PRINCIPLES OF COMMUNICATION ENGINEERING

1. Introduction

(a) Need for modulation and demodulation in communication systems.
(b) Basic scheme of modern communication system.

2. Amplitude Modulation

(a) Derivation of mathematical expression for an amplitude modulated wave showing Carrier and side band components. Significance of Modulation index, spectrum and bandwidth of AM wave, relative power distribution in carrier and sidebands.
(b) Elementary idea of DSB-FC, DSB-SC, SSB-SC, ISB and VSB modulations, their comparison and areas of applications.

3. Frequency Modulation

(a) Derivation of expression for frequency modulated wave and its frequency spectrum (without proof and analysis of Bessel function), modulation index, maximum frequency deviation and deviation ratio, BW of FM signals, Carlson's rule
(b) Effect of noise on FM carrier, noise triangle, need for pre-emphasis and de-emphasis, capture effect.
(c) Comparison of FM and AM communication system.

4. Phase Modulation

Derivation of expression for phase modulated wave, modulation index, comparison with frequency modulation.

5. Principle of AM Modulators

orking principles and typical applications of
(a) Collector Modulator
(b) Base Modulator
(c) Balanced Modulator.

6. Principles of FM Modulators

(a) Working principles and applications of reactance modulator, variactor diode modulator, VCO and Armstrong phase modulator, stabilization of carrier using AFC.
(b) Block diagram and working principles of reactance transistor and Armstrong FM transmitters.

7. Demodulation of AM waves

(a) Principles of demodulation of AM wave using diode detector circuit, concept of diagonal clipping and formula for minimum distortion (No derivation).
(b) Principle of demodulation of AM wave using synchronous detection

8. Demodulation of FM waves

(a) Basic principles of FM detection using slope detector.
(b) Principles & working of the following FM demodulators.
- Foster-Seeley Discriminator
- Ratio Detector
- Quadrature Detector
- Phase Locked Loop (PLL) FM Detector

9. Pulse Modulation

(a) Statement of sampling theorem and elementary idea of sampling frequency for pulse modulation.
(b) Basic concepts of time division multiplexing (TDM) and frequency division multiplexing (FDM).

(c) Basic ideas about PAM,PPM,PWM and their typical applications.
(d) **Pulse code modulation (PCM):** basic scheme of PCM system, Quantization, quantization error, block diagram of TDM-PCM communication system and function of each block, Advantages of PCM systems, concept of differential PCM (DPCM).
(e) **Delta Modulation**: Basic principle of delta modulation system, advantages of delta modulation over PCM system, limitation of delta modulation, concept of adaptive delta modulation system (ADM).
(f) Basic Block diagram and working principle of ASK, PSK, FSK & QPSK.

DIGITAL ELECTRONICS

1. Introduction
(a) Basic difference between analog and digital signal.
(b) Applications and advantages of digital signals.

2. Number Systems
(a) Binary, Octal and hexadecimal number system, conversion from one form to another.
(b) Concept of code, weighted and non weighted codes, BCD (8421 code only), excess -3 and grey code.
(c) Concept of parity, single and double parity and error detection.
(d) Alphanumeric codes (ASCII).
(e) Binary arithmetic (addition, subtraction, multiplication and division including binary points). BCD addition, 1's and 2's complement method of addition /subtraction.

3. Logic Gates
(a) Concept of negative and positive logic.
(b) Definition, symbols and truth table of NOT, AND, OR, NAND, NOR, XNOR, gates, working of AND and OR gates using simple diode circuits, NAND and NOR as universal gates.

4. Logic Simplification
(a) Postulates of Boolean algebra, De-Morgan's theorems, Various identities, formulation of truth table and Boolean equation for simple problems, implementation of Boolean (Logic) equations with logic gates.
(b) Karnaugh map (up to 4 variables) and simple application in developing combinational logic circuits.

5. Logic Families
(a) Logic family classification;
  (i) Definition of SSI, MSI, LSI, VLSI
  (ii) Comparison of TTL and MOS family characteristics with respect to delay, speed, noise margin, logic levels, power dissipation, fan-in, fan- out, power supply requirement.
(b) Logic Circuits: Open collector, wired-OR, totem pole output circuit operation (qualitative) for TTL NAND gate.
(c) Tri-state switch / Buffer.

6. Arithmetic Circuits
(a) Half Adder and Full adder circuits, design and implementation.
(b) Half and full adder circuits, design and implementation.
(c) 4 bit adder/subtractor

7. Display Devices

LED, LCD, seven segment displays, basic operation of common anode and common cathode types of displays.

8. Multiplexers, De-multiplexers and Decoders

Basic functions and block diagram of MUX, DEMUX, Encoders and Decoders. Detailed functioning of 3X8 decoder/demux.

9. Latches and Flip-flops

(a) Concept and types of latch with their working and supplications.
(b) Operation using waveforms and truth tables of RS, JK, D, Master/Slave JK and T flip-flops.
(c) Use of D fil-flop as latch
(d) Flip-flop as basic memory cell

10. Counters

(a) A synchronous counters:
  (i) Binary counters
  (ii) Modulus of a counter, modified count of a counter, Mod-8 and Mod-10 counter (including design),difference between decade and mod-10 counter.
  (iii) Presentable and programmable counters
  (iv) Down counter, up/down counter.
(b) Synchronous counters (only introduction)
(c) Difference between asynchronous and synchronous counters
(d) Ring counter and Johnson counter with timing diagram.

11. Shift Register

(a) Introduction and basic concepts including shift left and shift right.
(b) Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.
(c) Universal shift register.
(d) Buffer register, Tri-state buffer Register.

