

08. ELECTRONICS

DETAILS OF SYLLABUS

UNIT 1

CONTROL SYSTEMS

Basic Control System Components: Block diagram description – reduction of block diagram – Open loop and closed loop systems – Signal flow graphs and their use in determining Transfer function.

Properties of Systems: Linearity, time invariance, stability and causality, Special properties of Linear Time Invariant (LTI) systems: Transfer function, Impulse response; State variable Representation and Solution of State Equation for Electrical Systems, Electro-mechanical systems and analogous systems.

Transient and Steady State Analysis: Transient response of first order and second order systems – Error Constants – Generalized Definition of Error Coefficients, AC and DC Servomotors and Stepper Motor as Control System Components.

Concept of Stability: Poles, zeros and their significance in stability analysis, Tools and Techniques for LTI Control System Analysis: Root Locus Method, Routh Hurwitz's Criterion, Bode Plot, Polar Plot, Nyquist criterion, Nichols chart.

Design of Control Systems and Compensation Techniques: Control System Compensators – elements of Lead Compensation – Lag Compensation – Lead Compensation – Lag – Lead Compensation, PID Control.

NETWORK ANALYSIS AND SYNTHESIS

Review of basic circuit concepts:- Classification of circuits, circuit elements, sources and Kirchoff's law. Review of Network Theorems – Substitution, superposition, Reciprocity, Maximum Power Transfer, Thevenin's Norton's. Transients in linear circuits-Initial conditions – Rise and decay of current in RL circuit – Time Constant - RC circuits with impressed DC voltage – RL and RC circuits with sinusoidal voltage DC transients in RLC circuits – Damping.

Signal representations and network response: Characteristics of signals – Unit step function, impulse and ramp function, non sinusoidal signals – representation of a wave using Fourier series expansion – Frequency spectrum of periodic wave forms – Fourier integral and Fourier transforms - discrete and continuous frequency spectra.

Laplace transform analysis: Main properties of L.T- Laplace Transform of important signal waveforms. Laplace transform analysis of simple network – partial fraction expansion – initial and final value theorems – convolution integrals.

Network function: Concept of complex frequency transform impedance and admittance driving point impedance and admittance – Transfer function-relation between transfer function and impulse response-their use in network analysis and design - Poles and zeros Pole-Zero plot-relations between time domain behaviour and pole-zero plot.

Filters, attenuators and equalisers: Relation between bandwidth and rise time, delay time and network function. Analysis of constant K and M derive filters Introduction to network synthesis-synthesis of passive one port network properties and synthesis of LC, RC and RL network. Foster and Cauer methods – Introduction to positive real functions.

POWER ELECTRONICS

Theory and Operation of SCR, UJT, and Triac: Characteristics-design of relaxation oscillator using UJT – in SCR and TRIAC triggering circuits PUTs-silicon bilateral switch – speed control of DC Shunt Motor using thyristors – single phase phase half wave speed control system – Single – phase speed control system – Reversible control system.

Thyristor Commutation Techniques:- Introduction – natural commutation – forced commutation–self commutation–impulse commutation–response pulse commutation–external pulse commutation–load side commutation line side commutation–complementary commutation. Controller Rectifiers:- Introduction –Principle of phase controlled converter-single phase-semi-converter-single phase series converter.

Static Switches:- Introduction-single phase AC switches, three phase AC switches – Three phase reversing switches-AC switches for bus transfer-DC switches-Solid state relays. AC voltage controller: Introduction – Principle of ON OFF control – Principle of phase control-single phase bi-directional controllers with resistive. Loads and inductive loads - cyclo converters – single phase cyclo converters.

DC Choppers:- Introduction – principle of step-down operation-step-down with RL load, principle of step up operation – Switch mode regulator: buck regulator - boost regulator-Buck and Boost regulator

Inverters and power supplies:- Introduction – principle of operation-single phase inverters voltage control of single phase inverters – introduction to power AC and DC power supplies – resonant DC power supplies – bidirectional power supplies – AC power supplies

UNIT 2

ELECTRONIC DEVICES AND CIRCUITS

Semiconductor Diodes and Applications - Junction diode – Zener diode – LED – tunnel diodes – UJT- load line analysis- diode approximation – Series diode configuration with DC inputs – Series – parallel configuration - sinusoidal input – Half wave rectification – full wave rectification.

