

SYLLABUS FOR ELECTRONICS AND INSTRUMENTATION ENGINEERING**MATHEMATICS (50 Marks)****Unit-I: Matrices**

Matrices of 3rd order: Types of matrices-Algebra of matrices-Transpose of a matrix-Symmetric, skew symmetric matrices-Minor, cofactor of an element-Determinant of a square matrix-Properties-Laplace's expansion-singular and non singular matrices-Adjoint and multiplicative inverse of a square matrix-System of linear equations in 3 variables-Solutions by Cramer's rule, Matrix inversion method, Gauss-Jordan methods.

Partial Fractions: Resolving a given rational function into partial fractions.

Unit-II: Trigonometry

Properties of Trigonometric functions – Ratios of Compound angles, multiple angles, sub multiple angles – Transformations of Products into sum or difference and vice versa – Simple trigonometric equations – Properties of triangles – Inverse Trigonometric functions.

Complex Numbers: Properties of Modulus, amplitude and conjugate of complex numbers, arithmetic operations on complex number—Modulus-Amplitude form (Polar form)-Euler form (exponential form)-Properties- De Moivre's Theorem and its applications.

Unit-III: Analytical Geometry

Straight Lines – different forms of Straight Lines, distance of a point from a line, acute angle between two lines, intersection of two non- parallel lines and distance between two parallel lines. Circles-Equation of circle given center and radius, given ends of diameter-General equation-finding center and radius. Standard forms of equations of Parabola, Ellipse and Hyperbola – simple properties.

Unit-IV: Differentiation and its Applications

Functions and limits – Standard limits – Differentiation from the First Principles – Differentiation of sum, product, quotient of functions, function of function, trigonometric, inverse trigonometric, exponential, logarithmic, Hyperbolic functions, implicit, explicit and parametric functions – Derivative of a function with respect to another function-Second order derivatives – Geometrical applications of the derivative (angle between curves, tangent and normal) – Increasing and decreasing functions – Maxima and Minima (single variable functions) using second order derivative only – Derivative as rate measure -Errors and approximations - Partial Differentiation – Partial derivatives up to second order – Euler's theorem.

Unit-V: Integration and its Applications

Indefinite Integral – Standard forms – Integration by decomposition of the integrand of trigonometric, algebraic, exponential, logarithmic and Hyperbolic functions – Integration by substitution – Integration of reducible and irreducible quadratic factors – Integration by parts – Definite Integrals and properties, Definite Integral as the limit of a sum – Application of Integration to find areas under plane curves and volumes of Solids of revolution – Mean and RMS value.

Unit-VI: Differential Equations

Definition of a differential equation-order and degree of a differential equation- formation of differential equations-solution of differential equation of the type first order, first degree, variable-separable, homogeneous equations, exact, linear differential equation of the form $\frac{dy}{dx} + P_y = Q$, Bernoulli's equation, nth order linear differential equation with constant coefficients both homogeneous and non homogeneous and finding the Particular Integrals for

the functions e^{ax} , x^m , $\sin ax$, $\cos ax$.

Unit-VII: Laplace Transforms and Fourier series

Laplace Transforms and Inverse Laplace Transforms of Elementary functions. Shifting Theorems of LTs and ILTs.

Define Fourier series, Euler's Formulae Over the interval $(C, C+2\pi)$. Even and odd functions and their Fourier series

Unit-VIII: Probability and Statistics

Define Probability, addition Theorem, conditional Probability, Mean, Median, Mode, Mean deviation and standard deviation.

PHYSICS (25 Marks)

Unit-I: Units and dimensions: Physical quantity-fundamental and derived physical quantities-units-fundamental and derived units-SI units-multiples and sub-multiples in SI units-advantages of SI units-dimensions and dimensional formulae-dimensionless quantities- applications and limitations of dimensional analysis-problems.

Unit-II: Elements of vectors:

Scalar and vector quantities-examples-types of vectors- addition and subtraction of vectors-triangle law-parallellogram law and its cases-polygon law- resolution of a vector-unit vectors (i, j, k)-dot product and cross product of two vectors- characteristics of dot and cross products-examples-problems.

Unit-III: Kinematics and Friction

Equations of motion-acceleration due to gravity-equations of motion under gravity- expressions for maximum height, time of ascent, time of descent, time of flight, velocity on reaching the point of projection in vertical motion--motion of a body projected from the top of a tower-projectile motion-examples-horizontal and oblique projections-expressions for maximum height, time of ascent, time of flight, horizontal range, problems. Friction- causes and types of friction-normal reaction-laws of friction-coefficients of friction- angle of friction-methods of reducing friction-advantages and disadvantages of friction- motion of a body over a rough horizontal surface, a smooth inclined plane and a rough inclined plane-problems.

Unit-IV: Work, Power and Energy

Work, power and energy-definitions and units-potential and kinetic energies-examples and expressions-work-energy theorem-law of conservation of energy-problems.

Unit-V: Simple harmonic motion and Sound

Definition-conditions of SHM-examples of SHM-expressions for displacement, velocity, acceleration, time period, frequency and phase of SHM-time period of a simple pendulum-seconds pendulum-problems. Sound-musical sound and noise-noise pollution-Effects and methods of control of Noise Pollution-Beats and echo's-problems-Doppler effect – Explanation, and Applications - Acoustics of buildings-Reverberation-Sabine's formula- characteristics of a good building-problems.