12. Applications

Digital Clock and Calculator

NETWORKS, FILTERS & TRANSMISSION LINES

1. Introduction to networks

(a) Two port (4 terminals) networks, network elements, classification i.e, symmetrical and asymmetrical networks, balanced and unbalanced ,T-network, II network, ladder network, lattice network, L-network, bridge-network.
(b) Symmetrical network parameters concepts and significance i.e., characteristic impedance, propagation constant, attenuation constant, phase shift constant and insertion loss.
(c) Asymmetrical network parameters concepts and significance i.e., iterative impedance, image impedance image transfer constant and insertion loss.
(d) Network analysis: analysis of symmetrical T and II networks, derivation of Zo, a, b, c, d parameter, open circuit and short circuit analysis, simple design problems.
(e) The half section of symmetrical T and II section, derivation of iterative impedance, image impedance, open circuit and short circuit impedance of half section. Use of half section.

2. Attenuators

(a) Unit of attenuation (decibel and nepers), general characteristics of attenuators. Types of attenuators.
(b) Analysis and design of simple attenuators of the following types (i) Symmetrical T (ii) Symmetrical II (iii) L Type.

3. Filters

(a) Brief idea of the use of filters in different communication systems. Types of filters. Concept of LPF, HPF, BPF, BSF (Band Stop Filter), basic concept about response curve of Butterworth, Chebyshev and Caur type filters.

(b) Theorem connecting attenuation constant and characteristic Zo impedance, determination of cut-off frequency of constant K-filter.
(c) Prototype of LPF & HPF using T configuration. Following curves & simple design problems.
(d) Reactance
(e) M-derived filter section: limitation of prototype filter, advantages of m-derived filter, expression for m in terms of fc and fa for LPF and HPF, plots of attenuation (□), Zo with frequency, simple design problems.
(f) Concept of composite filter and matching of it's various components.
(g) Crystal filter: Crystal and its equivalent circuits, special properties of crystal filter and their use.
(h) Active Filter: Basic concept of active filter, comparison with passive filters, simple design problems on LPF, HPF, first and second order Butterworth filters, concept of all pass filter, active BPF and BSF.

4. Transmission Lines

(a) Transmission lines and their applications, different types of transmission lines including optical cables and submarine cables wave guide & stripline. Operating frequency range bandwidth of different type of transmission line.
(b) Primary constants of a transmission lines, equivalent circuit of an infinite line, T and π (pie) type representation of a section of transmission line.
(c) Definition, significance of characteristic impedance of a line, concept of short line terminated in Zo, current and voltage along an infinite line, propagation constant, attenuation and phase shift constant of the line.
(d) Relationship of Zo, Y in terms of primary constants of the line.
(e) Condition for minimum distortion and minimum attenuation of signal on the line, necessity and different methods of loading the communication lines (no derivation).
(f) Concept of reflection and standing waves on a transmission line, definition of SWR, relation between VSWR and voltage reflection coefficient, maximum impedance on a line in terms of Zo and VSWR.
(g) Transmission line equation, expression for voltage, current & impedance at a point on the line with and without losses. Expression for input impedance of the line (no derivation).
(h) Input impedance of an open and short circuited line and its graphical representation.
(i) Transmission line at high frequency, effect of high frequency on the losses of a transmission line, application of transmission lines as a reactive component and impedance transformer (quarter wave transformer)
(j) Principle of impedance matching using single stub, comparison of open and short circuited stubs. Concept of broad band matching.

ELECTRONIC DEVICES AND CIRCUITS – II

1. Multistage Transistor Amplifier

Need of multistage amplifier, different coupling schemes and their working; brief mention of application of each of the types of coupling, working of R-C coupled and transformer coupled multistage amplifier, approximate calculation of voltage gain of two stage R-C coupled amplifier. Frequency response for R-C coupled and transformer coupled amplifiers and physical significance of the terms bandwidth, upper and lower cross over frequencies. Direct coupled amplifier and its limitation; difference amplifier typical diagram and working.

2. Audio Power Amplifiers

Difference between voltage and power amplifiers; importance of impedance match in power amplifier, collector efficiency of power amplifier. Typical single ended power amplifier and its working, graphical method of calculation of output power; heat dissipation curve and importance of heat sinks; class A, class B and Class C Amplifier; collector efficiency and distortion in class A,B and C amplifier (without derivations) working principles of push pull amplifier circuits, its advantages over

single ended power amplifier, cross over distortion in Class B operation and its reduction. Different driver stages for push pull amplifier circuit. Working principles of complementary symmetry push pull circuit and its advantages. Transformer less audio power amplifiers and their typical applications.

3. Feedback in Amplifier

Basic principles and types of feedback Derivation of expression for the gain of an amplifier employing feedback Effect of negative feedback on gain, stability, distortion and bandwidth (only physical explanation), Typical feedback circuits RC coupled amplifiers with emitter by pass, capacitor removed Emitter follower and its application, simple mathematical analysis for voltage gain and input & output impedance of above circuits.

4. Operational Amplifier

Characteristics of ideal operational amplifier and its block diagram, definition of inverting and non-inverting inputs, differential voltage gain, input and output voltages, input offset current, input bias current, common mode rejection (CMRR), Power Supply Rejection Ratio (PSRR) and slew rate. Method of offset, Null Adjustment, use of Opamp as an invertor, scale changer, Adder, Subtractor, Differentiator, Integrator. Schmitt trigger circuit, time base generator circuit, S/H switch circuit.

5. Sinusoidal Oscillators

Application of oscillators. Use of positive feedback, negative feedback & negative resistance for generation of oscillation, Barkhousen criterion for oscillations. Different oscillator circuits tuned collector Hartley, colpitts, phase shifts, wiens bridge and crystal oscillators and their working principles (no mathematical derivation), Operational amplifier as Wein Bridge Oscillator and phase shift oscillator

6. Tuned Voltage Amplifiers

Classification of amplifiers on the basis of frequency. Series and parallel resonant circuits, expression for resonant frequency, expression for impedance at resonance; relationship between resonant frequency, Q and Band width (no derivation) Hybrid equivalent circuits of transistor and its parameters, h parameters model of single and double tuned amplifiers; their working principles and frequency response (no mathematical derivation) Concepts of neutralization. Staggered tuned amplifier and typical applications in brief.

