B.TECH. DEGREE COURSE

SYLLABUS

ELECTRONICS & COMMUNICATION ENGINEERING BRANCH

SEVENTH SEMESTER

MICRO-CONTROLLER BASED SYSTEM DESIGN

LA701 **2+1+0**

Module 1

Various logic families - features – comparison – PLA – PAL- GAL -comparison – combinational PAL – PAL with flip-flops – study of 16L8, 22V10 GAL – dual port RAM – FIFO - FPGA - gate arrays.

Module 2

Embedded C compiler – advantages – memory models – interrupt functions – code optimization - 89C2051 micro-controller- architecture-comparison with 89C51- design of a simple trainer circuit using 89C51/89C2051 µC – interfacing of DIP switch, LED, 7 segment display, alphanumeric LCD – relay interface – design of a traffic light control system - interfacing programs using C and assembly language.

Module 3

Analog to digital converters- single slope, dual slope, successive approximation, sigma delta, flash – comparison - typical ICs - A/D interface – digital to analog converters – different types – D/A interface - optically isolated triac interface- design of a temperature control system- interfacing programs using C and assembly language.

Module 4

Serial bus standards - I^2C bus, SPI bus – operation – timing diagrams – 2 wire serial EEPROM – 24C04 – 3wire serial EEPROM – 93C46 - interfacing - serial communication standards - RS232, RS422, RS485 – comparison – MAX232 line driver/ receiver - interfacing – interfacing programs using C and assembly language - low voltage differential signaling – PC printer port – registers – interfacing - universal serial bus – PCI bus.

Module 5

Matrix key board interface - AT keyboard – commands – keyboard response codes - watch dog timers - DS1232 watch dog timer – real time clocks – DS1302 RTC – interfacing - measurement of frequency - phase angle - power factor – stepper motor interface - dc motor speed control – L293 motor driver - design of a position control system - interfacing programs using C and assembly language.

References

1. The 8051 Microcontroller: Muhammad Ali Mazidi, Pearson Education.
2. The 8051 Microcontroller: Kenneth J Ayala, Penram International.
3. Digital fundamentals: Floyd, Pearson Education.
4. Programming and customizing the 8051 µC: Myke Predko, TMH
5. Programming with ANSI C and turbo C: Kamthane, Pearson Education.
6. Microcomputers and Microprocessors: John Uffenbeck, PHI.
7. Web site of Atmel semiconductors - www.atmel.com

VLSI TECHNOLOGY

LA 702 **3+1+0**

Module 1

Process steps in IC fabrication: Crystal growth and wafer preparation- Czochralski process- apparatus- silicon shaping, slicing and polishing- Diffusion of impurities- physical mechanism- Fick's I and II law of diffusion- Diffusion profiles- complementary (erfc) error function- Gaussian profile- Ion implantation- Annealing process- Oxidation process- Lithography- Photolithography, Fine line lithography, electron beam and x-ray lithography- Chemical vapour deposition (CVD)- epitaxial growth- reactors- metallisation- patterning- wire bonding and packaging.

Module 2

Monolithic components: Isolation of components- junction isolation and dielectric isolation- Transistor fabrication- buried layer- impurity profile- parasitic effects- monolithic diodes- schottky diodes and transistors- FET structures- JFET- MOSFET- PMOS and NMOS, control of threshold voltage (V_{th})- silicon gate technology- Monolithic resistors- sheet resistance and resistor design- resistors in diffused regions- MOS resistors- monolithic capacitors- junction and MOS structures- IC crossovers and vias.

Module 3

CMOS technology: Metal gate and silicon gate- oxide isolation- Twin well process- Latch up- BiCMOS technology- fabrication steps- circuit design process- stick diagrams- design rules- Capacitance of layers- Delay- Driving large capacitance loads- Wiring capacitance- Basic circuit concepts- scaling of MOS structures- scaling factors- effects of miniaturization.

Module 4

Subsystem design and layout- Simple logic circuits- inverter, NAND gates, BiCMOS circuit, NOR gates, CMOS logic systems – bus lines- arrangements- power dissipation- power supply rail distribution- subsystem design process- design of a 4 bit shifter.

