Syllabus for 3 years Diploma in Electronics/Telecom/ E&T Engineering

Principles of Electronic Communication

ANALOG MODULATION: Concept of frequency translation. Amplitude Modulation: Description of full AM, DSBSC, SSB and VSB in time and frequency domains, methods of generation & demodulation, descriptions of FM signal in time and frequency domains

PULSE ANALOG MODULATION: Ideal sampling, Sampling theorem, aliasing, interpolation, natural and flat top sampling in time and frequency domains

PCM & DELTA MODULATION SYSTEMS: Uniform and Non-uniform quantization. PCM and delta modulation, Signal to quantization noise ratio in PCM and delta modulation.

DIGITAL MODULATION: Baseband transmission: Line coding (RZ, NRZ), inter symbol interference (ISI), pulse shaping, Nyquist criterion for distortion free base band transmission, raised cosine spectrum. Pass band transmission: Geometric interpretation of signals, orthogonalization.

SPREAD-SPECTRUM MODULATION: Introduction, Pseudo-Noise sequences, direct sequence spread spectrum (DSSS) with coherent BPSK, processing gain, probability of error, frequency-hop spread spectrum (FHSS). Application of spread spectrum: CDMA

Electronics Devices and Circuits

Unit 1 – Semiconductor and Diodes

Definition, Extrinsic/Intrinsic, N-type & p-type PN Junction Diode – Forward and Reverse Bias Characteristics Zener Diode – Principle, characteristics, construction, working Diode Rectifiers – Half Wave and Full Wave Filters – C, LC and PI Filters

Unit 2 – Bipolar Junction Transistor (BJT)

NPN and PNP Transistor – Operation and characteristics Common Base Configuration – characteristics and working Common Emitter Configuration – characteristics and working Common Base Configuration – characteristics and working High frequency model of BJT Classification of amplifiers, negative feedback

Unit 3 – Field Effect Transistors

FET – Working Principle, Classification MOSFET Small Signal model N-Channel/ P-Channel MOSFETs – characteristics, enhancement and depletion mode, MOSFET as a Switch Common Source Amplifiers Uni-Junction Transistor – equivalent circuit and operation

Unit 4 – SCR DIAC & TRIAC

SCR – Construction, operation, working, characteristics DIAC - Construction, operation, working, characteristics TRIAC - Construction, operation, working, characteristics SCR and MOSFET as a Switch, DIAC as bidirectional switch Comparison of SCR, DIAC, TRIAC, MOSFET

Unit 5 – Amplifiers and Oscillators

Feedback Amplifiers – Properties of negative Feedback, impact of feedback on different parameters Basic Feedback Amplifier Topologies: Voltage Series, Voltage Shunt Current Series, Current Shunt Oscillator – Basic Principles, Crystal Oscillator, Non-linear/ Pulse Oscillator

Digital Electronics

Unit 1 – Number Systems & Boolean Algebra

Introduction to different number systems – Binary, Octal, Decimal, Hexadecimal Conversion from one number system to another. Boolean variables – Rules and laws of Boolean Algebra De-Morgan's Theorem Karnaugh Maps and their use for simplification of Boolean expressions

Unit 2 – Logic Gates

Logic Gates – AND, OR, NOT, NAND, NOR , XOR, XNOR: Symbolic representation and truth table Implementation of Boolean expressions and Logic Functions using gates Simplification of expressions

Unit 3 – Combinational Logic Circuits

Arithmetic Circuits – Addition, Subtraction, 1's 2's Complement, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel and Series Adders Encoder, Decoder Multiplexer – 2 to 1 MUX, 4 to 1 MUX, 8 to 1 MUX. Applications Demultiplexer – 1 to 2 DEMUX, 1- 4 DEMUX, 1-8 DEMUX

Unit 4 – Sequential Logic Circuits

Flip Flops – SR,JK, T, D, FF, JK-MS, Triggering Counters – 4 bit Up – Down Counters, Asynchronous/ Ripple Counter, Decade Counter- Mod 3, Mod 7 Counter, Johnson Counter, Ring Counter Registers – 4bit Shift Register: Serial In Serial Out, Serial in Parallel Out, Parallel In Serial Out, Parallel In Parallel Out

Unit 5 – Memory Devices

Classification of Memories – RAM Organization, Address Lines and Memory Sixe, Static RAM, Bipolar RAM, cell Dynamic RAM, D RAM, DDR RAM Read Only memory – ROM organization, Expanding memory, PROM, EPROM, EEPROM, Flash memory Data Converters – Digital to Analog converters, Analog to Digital Converters