7. Optical Electronics Devices and Their Applications

Working principles and characteristics of photo resistors, photo diodes, photo transistors, photo voltaic cells, LEDS, LCDs and optical couplers. Simple application of optical electronic devices (one example of each may be mentioned)

COMPUTER PROGRAMMING AND APPLICATIONS

1. Programming in C / C++.

1.1 Basic structure of C program
1.2 Executing a C program
1.3 Identifiers & keywords, data types, constants, variables
1.4 Operators, expressions & statements.
1.5 Library functions

1.6 Managing input-output operations, like reading a character, writing a character, formatted input, formatted output through print , scanf, getch, putch statements etc.
1.7 Decision making and branching using if --- else, switch, go to statements.
1.8 Decision making and looping using white, do & for statements.
1.9 Arrays – one dimensional and multi- dimensional
1.10 Functions
1.11 Recursion
1.12 Structures & unions
1.13 OOPS concepts

2. Information Storage and Retrieval

2.1 Need for information storage and retrieval
2.2 Creating data base file
2.3 Querying database file on single and multiple keys
2.4 Ordering the data on a selected key
2.5 Programming a very simple application
2.6 Indexing and storing, concept of storage

3. Computation and Graphic Tools

3.1 Use of Computation tools for

(i) Evaluation of function
(ii) Tabulation of function
(iii) Integration of functions
(iv) Matrix calculation
(v) Statistical calculation

3.2 Use of Graphic tools

i) Plotting graphics
ii) Making measurement on the graphs
iii) Solving equations using graphs

4. Computer Aided Drafting (3-D Design)

a) Designing simple 3-D objects using Parametric and non-Parametric modeling.
b) Retrieving different views & 2-D details of models.
c) Importing and exporting data for preparing a design.
d) Assembly modeling - Check for fits & tolerances.

5. Applications of computer

5.1 Web technologies

(i) Introduction to world wide web, search engines
(ii) E-mail, news
(iii) Basics of audio & Video conferencing
(iv) Languages used for web technologies

HTML – Practical examples
DHTML – Practical examples

ELECTRONIC FABRICATION & PRODUCT DESIGN

1. Introduction to PCB

(a) Need of PCBs
(b) Types of PCBs
(c) Types of materials used for PCB, their characteristics and limitations
(d) Brief summary of all the processes involved in fabrication of PCB from schematic diagram to final stage.

(e) Use of active and passive components. Manuals for using mechanical parameters of components

2. 2. Manual Design of PCB

(a) Layout generation
(b) Minimization of layout
(c) Layout transfer
(d) Etching of PCB
(e) Drilling

3. Introduction to PCB design software

(a) Familiarization and use of PCB software like ORCAD (minimum 9.1), Eagle, Pro E, PCB Express, Lab View (Any two) Electronics Workbench.
(b) Practice in PCB designing of circuits of the following categories;
  (i) Communication circuits
  (ii) Digital circuits (counters, shift registers, multiplexers, de-multiplexer etc.)
  (iii) Audio & Video
  (iv) Microprocessor based circuits

4. Fabrication and testing

(a) Fabrication of small analog and digital (minimum one each) circuits, CMOS ICs.
(b) Final assembly, troubleshooting of the developed product and product
(c) demonstration.
(d) Criterion for selection and mounting of heat sinks.

5. Fabrication Techniques

(a) Soldering methods, manual and demo on machine soldering
(b) Comparison of soldering methods
(c) Practice on PCB soldering/desoldering.
(d) Component forming and placement on the PCB
(e) Tools and precautions to be observed during manual soldering.

ELECTRONIC DEVICES & CIRCUITS – III

1. Wave shaping Circuits

General idea about different wave shapes. Review of transient phenomena in R-C and R-L Circuits. R-C and R-L differentiating and integrating Circuits. The applications (physical explanation for square/ rectangular input wave shapes only). Diode clippers, series and shunt biased type. Double clipper circuits. Zener diode clipper circuits. Use of transistors for clipping. Diode clamping circuit for clamping to negative peak, positive or any other level for different input waveforms (e.g. sine, square, triangular), ideal transistor switch, explanation using C.E. output characteristics.

2. Timer I.C.

Block diagram of I.C. timer (such as 555) and its working. Use of 555 timer as mono-stable and astable multivibrators.

3. Multivibrator Circuits

Concept of multivibrator : astable, monostable, bistable. 555 timer as mono and astable multivibrator. Op-amp as monostable, astable multivibrator and schmitt trigger circuit.

4. Time Base Circuits

Need of time base (sweep) wave forms, special features of time base signals. Simple method of generation of saw tooth wave using charging and discharging of a capacitor. Constant current generation of linear sweep voltage circuit using op-amp.

5. Integrated Electronics

Fabrication of transistor by planner process, a typical fabrication process for ICS (brief explanation).

6. Regulated Power Supply

Concept of regulation. Principles of series and shunt regulators. Three terminal voltage regulator ICs (positive, negative and variable applications). Block diagram of a regulated power supply. Concepts of cv,cc and foldback limiting, short circuit and overload protection. Major specifications of a regulated power supply and their significance (line and load regulation, output ripple and transients). Basic working principles of a switched mode power supply (SMPS). Concept of floating andngrounded power supplies and their interconnections to obtain multiple output supplies. Brief idea of CVT,UPS and dual tracking power supply.

7. VCO (IC565) and PLL(IC566) and their applications

8. Thysistors and UJT

Name,symbol,characteristics and working principles of SCR, Triac, diac, SCS, SUS,SBS and LASCR. Mention of their applications. Basic structure, principle of operation and VI characteristics of UJT. Explanation of working of UJT as relaxation oscilliator and its use in thyristor.

INTRODUCTION TO MICROPROCESSORS

1. Introduction

(a) Typical organization of a microcomputer system and functions of its various blocks.

(b) Microprocessors, its evolution, function and impact on modern society.

2. Architecture of microprocessor (with reference to 8085 microprocessor)

(a) Concept of bus, bus organization of 8085.

(b) Functional block diagram of 8085 and function of each block.

(c) Pin details of 8085 and related signals.

(d) Demultiplexing of address/data bus (AD0-AD7), generation of read, writes control signals.