Module 5

Gallium Arsenide Technology: Sub-micro CMOS technology- Crystal structure- Doping process- Channeling effect- MESFET- GaAs fabrication- Device modeling.

References

1. Modern VLSI design: Wolf, Pearson Education.
2. VLSI technology: S M Sze, Mc Graw Hill pub.
3. Basic VLSI design: Douglas Pucknell, PHI.
4. Principles of CMOS VLSI Design: H E Weste, Pearson Edn.
5. Integrated Circuits: K R Botkar, Khanna Pub.
6. CMOS circuit design layout and simulation: Barter, IEEE press.
7. Introduction to VLSI: Conway, Addison weslay.

MICROWAVE AND RADAR ENGINEERING

L703 **3+1+0**

Module 1

Introduction to Microwaves- Characteristic features- advantages and applications- Wave guides- basic concepts and properties. Scattering matrix- Concept of N port scattering matrix representation- Properties of S matrix- S matrix formulation of two-port junction. Passive microwave devices- T junctions- H plane, E plane and EH plane Tee junctions, its S matrix and properties- Applications of Hybrid junction. Directional coupler-Termination- Gyrator- Isolator- Circulator- Phase changer- Attenuator.

Module 2

Microwave measurements- frequency- power- VSWR- impedance. Microwave tubes- High frequency limitations- Magnetron- Multicavity Klystron- Reflex Klystron- Traveling Wave Tube- principle of operation. Microwave Communication: Basic Principles of Microwave Links – Microwave relay Systems – block schematic of terminal transmitters and receivers – repeaters – basic principles of design of a microwave links.

Module 3

Microwave semiconductor devices- Principle of operation of Transistors and FETs. Transferred Electron Devices- Gunn diode- Gunn diode as an Oscillator and an amplifier- InP diode- Tunnel diode- principle of operation. Avalanche Transit time devices- IMPATT and TRAPATT devices- principle of operation.

Module 4

Radar range equation- Block schematic of pulse radar- Radar frequencies- Applications of radar- CW radar- applications of CW radar- CW radar with nonzero IF- FM CW radar-FM CW altimeter- MTI and Pulse Doppler radar.

Module 5

Direction finders- Instrument Landing System- Radio ranges. Navigation- Hyperbolic navigation- LORAN. Satellite navigation- Doppler navigation - Global positioning system- Different types of microwave antennas-basic principles.

References

1. Microwave devices and circuit: Samuel Liao, PHI.
2. Microwave and radar — A K Maini, Khanna Publishers.
3. Microwave and Radar Engg. — M Kulkarni.
4. Introduction to radar systems — Merrill I Skolnik, McGraw Hill.
5. Radar systems and radio aids to navigation — A K Sen & A B Bhattacharya.

OPTICAL FIBRE COMMUNICATION SYSTEMS

L704 **2+1+0**

Module 1

Recollection of basic principles of optics: ray theory- reflections at boundary- critical angle- total internal reflection - Optical wave guides - Propagation in fibre- expression for acceptance angle-acceptance cone – numerical aperture- V number - Index profile-effect of index profile on propagation.

Module 2

SI fibre and GI fibre - Brief description of modes in SI fibre and GI fibre- Pulse dispersion and Band Width limitation- Mode coupling – Attenuation in single mode and multimode fibres- Optic fibre cables- characteristics of cables- Optic fibre couplers: types of coupling – fibre to fibre joints- splicing techniques- optical fibre connectors.

Module 3

Optical sources- LEDs, LASER diodes- operating characteristics- photo-detectors-principles of photo detection – PIN diode – APD – operating principles – photo-multiplier tubes- source to fibre power launching – lensing schemes- modulation circuits.

Module 4

Basic optical communication systems- point-to-point link- rise time budget- protection techniques- WDM – transceiver requirements-TDM- optical amplifiers- SOAs – EDFAs- optical receivers- Introduction to optical fibre networks.

