EMC measurements, choice of passive components for EMC, Noise pick-up modes and reduction techniques for analog circuits, design and layout of interference free analog and digital circuits.

Grounding Techniques: Grounding, safety grounds, signal grounds, high and low frequency grounding methods, shield grounding at high frequencies, guard shields, isolation and neutralizing transformers, digital grounds,

Shielding Techniques: Shielding and its effectiveness, near and far fields impedances, characteristics and wave impedances, absorption and reflection losses, composite absorption and reflection losses for electric fields, composite absorption and reflection losses for magnetic fields, trends in modern shielding enclosures, multimedia shielding theory.

Cabling Techniques: Introduction, Mechanism of EMI emission/coupling in cables, capacitive and inductive coupling, shield factor, Coaxial Cable versus shielded twisted pair . Braided shields, Selective Shielding,

Conducted EMI/EMC: Origins of conducted electromagnetic interference, Common and Normal Mode Noise, Noise From Power electronic Systems, Spectra of Pulsed Noise Sources, Modeling of EMI Noise Sources, Transient Disturbance Simulation Signals.

EMI Filters: EMI induced failure mechanism for power electronic equipment, EMI filters, design of power line filters, common mode filters, differential mode filters, combined CM and DM filters design, electromagnetic compatibility design of digital circuits, pulsed EMI immunity, electrical transients and burst, electrical surges, Electrostatic discharge (ESD) and switching interference reduction, susceptibility aspects of power electronic and digital equipment, shielding of electronic equipment, EMC standards and test equipment.

RECOMMENDED BOOKS:

- **Ott H.W., Noise Reduction Techniques in Electronic Systems,** 2nd ed. Jhon Wiely and Sons, New York, 1988
- **WILLIUM B GRESON,** Electrostatic Damage in Electronics : Devices and Systems Jhan Wiley and Son', 1986.
- **Digital Bus Hand Book** - Joseph Di Giacomo, McGraw-Hill Publishing Company, 1990

MDT-103 DIGITAL SYSTEMS DESIGN:

Minimization and Design of Combinational Circuits: Variable Entered Mapping, VEM Plotting Theory, VEM Reading Theory, Minimizing functions of more than six variables.

MSI And LSI Circuits and Their Applications: Arithmetic circuits, comparators, multiplexers, code converters, EX-OR and AND-OR INVERT gates, wired logic, bus oriented structures, tri-state bus system, propagation delay.

Sequential machines: The concept of memory, the binary cell, the cell and the bouncing switch, Set / Reset, D, Clocked T, Clocked JK flip flop, design of a clocked F/F, conversions, clocking aspects, clock skew.

Sequential analysis and design: state diagram, synchronous analysis process, design steps for traditional synchronous sequential circuits, state reduction, design steps for next state decoders, design of output decoder, counters, Shift registers and memory.

Multi Input System Controller Design: Systems controllers, design phases and system documentation, defining the system, timing and frequency considerations, functional position and detailed flow, diagram development, MDS Diagram generation, synchronizing two system and choosing, controller architecture, state assignment, next state decoder and its maps, output decoder, clock and power supply requirements, MSI decoders, multiplexers in system controllers, indirect addressed multiplexers configurations, ROM's , PROM's and applications, PLA's application,

Programmable System Controllers: MSI Shift registers in system controllers, design and implementation using AM74LS194, system controller using MSI counters, concept of programmable system controller, micro-instructions, fixed instructions set programmable controllers, 8X02 control store sequencer, system control function, 745482 and MS 2909, integrated circuit sequence controller.

Asynchronous Finite State Machines: scope, asynchronous analysis, design of asynchronous machines, cycles and races, plotting and reading the excitation map, hazards, essential hazards map entered variable, MEV approaches to asynchronous design, hazards in circuits developed by MEV Method.

Fault Analysis: Fault detection and location in combinational circuit: classical method, path sensitizing method, equivalent- normal form method (ENFM), boolean difference methods, multi level circuit, fault detection methods.

LAB. SESSION (Laboratory-1):

Design and testing of combinational and sequential logic circuits using MSI and LSI chips.