3. Instruction timing and Cycles

(a) Instruction cycle, machine cycle and T states.

(b) How a stored programme is executed-Fetch and Execute cycles.

4. Programming (with respect to 8085 microprocessor)

(a) Brief idea of machine and assembly languages, machine and mnemonic codes

(b) Instruction format and addressing mode, identification of instructions as to which addressing mode they belong.

(c) Concept of instruction set, explanation of the instructions of the following groups of instruction set of 8085. Data transfer group, Arithmetic group, Logic group, Stack, I/O and machine Control Group.

(d) Programming exercises in assembly language (Examples can be taken from the list of experiments)

5. Memories and I/O interfacing

(a) Memory organization, memory map, partitioning of total memory space, address decoding, concept of mapped I/O and memory mapped I/O. Interfacing of memory and I/O devices

(b) Concept of memory mapping, concept of stack and its function.

6. Interrupts

(a) Concept of interrupt, maskable and non-maskable, edge triggered interrupts, software interrupts, restart instruction and its use.

(b) Various hardware interrupts of 8085, servicing interrupts, extending interrupt system.

7. Data Transfer Techniques

(c) Concept of programmed I/O operations, sync data transfer, async data transfers (handshaking), Interrupt driven data transfer, DMA, serial output data, serial input data.

8. Brief idea and programming of interfacing chip 8255.

9. Microcontrollers

(a) Introduction, architecture of 8051 only applications of microcontrollers.

10. Comparison

(a) 8085, Z80, 6800 (8 bit microprocessors)

ELECTRONIC INSTRUMENTS & MEASUREMENTS

1. Basics of Measurement

(i) Review of performance, specifications of instruments, accuracy, precision, sensitivity, resolution range etc. Errors in measurement and loading effects.

2. Multi-meter:

(i) Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance in a multi-meter

(ii) Specifications of a multi-meter and their significance

(iii) Limitations with regards to frequency and input impedance

3. Electronic Voltmeter

(i) Advantages over conventional multi-meter for voltage measurement with respect to input impedance and sensitivity.

(ii) Principles of voltage, current and resistance measurements (block diagrams only)

(iii) Specifications of an electronic Voltmeter/Multi-meter and their significance.

4. AC Milli-voltmeter

(i) Types of AC millivoltmeters : Amplifier-rectifier and rectifier-Amplifier, Block diagram and explanation of the above types of ac millivoltmeters

(ii) Typical specifications and their significance

5. Cathode Ray Oscilloscope

(i) Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only – no mathematical treatment) Deflection sensitivity, brief mention of screen phosphor for CRT in relation to their visual persistence and chemical composition

(ii) Explanation of time base operation and need for blanking during fly back ; synchronization

(iii) Block diagram explanation of a basic CRO and a triggered sweep oscilloscope, front panel controls

(iv) Specifications of a CRO and their significance

(v) Use of CRO for the measurement of voltage (dc and ac) frequency, time period and phase angles

(vi) Special features of dual treace, delayed sweep and storage CROs (brief mention only); introduction to digital CROs

(vii) CRO probes, including current probes.

(viii) Digital storage Oscilloscope: Block diagram and principle of working.

6. Signal Generators and Analysis Instruments

(i) Block diagram, explanation and specifications of

(ii) laboratory type low frequency and RF signal generators

(iii) pulse generator and function generator

(iv) Brief idea for testing, specification for the above instruments

(v) Distortion factor meter, wave analysis and spectrum analysis

7. Impedance Bridges and Q-Meters

(i) Block diagram explanation of working principles of a laboratory type (balancing type) RLC bridge. Specifications of a RLC bridge.

(ii) Block diagram and working principles of a Q-meter

8. Digital Instruments:

(i) Comparison of analog and digital instruments, characteristics of a digital meter

(ii) digital voltmeter

(iii) Block diagram and working of a digital multi-meter

(iv) Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time-base stability, accuracy and resolution.

(v) Principles of working and specifications of logic probes, signature analyzer and logic analyzer.

(vi) Digital, LCR bridges

PERSONAL COMPUTER ORGANIZATION

1. Hardware Organisation of PC:

Microcomputer Organisation, 8086/8088 microprocessor, its architecture, brief view of instruction set, memory address and addressing techniques and I/O addressing, the Motherboard of PC: memory organisation, system timers/counters, interrupts, vectoring, interrupt controller, DMA controller and its channels, PC-bus slots, various types of digital buses, serial I/O ports e.g., COM1 & COM2, parallel port.

2. The Video Display of the PC:

The basic principles of the working of video monitors, video display adapters (monochrome and colour graphic). Video modes, detailed study of colour video monitors, introduction to TFT monitors, difference between monochrome, colour and TFT video monitors.

3. The Keyboard of the PC:

The basic principles of the working of a PC keyboard scan codes, introduction to multimedia keyboard.

4. Disk Drives:

Constructional features of Hard disk, Floppy disk and their drives and HDD, DVD drive and CD ROM drive, Pen drive working principle of HDD drive, CD ROM drive, DVD drive, introduction to special type of disk drives like Zip drive, MO drive, Logical structure of a disk and its organization, Boot record. File Allocation Table (FAT), NTFS Disk Directory.

5. Peripheral Devices:

Basic features of various other peripheral devices e.g. mouse, scanner, plotter, digitizer, modem, light pen and joystick, working principle of DMP, Inkjet and Laser printers, Basic operation digital camera, FAX.

6. Power Supply:

SMPS used in PC and its various voltages, basic idea of constant voltage transformer (CVT) and Uninterrupted Power Supply (UPS) – offline and line interactive types.

7. The BIOS and DOS Services:

The basic ideas of BIOS and DOS services for Diskette, Serial Port, Key board, Printer and Misc. services.

8. Advances Microprocessors:

Introduction to PISC and CISC system and comparison between the two introduction to superscalar architecture, detailed study of Pentium IV processor, mother board of PC, memory organization, Catch memory, keyboard interfacing, serial and parallel ports, introduction to pipelining.