Module 5

OTDR - Measurements- numerical aperture- dispersion measurements- refractive index profile measurements- band width measurements- fibre attenuation measurements- cutoff wave length measurements- applications of fibre optic systems- future developments

References

1. Fibre optic communication technology: Djafer K Mynbaev, Pearson Education.
2. Electronic communication: Dennis Roddy & John coolen, PHI.
3. Optic fibre communication: John M senior, PHI.
4. Telecommunication principle circuits Systems and experiments: S.Ramabhadran, Khanna.
5. Optical communication system: John Gower, PHI
6. Fibre optics in telecommunication: Sharma, Mc Graw Hill
7. Optical fibre and fibre optic communication: Subir Kumar Sarkar, S Chand & co. Ltd
8. Optical communication: M Mukund Rao , Universities press.
9. Fiber Optic Communication: Palais, Pearson Education.
10. Digital Communication system with Satellites & Fibre Optics Applications: Kolimbris, Pearson Education.
11. Optical Networks - 3rd Generation Transport systems: Black, Pearson Education.

INFORMATION THEORY AND CODING

L705 **3+1+0**

Module 1

Information theory: - Concept of amount of information -units, Entropy - marginal, conditional and joint entropies -relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels.

Module 2

Discrete channels: - Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, repetition of symbols, Binary unsymmetric channel, Shannon theorem. Continuous channels: - Capacity of band limited Gaussian channels, Shannon-Hartley theorem, Trade off between band width and signal to noise ratio, Capacity of a channel with infinite band width, Optimum modulation system.

Module 3

Source coding: - Encoding techniques, Purpose of encoding, Instantaneous codes, Construction of instantaneous codes, Kraft's inequality, Coding efficiency and redundancy, Noiseless coding theorem. Construction of basic source codes: - Shannon-Fano algorithm, Huffman coding, Arithmetic coding, ZIP coding.

Module 4

Codes for error detection and correction: - Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes. Cyclic codes: - Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.

Module 5

Convolutional codes: - Encoding- State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes -Viterby algorithm, Sequential decoding -Stack algorithm. Interleaving techniques: - Block and convolutional interleaving, Coding and interleaving applied to CD digital audio system -CIRC encoding and decoding, interpolation and muting. ARQ: - Types of ARQ, Performance of ARQ, Probability of error and throughput.

References

1. Communication Systems: Simon Haykin, John Wiley & Sons. Pvt. Ltd.
2. Principles of Communication Systems: Taub & Schilling, Tata McGraw-Hill
3. Principles of Digital Communication: Das, Mullick & Chatterjee, Wiley Eastern Ltd.
4. Error Control Coding Fundamentals and Applications: Shu Lin & Daniel J. Costello Jr., Prentice Hall Inc.
5. Digital Communications Fundamentals and Applications: Bernard Sklar, Person Education Asia

OPTIMIZATION TECHNIQUES (ELECTIVE - I)

CMELRTA 706.1 **3+1+0**

Module1 Classical optimization techniques

Single variable optimization – Multivariable optimization with no constraints – Hessian matrix – Multivariable saddle point – Optimization with equality constraints – Lagrange multiplier method - Multivariable optimization with inequality constraints – Kuhn-Tucker conditions.

Module 2 One-dimensional unconstrained minimization

Elimination methods – unrestricted search method – Fibonacci method – Interpolation methods – Quadratic interpolation and cubic interpolation methods.

Module 3 Unconstrained minimization

Gradient of a function – Steepest descent method – Newton's method – Powells method – Hooke and Jeeve's method.

Module 4 Integer – Linear programming problem

Gomory's cutting plane method – Gomory's method for all integer programming problems, mixed integer programming problems.

Module 5 Network Techniques

Shortest path model – Dijkstra`s Algorithm – Floyd`s Algorithm – minimum spanning tree problem – PRIM algorithm – Maximal Flow Problem algorithm.

References

1. Optimization theory and application: S.S. Rao, New Age International P. Ltd.
2. Optimization Concepts and applications in Engineering: A. D. Belegundu, T.R. Chandrupatla, Pearson Education Asia.
3. Principles of Operations Research for Management: F. S. Budnick, D. McLeavey, R. Mojena, Richard D. Irwin, INC.
4. Operation Research an introduction: H. A. Taha, Eastern Economy Edition.
5. Operations Research: R. Panneerselvam, PHI

OBJECT ORIENTED PROGRAMMING IN C++ (ELECTIVE - I)

LA706-2 **3+1+0**

Module 1

Introduction to loops: Evolution of object oriented languages - Support for experiments and structure - process of language translation – Need of objects - Definition of Object - Oriented Language.