Electronic Measurement and Instrumentation

Unit – I Basics of Measurements and Bridges

Accuracy & precision, Resolution Types of Errors DC Bridges – Wheatstone and Kelvin Double Bridge AC Bridges - Maxwell's Bridge, Hay's Bridge, Anderson Bridge, De-Sauty's Bridge

Unit- II Potentiometer

Basic DC slide wire Potentiometer Crompton's DC Potentiometer Applications of DC Potentiometer AC Potentiometers Applications of AC Potentiometers

Unit– III Measuring Instruments

Permanent Magnet Moving Coil Instruments (PMMC) Moving Iron type Instruments (MI) Electro Dynamo Type Instruments Single Phase Energy Meter

Unit– IV Electronic Instruments

Electronic Voltmeter and Digital Voltmeter Electronic Multimeters Q – Meter Vector Impedance Meter

Unit– V Oscilloscopes

Cathode ray tube: construction, operation, screens, graticules Vertical deflection system, Horizontal deflection system, Delay line, Measurement of frequency, time delay, phase angle and modulation index (trapezoidal method) Oscilloscope probe: Structure of 1:1 and 10:1 probe, Multiple Trace CRO

Unit- VI Transducers

Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers: RTD, Thermocouple, Thermistor LVDT, Strain Gauge Load Cell Piezoelectric Transducers

Electric Circuits & Network

Unit – 1 Basics of Network and Network Theorem

Node and Mesh Analysis Superposition Theorem Thevenin Theorem Norton Theorem Maximum Power transfer theorem Reciprocity Theorem

Unit– 2 Graph Theory

Graph of network, tree, incidence matrix F- Tie Set Analysis F-Cut Set Analysis Analysis of resistive network using cut-set and tie-set Duality

Unit– 3 Time Domain and Frequency Domain Analysis

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits Initial and Final conditions in network elements Forced and Free response, time constants Steady State and Transient State Response Analysis of electrical circuits using Laplace Transform for standard inputs (unit, Ramp, Step)

Unit– 4 Trigonometric and exponential Fourier series

Discrete spectra and symmetry of waveform, Steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values Fourier transform and continuous spectra

Unit- 5 Two Port Network

Two Port Network Open Circuit Impedance Parameters Short Circuit Admittance Parameters Transmission Parameters Hybrid Parameters Interrelationship of Two Port Network Inter Connection of Two Port Network

Microcontroller and Applications

Unit I Introduction

Introduction to Microprocessors and Microcontrollers, Architectures [8085,8086] Intel MCS51 family features – 8051 -organization and architecture

Unit II Programming with 8051

10 8051 instruction set, addressing modes, conditional instructions, I/O Programming, Arithmetic logic instructions, single bit instructions, interrupt handling, programming counters, timers and Stack

Unit III

MCS51 and external Interfaces 8 User interface – keyboard, LCD, LED, Real world interface - ADC, DAC, SENSORS Communication interface.

Unit IV C programming with 8051

8 I/O Programming, Timers/counters, Serial Communication, Interrupt, User Interfaces- LCD, Keypad, LED and communication interfaces [RS232].

Unit V

ARM processor core based microcontrollers 14 Need for RISC Processor-ARM processor fundamentals, ARM core based controller [LPC214X], IO ports, ADC/DAC, Timers.

Consumer Electronics

UNIT-I Audio Fundamentals and Devices

Basic characteristics of sound signal, Audio level metering, decibel level in acoustic measurement, Microphone & Types, speaker types & working principle, Sound recording principle & types

UNIT-II Audio Systems

CD player, home theatre sound system, surround sound, Digital console block diagram, working principle, applications, FM tuner , ICs used in FM tuner TDA 7021T , PA address system.

UNIT-III Television Systems

Monochrome TV standards, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution, Composite video signal, Colour TV standards, colour

theory, hue, brightness, saturation, luminance and chrominance, Different types of TV camera, Transmission standards

UNIT-IV Television Receivers and Video Systems

PAL-D colour TV receiver, Digital TVs:- LCD, LED , PLASMA, HDTV, 3-D TV, projection TV, DTH receiver, Video interface, Digital Video, SDI, HDMI Multimedia Interface , Digital Video Interface, CD and DVD player

UNIT-V Home / Office Appliances

Diagrams, operating principles and controller for FAX and Photocopier, Microwave Oven, Washing Machine, Air conditioner and Refrigerators, Digital camera and cam coder

Digital Communication Systems

UNIT1

Block diagram and sub-system description of a digital communication system. Sampling of low-pass and band-pass signals, PAM , PCM, signal to quantization noise ratio analysis of linear and nonlinear quantizers, Line codes and bandwidth considerations; PCM TDM hierarchies, frame structures, frame synchronization and bit stuffing.