SCR – characteristics

Bipolar junction transistors:

Amplification in the AC domain – BJT transistor modeling - important parameters – transistor model – Hybrid equivalent model – graphical determination of h – parameters- Variation of transistor parameters- common emitter fixed bias configuration – Voltage divider bias – CE bias configuration – Emitter follower configuration - common base configuration – collector feed back configuration – approximate hybrid equivalent model.

Fet (Field Effect Transistor) : - Construction and characteristics of JFET - fixed bias configuration – voltage divider biasing – Depletion type MOSFET – enhancement type MOSFET – FET small signal model – AC equivalent circuit – Enhancement MOSFET amplifier – design of JFET amplifier circuit.

Feedback and Stability : - Concept, negative Feedback, Effect of feedback on amplifier – performance, the four basic amplifier types, the four feedback topologies, effect of feedback connection on amplifier port resistance, examples of feedback amplifiers. Feedback loop stability.

Linear Wave shaping circuit : - RC / RL / RLC circuits, pulse transformer – modeling, switching characteristics of devices (diodes, BJT, MOS, IGBT) switch with capacitive load, inductive load, non saturating switches, multivibrators – astable, monostable, bistable, negative resistance switching circuits and characteristics, time base generators – bootstrap, miller blocking oscillators, transient switching and characteristics.

Oscillators : - Feedback concept – feedback amplification phase and frequency considerations – oscillator operations- phase shift oscillator – Wien's bridge oscillator – tuned oscillator circuits – crystal oscillator – UJT relaxation oscillator.

UNIT 3

VLSI DESIGN AND ANALYSIS

MOS Devices and Integrated Systems - The MOS transistor - Basic invertors – Nand and Nor logic circuits – Effects of scaling down the dimensions of MOS circuits and systems – n - channel mos process - VLSI patterning and processing – design rules.

Data and Control Flow in Systematic Structure - Introduction - Notationalis – 2 – phase clocks – shift register sub system implementation register – to – register transfer – combinational logic circuits programmable logic circuits finite state machine.

LSI Computer System and Design – Introduction – OM Project – System overview – overall structure of data path – ALU – ALU registers – Buses - Barrel shifter – register array.

System timings : Introduction to self timed system – self timed elements.

VLSI Fabrication Techniques - An overview of wafer fabrication – wafer processing – oxidation patterning diffusion- ion implantation – deposition – Si gate n MOS process – C MOS Process – n Well – p Well – Twin tub – Si on insulator – C mos process Enhancement Interconnect circuit elements.

Basic electrical properties of MOS and CMOS circuits – N MOS enhancement transistor - P MOS enhancement transistor Threshold voltage eqn – MOS device eqn - Basic DC eqn – N MOS Inverter – Steered I/P to inverter – depletion mode and enhancement mode pull-ups- C MOS inverter DC characteristics – inverter delay - pass transistor transmission gate.

MICROPROCESSORS AND THEIR INTERFACING TECHNIQUES

Digital interfacing : - Programmable parallel ports and hand shake Input Output application interfacing a microprocessor to keyboards, (KB): Keyboard type KB circuit connection and interfacing to Alpha numeric displays:- Seven segment display – LCD display – interfacing timer / counter 8253 – interfacing KB/DISPLAY 8279.

Analog Interfacing and Industrial Control : - Sensors – transducers – D/A converter operation , interfacing and application – A/D converter operation , interfacing and application - microprocessor based industrial process control system - microprocessor based scale.

Data Communication and Networks : - Asynchronous serial data communication - serial data transmission methods & standards : RS232 serial data standard – modems – LAN – IEEE 488 GPIB standard.

Advanced Microprocessors : - Introduction – RISC Vs CISC processors – intel 8086 architecture – architecture of intel 186, 286, 386 and 486 processor – intel Pentium – intel Pentium P6 processor- intel 1860 processor (RISC).

Application of Microprocessors : - Delay subroutine –frequency measurement – temperature measurement and control - Water level indicator – measurement and display of speed of a motor – interfacing stepper motor – microprocessor based control of firing circuit of a thyristor

MICRO CONTROLLERS AND THEIR APPLICATIONS

Introduction – memory organization in MCS 51 – logical separation of program and data memory – Program memory – Data memory- MCS 51 instruction set.

CPU Timing and 8751 : - Machine cycles – interrupt structure – 8751 micro controller – memory organization – process information – pin description programming the 8751.