ELECTRONIC DESIGN & DRAWING

1. Draw the standard symbols of the following

(a) (Different parts of ISI Standard IS.2032 may be referred to) for electronics with specification in Digital EC and Microprocessor System Design.

(b) Components : Resistors – Fixed, tapped and variable(presets and potentio-meters LDR, VDR and Thermistor, Capacitors – Fixed, tapped and variable types RF and Af chokes and inductors air cored, solid cored and laminated cored. transformer – step up, step down, Af and Rf types, Auto transformer, IF transformer, three phase transformer, Antenna, chasis, Earth, loudspeaker, Microphone, ear-phone, fuse, indicating lamp, co-axial cables, switches – double pole-on/off double pole, double throw an drotary types, terminal and connections of conductors.

(c) Devices: Semiconductor – rectifier diode, zener diode, variactor diode, tunnel diode, photo diode, light emitting diode (LED), Bipolar transistor,

(d) Working principles of ramp, dual slope and integrating type of field effect transistor (FET), MOSFET Photo transistor. Unjunction transistor (UJT) silicon control Rectifier (SCR), Diac and Triac case outlines (with their type numbers) of different types of semiconductor diodes, transistors, SCR, diacs, triacs and ICS (Along with indicators for identifying pins etc.)

2. Draw the Following

Circuit diagram of typical multimeter, Circuit diagram of a typical electronic multimeter – Circuit diagram of a typical transistor radio receiver. Complete lock diagram of a typical monochrome TV transmitter and receiver system. Front panel details of typical CRO.

3. Design and Draw for the given Specifications the following :

(a) A small power transformer. A simple power supply using a full wave rectifier and different types of filters. A simple zener regulated power supply. A small-signal (single-stage low-frequency amplifier) given specifications being the input impedance, load impedance, voltage gain and input signal level and the frequency range.

(b) Square-wave generator using 555 timer. sinusoidal oscillator-Wein's Bridge type using an op-amp. Voltage-controlled oscillator using IC565. Circuitory for using a DC micro-ammeter as

(i) a voltmeter
(ii) a current meter
(iii) for specified ranges

OBJECT ORIENTED PROGRAMMING USING C++

1. Introduction
- (i) Problems with procedure oriented Programming technique.
- (ii) Concepts of OOPs.
- (iii) Characteristics of OOPs
- (iv) Advantages and application of OOPs

2. C++ Programming Basics
- (i) Basic Data types
- (ii) Type Compatibility
- (iii) Operators in C++
- (iv) Scope resolution operator
- (v) Control Structure

3. Function C++
- (i) Function Prototyping
- (ii) Call by reference
- (iii) Inline function
- (iv) Function overloading
- (v) Library Function

4. Class and Objects
- (i) Comparison of Class and C-Structure
- (ii) Creating objects
- (iii) Arrays within Class
- (iv) Arrays of objects
- (v) Objects as Function Arguments

5. Constructor and Destructor
- (i) Constructor and its characteristics
- (ii) Parameterized Constructor
- (iii) Multiple Constructor in a class
- (iv) Copy Constructor
- (v) Overloaded Constructor
- (vi) Destructor and its characteristics

6. Operator Overloading
- (i) Overloading of unary operator
- (ii) Overloading of binary operator
- (iii) Manipulation of Strings using operator
- (iv) Type conversion – basic type of class & class to basic type

7. Inheritance
- (i) Type of Inheritance
- (ii) Need of protected members
- (iii) Application of inheritance

8. Virtual & friend function
- (i) Pointers to objects
- (ii) This pointers
- (iii) Pointer to derived classes
- (iv) Virtual functions

(v) Pure virtual functions
(vi) Concept of late & early binding

9. Managing Console I/O operation
(i) Unformatted I/O operation
(ii) Formatted I/O operation: fill, precision, width
(iii) I/O streams

10. File Operation
(i) Opening & closing a file.
(ii) Programming with files

INDUSTRIAL ELECTRONICS & INSTRUMENTATION

1. Thyristor ratings and gate rating. Turn on methods – Dc gate, AC Gate, and Pulse Gate Triggering and R-C trigger circuits. Turn off methods – Nature and Forced turn off methods.
2. Internal power dissipation and need for Heat sinks in thyristors. Definition of following terms and their relationship with the power dissipation of the device (no derivation).
   (i) Heat sink efficiency
   (ii) Heat Sink transfer co-efficient
   (iii) Heat dissipating area of a Heat Sink. Concept of thermal resistance of Heat Sinks. Various types of Heat sinks and techniques of mounting device on heat sinks
3. Principles of operation and working of the following switching circuits, using SCRs and Triacs
   (i) Automatic Battery charger
   (ii) Voltage regulator
   (iii) Emergency light
   (iv) Alarm circuit
   (v) Time delay relay Circuit
   (vi) Circuits for over voltage and over current protection
4. Explanation of the working of a single phase and 3-phase controlled bridge rectifiers with the help of waveforms, using SCR's with resistive and inductive loads mathematical expression (No derivations).
5. Principles of working of AC phase control circuit using triac and its applications.
   (i) Illumination control
   (ii) Fan speed control
   (iii) Temperature Control
   (iv) Speed control of DC and small AC motors
6. Principles of operation of Basic inverter circuits. Basic series and parallel commutated inverters
7. Principles of induction and dielectric heating and their typical applications

8. Introduction to instrumentations:
Basic Measurement System functions of its elements namely the transducer, signal conditioner, display or read-out and power supply.