UNIT 2

Quantization noise analysis of DM and ADM; DPCM and ADPCM; Low bit rate coding of speech and video signals. Baseband transmission, matched filter, performance in additive Gaussian noise; Intersymbol interference (ISI), Nyquist criterion for zero ISI, sinusoidal roll-off filtering, correlative coding, equalizers and adaptive equalizers; Digital subscriber lines.

UNIT 3

Geometric representation of signals, maximum likelihood decoding; Correlation receiver, equivalence with matched filter.Generation, detection and probability of error analysis of OOK, BPSK, coherent and non-coherent FSK, QPSK and DPSK; QAM, MSK and multicarrier modulation; Comparison of bandwidth and bit rate of digital modulation schemes.

UNIT 4

Introduction to Information and Coding Theories: Information Theory: information measures, Shannon entropy, differential entropy, mutual information, capacity theorem for point-to-point channels with discrete and continuous alphabets. Coding Theory: linear block codes – definitions, properties, bounds on minimum distance (singleton, Hamming, GV, MRRW), soft versus hard decision decoding, some specific codes (Hamming, RS, Concatenated); Convolutional codes – structure, decoding (the Viterbi and BCJR algorithms); Turbo codes, LDPC codes

Electronic Equipment Maintenance

Unit 1 :

Fundamental Troubleshooting Procedures Inside An Electronic Equipment: Reading Drawings And Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram; Dis-assembly and re-assembly of equipment, Equipment Failures and causes such as poor design, production deficiencies, careless storage and transport, inappropriate operating conditions, Nature of faults, Fault location procedure, Fault finding aids – Service and maintenance manuals and instruction manuals, Test and Measuring instruments, special tools Troubleshooting techniques, Approaching components for tests, Grounding systems in Electronic Equipment, Temperature sensitive Intermittent problems Corrective actions, Situations where repairs should not be attempted.

Unit 2 :

Passive Components and Their Testing Passive Components- Resistors, Capacitors, Inductors Failures in fixed resistors, testing of resistors, variable resistors, variable resistors as potentiometers, failures in potentiometers, testing of potentiometers, servicing potentiometers, LDRs and Thermistors Types of capacitors and their performance, Failures in capacitors, testing of capacitors and precautions therein, variable capacitor types, Testing of inductors and inductance measurement

Unit 3 :

Testing of Semiconductor Devices Types of semiconductor devices, Causes of failure in Semiconductor Devices, Types of failure Test procedures for Diodes, special types of Diodes, Bipolar Junction Transistors, Field Effect Transistors, Thyristors Operational Amplifiers, Fault diagnosis in op-amp circuits

Unit 4:

Logic IC families, Packages in Digital ICs, IC identification, IC pin-outs, Handling ICs, Digital troubleshooting methods – typical faults, testing digital ICs with pulse generators Logic clip, Logic Probe, Logic Pulser, Logic Current Tracer, Logic Comparator Special consideration for fault diagnosis in digital circuits Handling precautions for ICs sensitive to static electricity Testing flip-flops, counters, registers, multiplexers and de-multiplexers, encoders and decoders; Tri-state logic.

Unit 5:

Rework and Repair of Surface Mount Assemblies Surface Mount Technology and surface mount devices Surface Mount Semiconductor packages – SOIC, SOT, LCCC, LGA, BGA, COB, Flatpacks and Quad Packs, Cylindrical Diode Packages, Packaging of Passive Components as SMDs Repairing Surface Mount PCBs, Rework Stations

<u>Linear Integrated Circuits</u>

UNIT I - IC Fabrication and Circuit Configuration for Linear IC

Advantages of ICs over discrete components – Manufacturing process of monolithic Ics Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors Monolithic Capacitors – Inductors. Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

UNIT II Applications Of Operational Amplifiers

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III Analog Multiplier and PLL

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

UNIT IV Analog to digital and digital to analog converters

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R2R Ladder types switches for D/A converters, high speed sample-and-hold circuits, A/D Converters specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters.

UNIT V Waveform generators and special function ICs

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator Monolithic switching regulator, Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC

Embedded Systems:

Unit I Embedded C basics operators for Arduino

Familiarizing with the Arduino IDE. Sketch designing for Arduino Communication interface using serial port Basic understanding of the code with boolean operations, pointer access operations, bitwise operations, compounded operations.