Using MCS 51 : - Introduction - Boolean processor operations – Boolean processor application

Design with 80C 51B : - CMOS evolves– CHMOS evolves – MCS 51 family in CHMOS – latch up – logic level and interfacing problems – noise considerations – pull up and pull down resistors drive capabilities of internal pull ups – power consumption – using power down mode – using power MOSFET's to control Vcc – battery backup system – power switch over circuits 8031 CHMOS EPROM – scanning a key board – driving an LCD.

A/D processing with micro controller – small dc motor control.

UNIT 4

MODERN COMMUNICATION SYSTEMS

Modulation of Signals : - Simple AM waves - power relation – generations & detection of simple AM waves – typical circuits – DSBSC, SSB and VSB modulation systems – FM generation : direct and indirect method, demodulation of FM by Discrimination and PLL techniques.

Pulse Modulation System : - Sampling theorem – PAM, PWM, PPM generation and detection – TDM – SNR behaviour – PCM principles – Delta modulation – DPCM – ASK – FSK - PSK – DPSK.

Mobile Communication : - Evaluation and fundamentals – cellular structure and planning – frequency allocations – propagation problems – Base station antennas and mobile antenna – types of mobile systems, access methods : TDMA, FDMA and CDMA – Digital Cellular Radio.

Satellite Communication : - Satellite Orbits – Satellite frequencies - Altitude / station keeping transmission path – link calculations – noise considerations – factors affecting satellite communication.

Digital Microwave Communication – digital hierarchies – digital microwave system – band width and efficiency – hybrid microwave system.

FIBRE OPTICS AND THE APPLICATIONS

Optical Fibres, Structures and Wave Guides Fundamentals : - Optical fibre models and configuration fibre types - step index fibre structure, ray optic representation – wave representation – mode theory of circular wave guides, Maxwell's equation wave guide equations, wave equation for step index fibres – power flow in step index fibre - graded index fibre structure – graded index numerical structure.

Signal Degradation in Optical Fibres : - Attenuation units – core and cladding loss – signal distortion in optical wave guides – information capacity determination – group delay – materials dispersion - wave guide dispersion intermodal dispersion – pulse broadening in graded index wave guides – mode coupling.

Power Launching and Coupling : - Source to fibre power launching source output pattern – power coupling calculations – power launching versus wavelength – equilibrium numerical aperture – lensing schemes for coupling improvement – Imaging micro spheres – laser diode to fibre coupling, fibre to fibre joints – mechanical misalignment – fibre splicing losses – fibre end face preparation – splicing techniques.

Advanced Systems and Techniques : - Wave length division multiplexing – LAN:- Optical fibre bus – ring topology – star architecture – fail safe fibre optic nodes.

Optical Amp : - Basic application optical amp types – gain – Amp noise figure – optical bandwidth Photonic Switching – Mechanical Switches – Integrated optical Switch.

DATA COMMUNICATION NETWORKS

Networking Concepts : - Structure of the communication Network – Network Topologies – Telephone Networking – Fundamentals of Communications theory connecting the analog and digital worlds – Synchronising Network components- classification of communication protocols- polling / selection systems – non polling systems per to pear non – priority system – pear to pear priority system.

Components and Network Distributed Architecture : - Layering: Physical – Data link layer – network layer – transport layer - session layer – Application layer.

MODEMS : - Modulation techniques – multilevel transmission – advances in modems

SWITCHING : - Circuit switching – message switching – packet – multiplexing – line sharing – compression – FDM – TDM – TDMA.

Local Area Network : - Introduction – LAN definition – usage – major components of LAN – LAN protocols – IEEE standards : - CSMA/CD – Token ring, token bus – MAN – filter distributed data interface (FDDI) – logical Ink control – other LAN (ETHERNET IBM – token ring).

ISDN Narrow and broad band ISDN.

Evaluation of PBX – issue of voice data integration – using PBX in LAN – IV generation PBX – digital multiplexed interface (DMI) and computer to PBX (CPI) proposals.

Data Communication Applications :- Facsimila – scanning methods – flat bed scanner – FAX standards – fax system Telematics – teletex – E-MAIL –X 400, X500, Concept of internet.

INTERNET TECHNOLOGY AND PROGRAMMING

Internet Definition, TCP / IP protocol architecture, Operation of TCP / IP. Principles of Internet working , connection less Internet working. The internet protocol (IP) , IP services, IP protocol, IP address, ICMP, Routing Protocol , Gate Way Protocol, IPNG.