RECOMMENDED BOOKS :

- **W.I.Fletcher**, An Engineering Approach to Digital Design, PHI, India
- **Samual C Lee**, Digital Circuits and Logic Design, ND PH 1 1989
- **M. Moris Mono,** Digital Design, PHI, India
- **M. Moris Mono**, Digital Logic and Computer Design, PHI, India

MDT-104 DESIGNING WITH POWER DEVICES :

Power Devices: Characteristics & protection of power devices such as - GTOs, IGBTs, RCTs, MCTs, SITHs, LASCRs**,** Solar cells as power source devices and their characteristics.

Transformers: Fundamentals, selection of core material, insulating material and wires, design methodology of pulse transformers, high frequency transformer, design of transformer for PWM converters.

Coils: Fundamentals, selection of core materials, insulating material and wires, design of inductors for power frequency, radio frequency and high frequency.

Switch Mode Power Supplies: Basic regulators - buck, boost, derived topologies, flyback, forward, push-pull, half & full Bridge converters, special converters, PWM control techniques, study of PWM control ICs, design of base drive circuits, design of input section, output section & control section, thermal design concepts, EMI/ EMC consideration, protection circuit design for power supplies.

UPS & Other Power Supplies: Concept of AC & DC resonant power supplies, concept of AC & DC bidirectional power supplies, design concept of uninterrupted power supplies, CVT.

LAB SESSION (Laboratory-2):

(i) Design and Testing of transformers, inductors, power supplies.

(ii) Study & seminar on non conventional energy source development.

RECOMMENDED BOOKS:

- **George Chryssis**, “High Frequency Switching Power Supplies: Theory & Design” Mc Graw Hill Book Co., 1984.
- **K. Kitsum**, “Switch Mode Power Conversion - Basic Theory and Design” Marcel Deckker Inc., 1984.

- **N. Radhakrishnan and S.R. Bhat**, "Design and Technology of Low Power Transformers and Inductors " CEDT, July 1988.
- **Rashied**, Power Electronics Circuit Device and Application.

MDT-201 PHYSICAL DESIGN OF ELECTRONIC EQUIPMENTS:

Overview of electronics product design & fabrication.

PCB Design & Technology: Overview of PCB design guidelines, general considerations for PCB layout, artwork, photo printing, screen printing, plating, etching, soldering and assembly techniques, emerging PCB technology trends. Overview of design rules for analog circuit PCB, digital circuit PCB, power circuit PCB.

Thermal Design: Introduction to thermal design, mode of heat transfer process and design tips for efficient heat transfer. Case studies for heat sink design.

Interconnection Techniques: Elements of interconnection, wires, cables, connectors, termination methods. Maintainability and serviceability considerations: electrical, mechanical and other aspects.

LAB. SESSION (Laboratory-3):

Preparation of various PCB Drawings. PCB fabrication of SSB and DSB. PCB design using software tools like CADSTAR, ORCAD, PSPICE.

RECOMMENDED BOOKS:

- **Avram Bar - Cohen & Allan Craus**, Thermal Analysis and Control of Electronic Equipment, Mc Graw Hill, Hemisphere Pub. Co., New York 1983.
- **Harper**, Handbook of Electronic Packaging, Mc Graw Hill, New York 1979.
- **Scott, A .W**., Cooling of Electronic Equipment
- **Sameer Notes**, Guidelines for Design of PCBs
- **Walter C Bosschard**, PCB design & Technology, McGraw Hill, New Delhi.
- **Timoshenko**, Mechanics of materials, CBS 1986.
- **Ronald A. Reis,** Electronic Project Design and Fabrication, prentice hall.
- **Keith Brindley, Huneman Newness, Halley court**, Electronic Assembly handbook
- **Raskhodoff,** Electronics drafting & design.
- **Nievel & Draper,** Product Design & Process Engineering.

MDT-202 RELIABILITY OF ELECTRONIC EQUIPMENT

Introduction: Introduction to concepts of reliability, nature of reliability problems in electronic equipment, review of probability theory, random variables and probability distributions, functions of random variables, overview of commercial, industrial and mill space grade components.

System Reliability: Introduction, series configuration, Parallel Configuration, Mixed Configuration, Methods of Solving Complex Systems, Mean Time to Failure (MTTF) and Mean Time between Failure (MTBF) of Systems.

Maintainability and Availability: Introduction, Maintainability, Availability Concepts, System Downtime, Mean time to Repair (MTTR), Reliability and Maintainability Trade Off, Optimization Approaches.