Unit II - Embedded C control structure blocks

Looping mechanism – for, do and while. The branching operations based on conditions expression

Unit III Introduction to Arduino Mega

Arduino Mega specifications including power ratings, digital and analog peripherals. Difference between the C language and Embedded C language Arduino Mega Ports, Pins, Digital and Analog Peripherals

Unit IV Communication with Arduino

Different communication modules available with their real-life application Communication interface

Mobile and Wireless Communication

Unit I - Overview of Cellular Systems

Evolution 2g/3G/4G/5G Cellular Concepts – Frequency reuse, Cochannel and Adjacent channel Interference

Unit II - Wireless propagation

Link budget, Free-space path loss, Noise figure of receiver Multipath fading, Shadowing, Fading margin, Shadowing margin

Unit III Antenna diversity, wireless channel capacity and MIMO

Unit IV Overview of CDMA , OFDM and LTE

Industrial Automation

Unit I - Industrial automation overview and data acquisition

Architecture of Industrial Automation Systems. Measurement Systems Characteristics Data Acquisition Systems

Unit II - Control Generation

Introduction to Automatic Control P-I-D Control Feedforward Control Ratio Control The branching operations based on conditions expression

Unit III Sequential control and PLC

Introduction to Sequence Control, PLC , RLL PLC Hardware Environment

Unit IV Industrial control application

Hydraulic Control Systems Pneumatic Control Systems Energy Savings with Variable Speed Drives Introduction To CNC Machines

Microwave and Radar

Unit I - Introduction to Microwaves

History and applications of Microwaves Mathematical Model of Microwave Transmission- Microwave transmission modes, waveguides and transmission lines, Impedance Matching Microwave Network Analysis

Unit II - Passive and Active Microwave Devices

Directional Coupler, Power Divider, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Microwave Tubes

Unit III -Microwave Design Principles-

Microwave Filter Design, Microwave Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas

Unit IV –

Microwave Measurements, Microwave Systems, Effect of Microwaves on human body.

Computer Networking and Data Communication

Unit 1 - **Introduction to data communication**.

Concept of analog and digital signals. Bandwidth. Network architecture. Basics of OSI and TCP/IP reference models. Types of Computer Networks – Personal Area Network, Local Area Netwrk, Metropolitan Area Network, Wide Area Network, Internetwork. Computer Network Topologies – Point to Point, Bus topology, Star topology, ring topology, mesh topology, tree topology, Daisy Chain, Hybrid Topology, Computer Network Model. Transmission media. Wired and wireless connectivity.

Unit 2 – Digital & Analog Transmission.

Digital Transmission – Digital to Digital Conversion, Line Coding, Unipolar Encoding, Polar Encoding, Bipolar Encoding, block Coding Analog Transmission - Analog-to-Digital Conversion, Digital to analog Conversion, Analog to Analog Conversion. Sampling, Quantization, Encoding, Transmission Modes.

Unit 3 – Wireless Communication

Radio, Micowave, Infra-red, Light Transmission. Wireless Communication Standards, Characterization of the Wireless Channel, Receiver Techniques for Fading Dispersive Channels, Mobility Management in Wireless Networks, Mobile IP, Mobile Ad hoc Networks,

Ad hoc Routing Protocols, Performance Analysis of DSR and CBRP, Cluster Techniques, Incremental Cluster Maintenance Scheme, Space time Coding for Wireless Communication.

Unit 4 – Data Link Layer Technologies

Types of Network Routing, Network Layer Protocols. FDM, TDM and CDMA. Circuit and packet switching. Frame relay and ATM switching. ISDN. Local area network protocols. Fibre optic networks. Satellite networks. Data link layer design issues: its functions and protocols. Internet protocol. Routing algorithms. Congestion control algorithms. IP addressing schemes. Internetworking and sub-netting. Error Detection and Correction - Types of Errors, Detection, Correction Switching and Data link layer, data link control and protocols

Unit 5 - Transmission Media & Transmission Control protocol

Magnetic Media, Twisted Pair Cable, Coaxial Cable, Power Lines, Fiber Optics. Protocol– Features, Header, Addressing, Connection Management, Error Control and Flow Control, Multiplexing, Congestion Control, Timer Management, Crash Recover

Note: The above syllabus is indicative and the questions in the test may include similar other topics pertaining to the level and content of essential qualification.