The Internet Transport Protocol; TCP, TCP services, TCP protocol, TCP connection management, UDD Providers, shell account / (TCP/IP) account connectivity , SLIP/ PPP protocols

Distributed Applications.

E- mail Architecture and Services , World Wide Web definition , Linking of documents in WWW, URL, DNS, major categories of websites over internet – institutional, business, Tourism, Industry, Entertainment industry websites , Browsers, Browsing the web, Getting and viewing the document , searching for information, HTTP, study of HTML, writing a web page in HTML.

Study of Java – Java applets – Design of a simple GUI – To access a file from a website.

UNIT 5

PROGRAMMING C++

Introduction to object oriented concepts, C++ programming basics, loops and decisions, structures, functions, objects and classes, constructors, objects as function arguments, structures and classes.

Arrays, arrays as class member data, arrays of objects, strings, string as class members, operator overloading, overloading unary operators, overloading binary operators, data conversion.

Inheritance: Derived class and base class, derived class constructors, class hierarchies, private and public hierarchies, levels of inheritance, multiple inheritance, classes within classes.

Pointers: memory management, new and delete, pointers to objects, pointers to pointers, virtual functions, virtual functions friend functions, static functions, assignment copy, initialization, polymorphism.

Files and streams: streams, string I/O, character I/O, object I/O, I/O with multiple objects, file pointers, disc I/O with functions, command line arguments.

Templates and exception handling.

PC HARDWARE

MAINTENANCE AND TROUBLE SHOOTING

PC Hardware Overview:- Introduction to computer organization – Memory – PC family – PC hardware interconnections between Boxes- Inside the boxes:- mother board, daughter boards, floppy disk drive, HDD, speaker, mode switch, front panel indicators and control – mother board logic – memory space I/O port address – wait state – interrupts – I/O data transfer – DMA channels. POST sequence.

Peripheral Devices:- Floppy drive controller:- Overview – Disk format – FDC system interface Hard Disk controller – overview- Disk Drives and Interface – Controller post description Hard disk, disk card – Hard disk format. Display Adapter: CRT display CRT controller principle – CRT controller 6845 printer controller:- Centronics interface – programming sequence – Hardware overview – printer – subassemblers.

Motherboard Circuits:- Motherboard functions – functional units and inter communications:- Reset logic – CPU nucleus logic – DMA logic – Wait state logic – NA logic – speaker logic – keyboard interface – SMPS.

Installation and Maintenance:- Introduction – pre installation planning – Installation practice – routine checks – special configuration memory up gradation – HD up gradation – DOS command (internal and external) Preventive maintenance – system usage.

Trouble Shooting:- Computer faults – nature of faults – types of faults – diagnostic programs and tools – fault elimination – systematic trouble shooting procedure mother board problem – serial port problems – FDC, HDC, display problems display adapter printer problem monitor problems, HDD, FDD problems.

ANALOG AND DIGITAL ICs AND APPLICATION

Operational Amplifiers:- Op-AMP DC characteristics:- input bias current – Input offset current-input offset voltage-output offset voltage-thermal drift.

OP-AMP AC characteristics:- frequency response-stability of opamp-frequency compensation-slew rate-Inverting and non-inverting amplifiers and its applications:- Adder – Subtractor – Integrator – Differentiator – Current to voltage – voltage to current converters – current amplifier – instrumentation amp – bridge amp – voltmeters and current meters.

Comparators and Applications:- Comparator characteristics and limitations – comparator applications:- zero crossing detector-level, detector-window detector-phase detector-schmitt trigger-Voltage limiter-Precision half wave-full wave rectifier-clipper – clamper sample and hold circuit – log and antilog amplifiers-frequency multiplication and division-A/D and D/A converter.

Filter and Wave Generators:- Filters: first order low pass filter-second order low pass filter-High-pass filter and second order band pass filter-Narrow band and wideband pass filter. Band rejection filter-Notch filter.

Astable – Monostable Multivibrator – Triangular wave generator – Sine wave generator – Phase shift and Wein bridge oscillator.

Digital IC Application

Number systems – Boolean Algebra – logic gates – combinational and sequential logic circuits – synchronous and asynchronous counters – Digital IC's and applications – Decade counter, decoder parity generator/checker, sequence generator, pattern detector.