Module 2

Encapsulation & Inheritance: Building classes - Declaring objects Member functions - constructors and destructors members access control.

Module 3

POLYMORPHISM - Virtual functions - Defining virtual functions – Usage of virtual functions - Abstract classes - simulation using abstract classes.

Module 4

OVERLOADING: Overloading functions - Overloading operators to provide new meaning - Selecting Friend or Member Functions for Operator Overloading.

Module 5

DYNAMIC OBJECTS: Dynamic object allocation - Using references with dynamic memory allocation - Inline functions outside class definitions - Friend functions, Applications - Object oriented databases case study – some language (Simula, Smalltalk, C++, Ada) features.

References

1. Data abstraction & OOP in C++: Gordenkeeth, Wiley Eastern.
2. Object oriented programming usig C++: Pohl, Pearson Education.
3. Object oriented programming with C++: E. Balaguruswamy, TMH.
4. C++ Programming language: Strostroup, Pearson Education.
5. Object Oriented Programming in C++: Nabajyoti Bjarne.

NEURAL NETWORKS (ELECTIVE - I)

L706-3 **3+1+0**

Module 1

Introduction - Principles - artificial neuron - activation functions - Single layer & multi-layer networks - Training artificial neural networks - Perception - Representation - Linear separability - Learning - Training algorithms.

Module 2

Back Propagation - Training algorithm - Applications - network configurations - Network paralysis - Local minima - temporal instability.

Module 3

Counter Propagation networks: Kebenon layer - Training the cohenen layer - Pre initializing the wright vectors - statistical properties - Training the Grosbery layer - Full counter propagation network - Application.

Module 4

Statistical methods- Boltzmann's Training - Cauche training - Artificial specific heat methods - Applications to general non-linear optimization problems.

Module 5

Hopfield nets - Recurrent networks - stability - Associative memory - applications - Thermo dynamic systems - Statistical Hopfield networks – Bi-directional associative memories - Continuous BAM - Adaptive resonance theory - Architecture classification - Implementation.

Text Book

Neural Computing Theory & Practice - Philip D. Wasserman.

References

1. Neural Networks - Simon Haykins, Pearson Education.
2. Adaptive Pattern Recognition & Neural Networks - Pay Y.H.
3. An Introduction to neural computing - Chapman & Hall
4. Artificial Neural Networks - Robert J. Schalkoff, McGraw Hill
5. Artificial Neural Networks - B.Yegnanarayana, PHI

BIOMEDICAL ENGINEERING (ELECTIVE - I)

L 706-4 **3+1+0**

Module 1

Biometrics- Biomedical instruments- parameters- Man-instrument system- components- physiological systems of human body- cardiovascular system- The heart- Respiratory system- blood purification- The Kidney- Nervous system- Bioelectric potentials- Resting and Action potentials- propagation- bio-potential electrodes- Transducers- ECG-EEG-EMG.

Module 2

Biomedical measurements: ECG measurement- electrodes and leads- ECG recorder- different recorders. Blood pressure measurements- indirect measurement- sphygmomanometer- direct measurement techniques. Respiratory measurements- Lung volume and capacities- Spirometer- Gas exchange measurements. Clinical measurements: Blood cells- tests on blood cells- chemical tests- colorimeter- spectro photometer- continuous flow analyzer.

Module 3

Ultrasonic measurements: Characteristics of Ultrasound- Attenuation- Doppler effect- basic modes of transmission- pulsed, continuous, pulsed Doppler- Ultrasonic imaging- Block schematic of A mode, B mode, M mode instruments- Electronic scanners: Linear and Phased array- Applications of Ultrasound: Gynecology and obstetrics- blood flow measurements- cardiac imaging- echocardiography- echoencephalography.

Module 4

X ray imaging and measurements: x ray generation- x ray machine- C arm machine- image intensifiers- x ray films- photographic imaging- Fluoroscopy- computed tomography- CAT scan: block schematic- Gantry- detectors.