Reliability Improvement: Introduction, Improvement of Components, Redundancy, element Redundancy, Unit Redundancy, Standby Redundancy, Optimization, Reliability Cost Trade – Off.

Reliability Prediction: Introduction, Similar Equipment Techniques, Similar Complexity Techniques, Similar Function Techniques, Part Count Techniques, Part Stress Analysis Techniques, Worst Case Design and Derating,

Fault Analysis Techniques: Introduction, System Safety Analysis, Failure Modes and Effects Analysis, Fault Tree Analysis- Concepts and Procedures, Rules for Fault Tree Construction, Reliability Calculation through Fault Tree.

LAB SESSION (Laboratory-2):

Case study of electronic equipments and analysis of EMC/ reliability problems

RECOMMENDED BOOKS:

- **Fquna**, Reliability Engineering for Electronic Design, Marcel Dekker, 1988.
- **Dr. R.K. Aggarwal**, Reliability Engineering
- **Dr. A.K. Govil**, Reliability Engineering
- **L.S. Srinath**: Reliability Engineering , 3rd ed. East-West Press,

MDT-203 MICROCOMPUTER SYSTEM DESIGN:

General study of architecture of typical 16 bit microprocessors from Intel, Motorola and Zilog, timing consideration for 16 bit microprocessor and its importance in interfacing. Programming concepts for 16 bit microprocessor, interrupt handling.

Design of Microprocessor Based System: System design using 8086/8088 in maximum & minimum mode. Interfacing various peripheral chips (8259, 8279, 8237) and co-processors (8087) along with related programming examples. Read/ Write timing analysis and wait state generation for memories & I/O devices. Multi tasking/ Multi programming, multi processing, time sharing concepts. Interfacing two processors in parallel processing environment.

32- Bit Processor: Salient features of 80386 and 80486, architecture and signal description, addressing modes, real, protected and virtual modes, segmentation and paging, enhanced instruction set of 80386/ 80486

Recent Advances in Microprocessor Architecture: 64 Bit processors, salient features of Pentium, branch prediction architecture, enhance instruction set of Pentium, MMX architecture, MMX instruction set, Pentium-Pro, Pentium-II & Pentium-III, Pentium-IV etc.

LAB. SESSION (Laboratory-1): Programming in 8086/ 80386 assembly language making use of almost all types of instruction using assembler.

Programming in 8051/31 assembly language of 8051/31, interfacing using 8031/51.

RECOMMENDED BOOKS:

- **Liu Gibson,** Microcomputer System: The 8086/8088 family Architecture Programming and Design
- **Rafiquzzmahman,** Microprocessor Theory and Application, PHI
- **Mohamed R.**, Microprocessor and Microcomputer Development System. Willy N.W.,1984
- **John B. Peatman**, Microcomputer Based Design- McGraw Hill, 1988
- **Barora. B. Brey,** The Microprocessors the 8086/ 8088/ 80186/ 8188/ 80286/ 80386/ 80486 Pentium and Pentium processor Architecture Programming and Interface.
- **M Slater**, Microprocessor Based Design- PHI Pvt., New Delhi
- **B.P. Singh**, **Renu Singh,** Advanced Microprocessors and Microcontrollers, New Age International Publishers

MDT-204 Analog and Data Conversion Systems:

Introduction to Linear IC Application**,** Signal Conditioners with Instrumentation Auto-zero/chopper/isolation/charge apmplifier, scaling & level shifting circuits. V to F & F to V converters, V to I & I to V converters.

Design and applications of active filters and high frequency circuits, Design of multi channel low level and high level data acquisition System using ADC/DAC, SHA and Analog multiplexers, Noise consideration in data acquisition system design.

Designing of low power circuits for transducers

Data transmission: General requirements, types of transmission, EIA standards in circuits design.

LAB. SESSION (Laboratory-3):

Design and study of application of instrumentation amplifiers, multiplexers, A/D and D/A converters.

Interface of mV, mA signals with Microprocessor/Microcontrollers.