9. Transducers:
a) Distinguish between active and passive transducers with examples.
Basic requirements of a transducer
b) Principle of operation of the following transducers and their applications in measuring the physical quantities listed against each one of them.
c) Transducer

Variable Resistance Type	**Physical Quantities**
- Potentiometeric	Displacement and force
- Strain gauge	Torque and displacement
- Thermister	Temperature
- Resistance Hydrometer	Humidity

Variable capacitance Type	
Pressure gauge	Displacement and pressure
- Dielectric gauge	Liquid Level and thickness

Variable Inductance Type	
- LVDT	Pressure, force, displacement and position

Other Types	
- Solid State Sensor	Temperature
- Thermocouple	Temperature
- Piezoelectric device	Force
- Photoelectric devices	Light
- Proximity probes	r.p.m
- Digital transducer	displacement

10. Security & Surveillance devices:-
Block diagram, application & use of the following:
- Hand held metal detector and door frame
- Analog & IP CCTV including DV Recorder & NVR (Network Video Recorder) with video analysis
- Access Control System (Bio-metric)
- Attendance Recording System

12. Output Devices and Displays
Basic principles of operation, constructional features and application of the following:
(i) Graphic Recorder
(ii) X-Y Recorder

COMMUNICATION SYSTEMS

1. Audio systems

(i) Microphones: Construction, working principles and applications of carbon, moving coil, velocity, crystal, condenser type, cordless microphone.

(ii) Loudspeakers: Direct radiating, horn loaded woofer, tweeter, mid range, multi speaker system, baffles and enclosures.

(iii) Sound Recording on magnetic tape, its principles, block diagram and tape transport mechanism, digital sound recording on tape and disc.

2. AM/FM transmitters

(i) Classification of transmitters on the basis of power & frequency.

(ii) Concept of low level and high level modulation. Block diagram of low level and high level modulation. AM transmitters and working of each stage.

(iii) Block diagram and working principles of reactance transistor and Armstrong FM transmitter.

3. AM/FM Radio Receiver

(i) Principles of working with block diagram of super heterodyne AM receiver function of each block and typical waveforms at input and output of each block.

(ii) Performance characteristics of a radio receiver sensitivity, selectivity, fidelity, S/N ratio, image-rejection ratio and their measurement procedure, ISI standards on radio receivers (brief idea).

(iii) Selection criteria for intermediate frequency(IF) , Concepts of simple and delayed AGC

(iv) Block diagram of an FM receiver, function of each block and waveforms at input and output of different blocks. Need for limiting and de-emphasis in FM reception.

(v) Block diagram of communication receivers, differences with respect to broadcast receivers.

4. Antennas:

(i) Electromagnetic spectrum and its various ranges: VLF, LF, HF, UHF, Microwave.

(ii) Physical concept of radiation of electromagnetic energy from a dipole. Concept of Polarization of EM waves.

(iii) Definition and physical concepts of the terms used with antennas like point source, gain, directivity, aperture, effective area, radiation pattern, beam angle, beam width and radiation resistance.

(iv) Types of antennas – brief description, characteristics and typical applications of dipole, medium wave (mast) antennas, folded dipole, turns tile, loop antenna, yagi and ferrite rod antenna(used in transistor receivers).

(v) Brief description of board-side and end fire arrays, their radiation pattern and applications (without analysis); brief idea about Rhombic antenna and disc antenna.

5. Propagations:

(i) Basic idea about different modes of radio wave propagation and typical areas of applications. Ground wave propagation & its characteristics, summer field equation for field strength.

(ii) Space wave communication _ line of sight propagation, standard atmosphere, concept of effective earth radius, range of space wave propagation in standard atmosphere.

(iii) Duct propagation: sky wave propagation-ionosphere & its layers, explanation of terms-virtual height, critical frequency, skip distance maximum usable frequency, multiple hop propagation.

6. Fiber Optic Communications

(i) Advantages of fiber optic communication

(ii) Constructional features of optical fiber and fiber optic cables, concepts of numerical aperture (NA), modes of propagation in an optical fibers, fiber attenuation and dispersion.

(iii) Light sources-diode laser, LEDs and their characteristics

(iv) Light detectors and their characteristics

(v) Basic idea of fiber connection techniques

(vi) Block diagram of fiber –optic communication link

7. Satellite Communication

(i) Basic idea, passive and active satellites, meaning of the terms, orbit, apogee, perigee.

(ii) Geostationary satellites and its need, block diagram and explanation of satellite communication link.

MICROWAVE ENGINEERING

1. Introduction to microwaves and its applications, frequency bands as per IEEE, advantages of microwave

2. Electromagnetic theory
- i) Coulomb's law, Electric field intensity, Electric flux and Gauss's law, Ampere's law, Faraday's law, magnetic flux density, Maxwell's equations. Simple numerical problems on Electric and magnetic fields.
- ii) Concept of plane waves, uniform plane waves, wave equations
- iii) Boundary conditions, free space impedance, skin effect, pointing vector (no derivations)

3. Wave Guides
- i) Rectangular and circular waveguides and their applications.
- ii) Cut-off frequency, cut-off wave length, guide wave length, guide impedance, phase velocity and group velocity and their relations.
- iii) TE and TM modes in wave guides, impossibility of TEM made in waveguide, degenerate modes, simple numerical problems on rectangular and circular wave guides, dominant modes.
- iv) Field patterns in rectangular wave guides for TE10, TE20 and TM11 modes
- v) Methods of exciting wave guides

4. Cavity Resonators
- (i) Physical ideas of rectangular and cylindrical and reentrant cavity resonators, applications, coupling methods, tuning and Q factor of cavity resonators
- (ii) Calculations of resonant frequencies (simple numerical problems) of rectangular and circular cavity resonators (no derivation)

5. Microwave Components

Constructional features, characteristics and applications of:-
- i) E-plane, H-Plane, Magic Tee's, Hybrid ring
- ii) Waveguide joints, bends, corners, transition and twists
- iii) Waveguide irises, posts and tuning screws
- iv) Coupling probes, coupling loops
- v) Terminations, fixed and variable attenuators
- vi) Isolator, circulator, two hole directional couplers
- vii) Duplexer (Y-type and branch type), coaxial to waveguide adapter

6. S-Parameters
- i) Concept of scattering (s) parameters
- ii) S-parameters of E,H, and magic Tee's (no derivations)

7. Microwave Devices
- i) Basic concept of thermionic emission and vacuum tubes
- ii) Effect of inter electrode capacitance, load inductance and transit time effect on high frequency performance of conventional vacuum tubes and steps to extend their high frequency operations.
- iii) Construction,, characteristics principles, bunching process and typical applications of the following
  - a) Two cavity klystron amplifier,

b) Reffex klystron
c) Multi cavity magnetron, phased focusing effect, electronic tuning, strapping, frequency pulling and pushing
d) Travelling wave Tube (TWT)
e) Gunn diode
f) IMPATT diode

iv) Concept of parametric amplifiers

8. Microwave Antennas

i) Parabolic reflector / dish antenna, gain, beam width, feeding methods, typical applications
ii) Horn antenna, sectoral, pyramidal and circular, flase angle of horn antenna, typical applications.
iii) Basic idea of slot antenna

9. Microwave communication systems

i) Block diagram and working principles of microwave communication link
ii) Block diagram of tropospheric communication link and its working principles, advantages and disadvantages
iii) Digital microwave communication system block diagram and its working.