Module 5

Bio-telemetry: components in telemetry system- transmitter-receiver- pulse modulators- implantable units- applications. Intensive care unit: Planning and location of different instruments- Bedside monitors- Prosthetic instruments- artificial heart- pump oxygenators- hemodialysis- artificial kidney- different dialysers. Electrical safety: Physiological effects of electric current- let go current- shock hazards- need of grounding- isolation of patients- isolated power distribution system.

References

1. Introduction to biomedical technology: Joseph J Carr, Pearson Edn.
2. Biomedical Instrumentation & Measurements: Leslie Cromwell, PHI.
3. Biomedical Instrumentation: John G Webster, Houghton Mifflin Company.
4. A handbook to biomedical instrumentation: R S Khandpur, Tata Mc Graw Hill Pub.

PRINCIPLES OF REAL TIME SYSTEMS (ELECTIVE - I)

LA 706-5 **3+1+0**

Module 1

Introduction to Real Time Systems – Structure of real time systems, real time computer, task classes – Periodic, Aperiodic, critical, Non-critical, definition of real time systems – real time systems, embedded systems - Hard real time systems, soft real time systems, real time design issues.

Module 2

Real time kernel – polled loop systems, co-routines, interrupt driven systems – sporadic, fixed rate systems, hybrid systems, task control block - task status, scheduling – uni-processor scheduling – traditional rate monotonic, rate monotonic deferred server, EDF, IRIS tasks – multiprocessor scheduling – utilization balancing algorithm, next-fit, bin- packing algorithm, myopic offline, buddy strategy (no need of proofs) fault tolerant scheduling.

Module 3

Communication – Communication Media and message sending topologies, network architecture issues, protocols – contention – based, token - based, stop and go multi-loop, polled bus, hierarchal, round robin, fault tolerant routing – clocks and synchronization – fault tolerant synchronization in hardware, synchronization in software.

Module 4

Fault tolerance – definition, cause of failure, fault types, fault detection and containment, redundancy – hardware, software, time, information, integrated failure handling – reliability – parameter values – series – parallel systems, NMR clusters, combinational model, master chain model, fault latency, transient faults, software error models.

Module 5

Programming Languages – Desired language characteristics, Real time databases, characteristics, main memory databases, Transaction, Disk schedule algorithms, Databases for hard real time systems, maintaining serialization constituency.

Text Book

Real Time Systems - C.M Krishna, Kang G. Shini (McGraw Hill)

References

1. Real Time Systems, Design & Analysis - Philip Laplante (IEEE)
2. Real Time Systems - Krishna, Tata McGraw Hill

MICROPROCESSOR AND MICROCONTROLLER LAB

LA707 **0+0+3**

1. Familiarization of 8085 trainer kit, manual code entry, simple examples.
2. Design and construction of a simple flash programmer for 89C51/89C2051 µC.
3. Study of Intel Hex file format.
4. Computer aided assembly language program development for 89C51/89C2051.
5. Use of assembler, linker and simulator for 89C51/89C2051.
6. Programming examples. Sorting, arithmetic operations (Using assembler, simulator).
7. Programming examples using Embedded 'C' compiler for 89C51/89C2051.
8. Programming examples using timer, external interrupts.
9. Design and construction of the following interfacing modules.
    a) A/D converter.
    b) D/A converter.
    c) Alphanumeric LCD display.
    d) Matrix keyboard interface.
    e) Seven segment display.
    f) Extending I/O port using shift registers(74HC595, 74HC165).
    g) Stepper motor.
    h) Infra red transmission and reception.
    i) Opto isolated I/P and O/P.
    j) Serial EEPROM.
    k) Real time clock.
    l) Interfacing using RS 232 and printer port.

Note

Any other embedded processor with similar or better capability may be used instead of 89C51/89C2051.

COMMUNICATION II LAB

L708 **0+0+3**

1. Microwave measurements - VSWR, wavelength, Attenuation, Impedance.
2. Antenna Measurements - Gain, Directivity, Radiation Pattern of various types antennae.
3. Characteristics of Klystron.
4. Wave-guide Measurements.
5. Study of optical fibers and optical communication systems.
6. Delta modulation, PCM, PAM, PPM, PWM, ASK, PSK.
7. Experiments of Satellite communication system.
8. Display systems.
9. Study of PLC's.
10. Familiarization of Digital modulation and demodulation Trainer Kit.