RECOMMENDED BOOKS :

- **Franos,** Design and operational amplifiers and analog integrated circuits, Mc Graw Hill Book Co., 1988.
- **Bernard L,** Analog/ Digital and Digital Analog Conversion, Heyden and Son Ltd., London, 1982.
- **Jones, B.E.** Instrumentation, Measurement and Feedback, Tata Mc Graw Hill, New Delhi, 1978.
- **Santa Clara,** Transducer, 1981
- **Daniel H. Sheingold, Norwood MA, Analog Devices, INC** (1980) Interfacing Handbook: A guide Analog signal Conditioning edited
- **DE Pippenger & EJ Tobuben,** Linear & Interface Circuits Applications, Mc Graw Hill,

DR-01 & 02 PROJECT WORK & DISSERTATION

General Guidelines

(a) The project work shall be of a nature of real life product/ system design and development. The problem may be selected from an industry/ institution. The student shall follow all the phases and activities as followed in an industry, using state of the art design and development tools and techniques. Due importance shall be given for the project (process), the product (the output) and the documentation.

(b) Problem identification and finalization along with the internal guide (faculty) and industry/institution. System analysis/ requirement identification (QFD, market/ user survey etc.) Product/system requirement specification, Cost & Time estimation project proposal presentation and review. System Design, Detailed design, Simulation/ design prototype, Design documents, Engineering & Test plan, Design review. Product engineering (PCB/Enclosure fabrication, assembly, testing, integration), engineering documents, product review.

(c) **Final documentation, Presentation, Viva Voce:** The final output shall be a productionable / marketable product/system in all sense. This exercise will give an opportunity to the participant to get exposed and experienced in all dimensions of an electronic product / system design and become effective and efficient real life problem solvers. The candidate is expected to work under the guidance of a project guide (faculty from Centre , at least for a period of eight full months. In case the project work is taken up in an external Industry/Institution, the project shall have two guides; one in the participating organization (Industry/Institution) and the other shall be one of the faculty members from Centre The dissertation should be submitted within twelve calendar months from the starting date of the 2nd Year start.

Five copies of the dissertation have to be submitted to the Head of the department /exam. controller These copies shall be distributed one each for the Technical cell /H.O.D.., external examiner, internal examiner, project guide (Faculty), and Centre Library.

SEMINAR

Seminar on recent development and advancement.

ELECTIVE SUBJECTS

E-01 VHDL BASED DESIGN:

History, design tool flow, synthesis and simulation, programmable logic devices: PLD, CPLD, FPGA, VHDL components entity and architecture, design hierarchies, concurrent VHDL, delta delay, behavior and data flow mode,. Sequential VHDL. Library package and subprograms. Structural VHDL. State machine design with VHDL. Test methodology, Circuit partitioning, Floor planning, Placement, Routing and Layout generation.

LAB. SESSION: **(Laboratory -4)** Mini Project on WARP and View Logic VHDL Packages and hardware implementation with CPLD/ FPGA.

RECOMMENDED BOOKS :

- **Kevin Skahill,** VHDL for Programmable Logic
- **Stefan Sjohalm and Lenhart Lindh,** VHDL for Designers
- **Nababi,** VHDL
- **J. Bhasker,** VHDL Primer
- **Douglas Perry,** VHDL, TMH
- **Sait & Yousse,** VLSI Physical Design Automation

E-02: ASIC DESIGN

Introduction to ASIC: Design, types of ASICS, advantages and disadvantages, ASIC library design.

ASIC Design Methodology: The ASIC design flow, ASIC design methodology choices & trade-offs- custom-full-custom, cell- based-array based - gate array architectures, counting the gates, estimating performance, integrating RAM, programmable logic, FPGA architecture, evaluating PLD performance, cost effectiveness.

Design Guidelines & Issues: Portioning including core function on the ASIC, mixed signal design, mixed signal simulation & test issues. The ASIC specification design guidelines, I/O considerations, simulation considerations, basic design considerations, design for reliability, design for testability, fault grading, scan test, JTAG boundary scan, ATPG, testability trade offs.

ASIC Construction: Physical design, CAD tools, system partitioning, estimating ASIC size, power dissipation, partitioning methods.

Optimizing Designs: Design space exploration, total negative slack, compilation strategies, optimization techniques.

Design For Test (DFT): Different types, scan insertion, DFT guidelines,

Floor Planning & Placement: Introduction, details of floor plannings & placement, physical design flow, information formats.

Routing: Global, detailed and special routing, circuit extraction and DRC.

ASIC Prototyping and Verification: Design verification, prototype fabrication, mask making, wafer fabrication, wafer probing, packaging, prototype test, test program development, debugging the setup, characterization, evaluating ASIC tester.