10. Radar Systems

i) Introduction to RADAR and its various applications
ii) Radar range equation and its applications
iii) Block diagram and operating principles of Pulse, CW, FMCW and MTI Radar systems and their applications
iv) Radar displays : A-scope, B-scope, E-scope, F-scope and Plan position Indicator (PPI)

11. Microwave oven

Block diagram and its working

TROUBLESHOOTING & MAINTENANCE OF ELECTRONIC EQUIPMENT

1. Repair, servicing and Maintenance Concepts

Introduction, Modern Electronic equipment, Mean time between failures (MTBF), Mean time to repair (MTR), Maintenance policy, potential problems, preventive maintenance, corrective maintenance.

(i) Study of basic procedure of service and maintenance
(ii) Circuit tracing techniques
(iii) Concepts of shielding, grounding and power supply considerations in instruments.

2. Fundamental Trouble Shooting Procedure

Fault location, Fault finding aids

- Service manuals
- Test and measuring instruments
- Special tools

Trouble Shooting Techniques

- Functional Areas Approach

- Split half method
- Divergent, convergent and feedback path circuit analysis
- Measurement techniques

3. Passive components
   Test procedures for checking passive components, resistors, capacitors, inductors, chokes and transformers.

4. Semiconductor Devices (From Testing Procedure Point of view)
   Diodes, rectifier and zener diodes. Bipolar transistors. Field effect transistors JFET and MOSFET. Thyristors, unijunction transistors, Photo cells, Transistor equivalents, Data books on transistors.

5. Trouble-shooting Digital Systems
   Typical faults in digital circuits. Use of Logic clip, logic probe, logic pulser, IC tester

6. Typical Examples of Trouble Shooting
   Trouble shooting procedures for the following:
   (i) Oscilloscope
   (ii) Power supplies
   (iii) Digital multi-meters
   (iv) Signal generator
   (v) PA system
   (vi) Tape recorder and
   (vii) Stereo amplifier

7. Log Book & History Sheet
   Introduction, preparation and significance of log book and History sheet.

ADVANCED COMMUNICATION SYSTEMS

1. Introduction of Basic block diagram of digital and data communication systems. Their comparison with analog communication system. Review of sampling theorm and PCM

2. Coding

(i) Introduction to various some loads like, Lempel, Shannon faro, ha ziv code etc.

(ii) Code error detection and correction techniques – Redundancy, parity, block check character (BCC), Vertical Redundancy check (VRC), Longitudinal Redundancy, Check (LRC), Cyclic Redundancy check (CRC), Hamming code, Cycle codes, Linean block codes.

3. Digital Modulation Techniques:

(i) To study the basic block diagram and principle of working of their modulator and demodulator of the following

(a) Amplitude shift keying (ASK): Interrupted continuous wave (ICW), two tone modulations.

(b) Frequency shift keying (FSK).

(c) Phase shift keying (PSK)

(d) Quadrature Amplitude modulation (QAM), DPSK, Quadrature PSK.

4. Characteristics/working of data transmission circuits; bandwidth requirements, data transmission speeds, noise, cross talk, echo suppressers, distortion, equalizers.

5. UART, USART:
Their need and function in communication systems and study of their block diagram.

6. Modems:
Need and function of modems, Mode of modems operation (low speed, medium speed and high speed modems). Modem interconnection, Modem data transmission speed, Modem modulation method, Modem interfacing (RS 232 Interface, other interfaces).

7. Network and Control Considerations:
Protocols and their functions. Data communication network organisation, Basic idea of various modes of digital switching – circuit switching, message switching, packet switching.

Basic concept of Integrated Services of Digital Network (ISDN)

Digital Network (ISDN) its need in modern communication, brief idea of ISDN interfaces.

Basic idea of local area Network (LAN), and its various topologies.

8. Telemetry: radio-telemetry, and its application. Block diagram of DTM and FDM telemetry system

9. Electronic Exchange: Typical telephone network. Various switching offices (Regional Centre, District Centre, Toll Centre, Local Office) and their hierarchy.

Principles of space division switches. Basic block diagram of a digital exchange and its working. Combined space and time switching: Working principle of STS and TST switches.

Functions of the control system of an automatic exchange. Stored programme Control (SPC) processor and its application in electronic exchange and rural telephone exchange.

Introduction to PBX, PABX and EPABX. Function of PBX. PABX relation with central office. Modern PABX capabilities.

10. Operation of CELLULAR mobile telephone system. Concept of cells and frequency reuse. Special features of cellular mobile telephone. Introduction of GSM CDMA, their advantages & disadvantages. Basic idea of spread spectrum, 2g & 3G Technology.

11. Facsimile (FAX)
Basic idea of FAX system and its applications. Principle of operation and block diagram of modern FAX system. Important features of modern FAX machines.

TELEVISION ENGINEERING

1.