ASIC Package: Ceramic, plastic, chip on Board, multichip packages.

RECOMMENDED BOOKS :

- **John Schroeter,** ASIC Experience
- **Michael John Sebastain Smith,** Application Specific Integrated Circuits. Addison Wesley
- **Himanshu Bhatnagar,** Advanced ASIC Chip Synthisis, Kulwar Academic Publishers.

E-03 VLSI DESIGN

Review of NCS Technology: Basic MOS transistors, enhancement and depletion mode transistors, NMOS and CMOS processor, thermal aspects of processing, production of masks.

Electrical properties of circuit: Parameters of MOS transistors, pass transistor, NMOS invertor, pull-up to pull down ratio for an NMOS invertors, CMOS inverters, MOS transistor circuit model, latch up on CMOS circuits.

Design Processes: MOS Layers, stick diagrams, design rules, AWA OX C MOS process description,double metal single poly silicon CMOS process.

Basic Circuit Concepts: Sheet resistance, area capacitance delay unit, invertor delay, super buffer's, propagation delays.

Subsystem Design and layout: Architectural issues, switch logic, gate logic, Example of combinational logic, clocked sequential circuits, other system consideration.

Scalling of MOS Circuits: Scalling factor, limitations, scalling of wires and interconnections.

PLA and Finite State Machines: Design examples, design of an ALU subsystems, carry look ahead address, parallel.

LAB SESSION: (Laboratory-4): Simulation of CMOS circuits & layout design using software.

RECOMMENDED BOOKS :

- **Pucknell D.A. and Eshrachain K,** Basic VLSI Design, Systems & Circuits by Pucknell
- **Geigar, Rr, Allen P.E. Strader N.R. (M.C Graw Hill 1990),** VLSI Design Techniques for Analog and Digital Circuit

E-04 TRANSDUCERS & INSTRUMENTATION:

Transducer fundamentals, classification of transducers, general transducer characteristics, displacement transducers, strain gauges, pressure and force transducers, torque transducers, vacuum sensors, radiation sensors, flow transducers, transducers for bio medical application, tactile sensors, micro sensors, signal conditioning and processing electronics for transducers/sensors systems, voltage and current sources, programmable amplifiers, phase sensitive defectors, A/D and D/A converters, data transmission, recording techniques and related aspects.

RECOMMENDED BOOKS:

- **Murthy D.V.S.,** Transducers and Instrumentation, Prentice Hall (1995)
- **Harry N. Norton**, Handbook of Transducers, Prentice Hall (1989)
- **Gardner J.W. Microsensors**, Principles and Applications, John Wiley (1994)
- **Leslic M. Zoss**, "Applied Instrumentation in the Process Industries- Vol.V; Gulf Pub. Com.
- **B.C. Nakra and K.K. Chaudhary**, "Instrumentation Measurement and Analysis" - Tata Mc Graw Hill Pub. Com. Ltd.
- **Francis S. TSE & Ivan. E. Morse**, "Measurement and Instrumentation in Engineering" - Marcel Dekker Ins.
- **B.E. Noltigk**, "Instrumentation Reference Book" - Butterworth International ED.
- "Instrumentation and Analytical Science" - IEE Electrical Measurement Series 6, Peter Peregrinus Ltd.

E-05 COMPUTER AIDED INSTRUMENTATION

Introduction to architecture of personal computers. Features available in the personal computers for instrumentation, programming exercises. Hardware and software support for I/O, PC bus and signal, design of special purpose add-on card. Operating systems (calls & interrupts), device drivers, interfacing with serial port, parallel port, GPIB interface and software tool for processing and graphical user interface(GUI) and application.

LAB SESSION: (Laboratory-4): Application of software tools like SPICE, VI, MATLAB, design of simple add on cards.

RECOMMENDED BOOKS:

- **Douglas V. Hall**, Microprocessors and Interfacing Techniques.
- **Roger S.Pressman**, Software Engineering

E-06 DESIGN OF INDUSTRIAL CONTROL SYSTEM :

Introduction, fundamentals of automatic control, automatic control principle, design aspects of proportional, integral, derivative and PID controllers and their tuning. Advance control techniques: batch, cascade, ratio, feed forward, adaptive and their applications to industry.Design aspects of digital control system. Case study on process control systems i.e. sugar, fertilizer, steel, power and chemical industries

LAB. SESSION (Laboratory-4): Mini Project on controller development.

RECOMMENDED BOOKS:

- **Donald P. Eckman**, "Automatic Process Control", Willey Eastern Ltd.
- **E.A. Parr**, "Industrial Control Handbook" - BSP Professional Books.
- **Bela. G. Liptak**, "Instrument Engineers Handbook - IIIrd Edition" : Chilton book company.
- **Patranabis,** Automatic Process Control
- **F.G. Shinskey**: Process Control System, MC Graw Hill.

E-07 ADVANCED DIGITAL SIGNAL PROCESSING:

Modeling of Filters

Power spectrum sample random filter model of first order Markov process-parameter identification liner prediction and signal modeling minimal phase signals and filters. Minimum delay property spectral factorization theorem.

Linear Estimation

Linear estimation of signals stationary Wiener filter as Kalman filter Construction of Wiener filter least as Kalman filter construction of wiener filter Kalman filter.

Linear Prediction

Auto representative model levenson recursion-Analysis and synthesis of lattice filters schur algorithm-FIR wiener filter Least square wave shaping and spiking filters.

Spectrum Estimation

Spectrum estimation by auto regressive modeling spectral analysis of sinusoids in noise Maximum likehood method spatial smoothing.

Adaptive Filter

Adaptive implementation of Wiener filter-Adaptive linear combiner-Adaptive FIR Wiener filter-Adaptive Channel equalizer-Adaptive echo cancellers-Adaptive noise canceling-Adaptive linear prediction.

LAB SESSION: (Laboratory-4) Students have to Write and simulate the above Algorithm using software packages.

Students have to do mini project.

RECOMMENDED BOOKS :

- **Sphoclas J Orfanidis, Optimum Signal Processing, McGraw Hill, 1990**
- **J.G. Proakis, C.M. Rader, F. Ling and C.L. Nikis, Advanced Digital Signal Processing Maxwell Macmillan International Edition, 1992.**
- **J.V. Candy, Signal Processing, McGraw Hill, New York, 1986.**

REFERENCE BOOKS

- **B. Mulgrew and Colin F.N. Cowan, Adaptive Filters & Equalisers, Kuluwer Academic Publishers, Boston, 1998**
- **J.V. Candy, Signal Processing, McGraw Hill, New York, 1986**

E-08 SOFTWARE FOR INDUSTRIAL MICROCOMPUTER SYSTEM :

Principles of Software Engineering : Structured and object oriented software programming development phases. Software specifications, design methods, coding and verification, software quality and reliability, project planning, programming in embedded C. Principles of operating system, RTOS design, embedded 'C' programming under Windows environment.

LAB SESSION (Laboratory-4): Development of application software.

RECOMMENDED BOOKS :

- **Pressman**, Software Engineering, Mc Graw Hill, 1992
- **Milan Kovic**, Operating Systems, Mc Graw Hill 1990

E-09 OPTO ELECTRONICS:

Introduction to EM theory, wave propagation in conductors & Dielectrics, boundary conditions.

Optical fibers: Dielectric slab waveguides, optical fiber structures, optical fiber modes & configurations, mode theory for circular waveguides, single mode fibers, manufacturing of optical fibers & cables.

Signal degradation in optical fibers: Attenuation, dispersion-intramodal & intermodal, Design optimization of SM fibers.

Optical Sources: Light Emitting diodes, Laser diodes, reliability consideration, Materials, performance parameters and specifications.

Power Launching and Coupling: Source to fiber power launching, Lensing schemes for coupling improvement, Fiber to Fiber joints, LED coupling to single mode fibers, fiber splicing, optical fiber connectors.

Photodetector: Physical principles of photodiode- PIN, APD performance parameters and specifications.

Optical phenomena: Wave propagation in isotropic media, in crystals, Birefringence, Linear & quadratic Electro- Optic effect, Acousto-optic effect, Magneto-Optic devices, nonlinear optics.

Integrated Optics: Optoelectronic Integrated Circuits, Application of OEITCTS, Materials for optics, Integrated transmitters & Receivers, guided wave devices.

Optical Fiber Sensors: Multimode passive, Multimode active, single mode fiber sensors.