(i) Fundamentals of TV Communication

(a) Elements of TV communication system
(b) Scanning, its need for picture transmission
(c) Need for synchronizing and blanking pulses
(d) Progressive scanning, Interlaced scanning, its need, persistence of vision, frame field and line frequencies, bandwidth requirement for picture transmission, concept of picture resolution and its dependence on the bandwidth.
(e) Composite video signal (CVS), blocker than black level, CVS at the end of even and odd fields, equalizing pulses and their need.
(f) Construction and working of monochrome picture tube, comparison of magnetic and electrostatic deflection of beam.
(g) Construction and working of vidicon and plumbicon camera tubes, typical voltages at different electrodes, block diagram of monochrome TV camera and the transmitter chain.
(h) Block diagram of a TV receiver, function of each block and waveforms at the input and output of each block.
(i) Frequency range of various VHF, UHF bands and channels used in India, major specifications of CCIR-B system.

(ii) System adopted in India – channel bandwidth and transmitted RF spectrum. (8 Hr)

(a) Concepts of positive and negative modulation, VSB transmission, trap frequencies and aspect ratio.
(b) Typical circuits of scanning and EHT stages of TV receiver and explanation of their working principles, function of keyed AGC.
(c) Function and location of brightness, contrast, V-hold, H- hold and centering control.
(d) Identification of faulty stage by analyzing the symptoms and basic idea of a few important faults and their remedies.

2. Color TV Communication

(i) Relative sensitivity of eye to different spectral colours (visibility curve)

(ii) Primary colours, tristimulus values, trichromatic coefficients, concepts of additive and subtractive mixing of colours, concepts of luminance, hue and saturation, representation of colour in colour triangle, non-spectral colours.

(iii) Compatibility of colour system with the monochrome TV system, block diagram of colour TV camera, basic colour TV systems – NTSC, SECAM and PAL, their advantages and disadvantages.

(iv) Construction and working principles of Trinitron and PIL types of color picture tubes, concepts of convergence and purity.

(v) Need for luminance signal and band sharing by color signals, sub-carrier frequency, colour difference signal, its need, synchronous quadratic modulation and representation of colour by a vector, burst signal, its need, chrominance signals.

(vi) Block diagram of PAL TV receiver and explanation of its working.

3. Elements of Cable TV

- Introduction, signal reception, signal processing and signal distribution, Conditional Access System (CAS), Concepts and block diagram.

4. Video CD player

- Introduction, CD structure, VCD encoding, block diagram of a VCD player and its explanation.

5. Latest Trends in TV Technology

- Concepts of Plasma TV, LCD, LED TV, Comparison between Plasma and LCD and introduction to DTH and basic principle of transmission & reception of DTH (Set Top Box). Concepts of High Definition TV (HDTV).

INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP DEVELOPMENT

1. Introduction

Pattern of economics i.e. socialistic economy, capitalistic economy and mixed economy. Industrial Growth in India.

2. Business Organisations

Salient features of sale proprietary, partnership private and public limited companies, cooperative societies and public sector.

Role of public and private sectors in growth of economy and their social obligations towards society; monopoly and price restriction.

3. Entrepreneurship

Entrepreneurial qualities, selection of product, estimation of capital expenditure resources of capital financial agencies, procedural formalities for registrations of firm. Exposure to sales tax registration import export procedures and project report preparation.

4. Financial Management

Brief idea of money banking, international trade, foreign exchange, various taxes such as property, wealth company income, excise duty, sales tax, finance forecasting. Types of accounts and account books, trial balance, final accounts and statements.

5. Personnel Management

Duties and responsibilities of personnel department, manpower planning, sources of employment, recruitment selection, various methods of testing, training and development of workers and supervisors. Promotions, retirement, retrenchment. Industrial relations, discipline, industrial fatigue, leadership, attitudes and human behaviour, morale maintenance, motivation systems, payment of wages, personnel records.

6. Technician

Role of engineer and technician in the industry and in society: duties and responsibilities of a technician (foreman) towards management, workers and work.

7. Industrial Safety and House Keeping

Magnitude and cost of accidents, causes of accidents, job safety analysis, safety planning and its implementation safety education instructions and visual aids, obligatory provisions, first aid, investigation of accidents, fire fighting, BIS standards, security watch and ward.

8. Marketing

Importance of marketing, theory of demand and supply forecasting demand and supply, product pricing, branding and packaging, sales promotions, advertising and publicity, warranty, after sales service, product improvement and development, salesmanship, tenders and contracts, installations and commissioning, feedback invoicing and trade documents.

9. Industrial Legislation

Important provisions of the following acts: Factory Act, ESI, GPF, Bonus, Trade Union, Industrial Dispute, Shop, Minimum Wages, Compensation, Apprenticeship, Payment of Wages aCt and Commercial Establishment Act.

DIGITAL SYSTEM DESIGN

1. Memories

(i) Basic RAM cell, NXM bit RAM, Expansion of word length and capacity, static and dynamic RAM, basic idea of ROM, PROM, EPROM, EEPROM.

2. A/D and D/A Converters

(i) General principles of A/D and D/A conversion and brief idea of their applications.

(ii) A/D Converter : Binary Ladder

(iii) D/A Converter : Simultaneous method, counter type and continuous counter, successive approximation types of ADCs, integrating type (single slope and dual slope)

3. Combinational Circuits

(i) Boolean algebra and minimization techniques

(a) Review of logic variables, Boolean expression, and minimization of Boolean expression using K-map method (up to 5 variables) Tabular method of function minimization

(ii) Combinational circuit design

(b) Components of combinational circuits

(c) Design procedures and implementation using gates (SSI approach) e.g., half and, full adder, half and full sub tractors, multiplexer, de-multiplexer /decoder (MSI approach)ROM / PLA (LSI approach)

4. Sequential Circuits

(i) Essential Components of a Sequential Circuit Synchronous and asynchronous sequential circuits Classification of sequential circuits (Mealy and Moore Machines)

(ii) Sequential Circuit Design Sequential logic circuit, review of RS,D,JK (including Master/slave JK) and T flip-flops. Their truth tables, characteristic tables, characteristic equation, exciation tables, conversion of one Flip Flop to another.

(iii) Design of clocked sequential circuits: Generation of primitive state table/diagram, minimization of states, state assignment, choice of memory element. Design of counters

4. Synchronization of asynchronous inputs spikes in output and their removal. Design approach to asynchronous circuits, definition of cycles, races and hazards.