RECOMMENDED BOOKS:

- **Gerd Keiser (McGraw Hill),** Optical Fiber Communication
- **John Gowar (PHI 1993),** Optical Communications System
- **Pallale Bhattacharya,** Semiconductor Optoelectronic Devices. Prentic Hal of India (EEE), 1995 Edition:
- **J.wilson-J.F.B. Hawkes "** Opto Electronics, an Introduction" 2nd Ed., PHI

E-10 Network Programming:

The Network Basics: ISO/OSI model, TCP/IP model, functions of different layers
The client server model and software design
Concurrent processing in client server software, context switching, asynchronous I/O
Program interface to protocols, system calls, basic I/O functions (Unix, Windows)
The socket interface, IP addresses, port numbers
Algorithms & issue in client software design
Algorithm & issue in server software server design; iterative, connectionless servers (UDP); Iterative, connection-driented servers (TCP); Concurrent, connection-oriented servers (TCP)
Single-process, concurrent servers; multiprotocol servers, multiservice servers uniform, efficient management of server concurrency; concurrency in clients
Application level Gateways
Remote procedure call concept (RPC)
Distributed program generation
Network file system concepts

LAB SESSIONS:
Socket Programming in VC++ on WINDOWS platform
Develop Client Server software for small applications such as message transfer, file transfer
Development of Concurrent And Iterative processing at server software
To understand Subnetting, IP addresses, DNS and their setting on the computer

RECOMMENDED BOOKS:

Douglas Comer & Stevens, Inter Networking With TCP/IP- Vol. III-

E-11 COMPUTER COMMUNICATION NETWORKS

LAN Networking & data transmission protocols: IP, IPX, Aplle- talk, Ethernet, FDDI, token ring, wireless 802.11(b).

WAN Digital Transmission Technologies: T-Carrier, SONET, frame relay ISDN, global cellular, design & implementation of enterprises- networks, routers & switches (including ATM Switches), Router configuration Multiprotocol Network, Traffic Routing in PDN & Internet environments.

Network performance measurement & trouble shooting concepts: including SNMP

Cellular Mobile Computer Communication : GSM technology, NA-TDM,PCN voip/FoIP and SMS.

CISCO'S GPR/EGPR, ACL, NAT, TUNNEUNG & IOS basics.

Satellite links and broad band networks.

RECOMMENDED BOOKS :

- **M.James Martin** ,Understanding the Network, New Rider Publication, 2000
- **William Stallings , Data and Computer Communication, PHI, 5th Edition**
- **William C.Y.Lee ,Mobile Cellular Tele Communication,** Mc-Graw Hill Inc 2nd Edn.

E-12 WIRELESS COMMUNICATION

Introduction to Wireless Communication Systems: Evolution of mobile radio communications; examples of mobile radio systems; the cellular concept - system design fundamentals; frequency reuse; channel assignment strategies; handoff strategies; interference and system capacity; improving capacity in cellular systems

Mobile Radio Propagation: Introduction to radio wave propagation; free space propagation model; basic propagation mechanisms; outdoor propagation models; indoor propagation models

Modulation Techniques for Mobile Radio: Frequency modulation vs. amplitude Modulation; amplitude modulation; angle modulation; FM; digital modulation; BPSK, DPSK, QPSK; Fundamentals of equalization; equalizers; RAKE Receiver; fundamentals of channel coding; clock Codes; convolutional Codes

Speech Coding: Introduction; characteristics of speech signals; quantization techniques; adaptive differential pulse code modulation; frequency domain coding of speech vocoders; linear predictive coders; The GSM codec; The USDC codec

Multiple Access Techniques for Wireless Communications: Introduction to multiple access; FDMA; TDMA; SDMA; Packet radio capacity of cellular Systems

Wireless Networking: Introduction to wireless networks; fixed network transmission hierarchy; traffic routing in wireless networks; wireless data services; CCS, ISDN, SS7; PCS/PCN; UMTS; Wireless systems and standards: : IEEE 802.11 wireless LAN standard, Bluetooth, AMPS and ETACS; IS-54; GSM; CDMA; IS-95; CT2 ; DECT; PACS ; PDC; PHS

RECOMMENDED BOOKS:

- **Theodore & Rapport,** by Wireless Communications: Principles & Practices PHI 2nd ed.- 2001
- **William Stalling,** Wireless Communications & Networks: PHI 1st Edn.