Unit-VI: Heat and Thermodynamics

Expansion of gases-Boyle's law-Absolute scale of temperature-Charles laws-Ideal gas equation-Universal gas constant and its value-SI Units-problems-external work done by a gas-isothermal process-adiabatic process-first law of thermodynamics and its applications to

isothermal process and adiabatic process-two specific heats of a gas-relation between C_p and C_v - problems-second law of thermodynamics and its applications.

Unit-VII: Modern physics

Photoelectric effect – explanation and its laws-applications of photoelectric effect (photocell)- Einstein's photoelectric equation – critical angle and total internal reflection – optical fibers - principle, working , types and applications-concept of super conductivity – its properties and applications.

CHEMISTRY (25 Marks)

Unit – I: Fundamentals of chemistry:

Atomic structure: Introduction-Fundamental particles – Bohr's theory – Quantum numbers – Aufbau principle – Hund's rule – Pauli's exclusion principle- Electronic configurations of elements up to atomic number 20, shapes of **s**, **p**, **d** orbital's.

Chemical Bonding: Introduction – types of chemical bonds – Ionic bond taking example of NaCl and MgO –characteristics of ionic compounds and covalent bond taking example H_2 , O_2 , N_2 , HCl , characteristics of covalent compounds-Coordinate covalent bond- Metallic bond .

Oxidation-Reductions:concepts of Oxidation-Reduction ,Oxidation number and its calculations, differences between oxidation number and Valency

Unit-II: Solutions: Introduction solution classification of solutions, solute, solvent, concentration, mole concept,-Molarity,-Normality, equivalent weight using acids, bases and salts, numerical problems on Molarity and Normality.

Unit-III: Acids and Bases: Introduction – theories of acids and bases – Arrhenius, Bronsted – Lowry theory – Lewis acid base theory – Ionic product of water - p^H and related numerical problems – buffers solutions – Applications.

Unit – IV: Principles of Metallurgy: Characteristics of metals and distinction between metals and non- metals. Definitions of metallurgy , ore, gangue, flux, slag –concentration of ore-hand picking, levigation, froth floatation – extraction of crude metal – roasting calcination, smelting – alloys – composition and uses of brass, German silver and nichrome.

Unit-V: Electrochemistry: Conductors, insulators, electrolytes - Arrhenius theory of electrolytic dissociation – electrolysis – Faraday's laws of electrolysis- numerical problems – Galvanic cell – standard electrode potential – electro chemical series –emf and numerical problems on emf of a cell.

Unit –VI: Corrosion: Introduction - factors influencing corrosion - electrochemical theory of corrosion- composition cell, stress cell and concentration cells– rusting of iron and its mechanism – prevention of corrosion by (a) coating methods, (b) cathodic protection (sacrificial and impressive voltage methods).

Unit-VII: Water Technology: Introduction –soft and hard water – causes of hardness – types of hardness –disadvantages of hard water – degree of hardness, units and Numerical problems–softening methods – permutit process – ion exchange process – qualities of drinking water – municipal treatment of water for drinking purpose.- Osmosis and reverse Osmosis, advantages of reverse Osmosis.

Unit-VIII: Polymers: Introduction – polymerization – types of polymerization – addition , condensation polymerization with examples – plastics – types of plastics – advantages of plastics over traditional materials – Disadvantages of using plastics ,thermo plastics and thermo setting plastics– differences between thermo plastics and thermo setting plastics- preparation and

uses of the following plastics: 1. Polythene, 2. PVC, 3. Teflon, 4. Polystyrene, 5. Urea formaldehyde – Rubber – natural rubber – processing from latex –Vulcanization – Elastomers – Butyle rubber Buna-s, Neoprene rubber and their uses.

Unit-IX: Fuels: Definition and classification of fuels based on physical state and occurrence – characteristics of good fuel - composition and uses of gaseous fuels. (a) Water gas, (b) producer gas, (c) natural gas, (d) coal gas, (e) bio gas, (f) acetylene.

Unit-X: Environmental Chemistry: Introduction – environment –understand the terms lithosphere, hydrosphere, atmosphere bio sphere, biotic component, energy component pollutant, receptor, sink, particulate, DO, BOD, Threshold limit value, COD- Air pollution - causes-Effects- Forest resources ,uses and over exploitation ,deforestation acid rain, green house effect –ozone depletion – control of Air pollution – Water pollution – causes – effects – control measures. Renewable and Non Renewable energy sources – concept of ecosystem –producers, consumers and decomposers – Biodiversity ,threats to Biodiversity .

ELECTRONICS AND INSTRUMENTATION ENGINEERING (100 Marks)

UNIT-I: Electrical Engineering: Ohm's law- Kirchhoff's law, ideal voltage source and ideal current source and its conversions - units of work, power, energy, biot savarts law, fleming rules, faradays law, lenz's law, self and mutual inductance, Lifting power of magnet.

Electrostatics: laws of electrostatics and coulombs, permittivity, induction, dielectric strength constant, energy stored in the capacitor.

Batteries: Primary cell, different types, charging and discharging, maintenance free batteries.

Single phase transformers: O.C and S.C tests, three phase transformer, auto transformer, star – delta transformation.

Basics of D.C Machines: Motors and generators - A.C. machines – node voltage and mesh current analysis, crammers rule, dual network theorem, reciprocating theorem for impedance matching, superposition's, Thevenin's and Norton's theorems, DC Maximum power transfer theorem, resonance in series and parallel circuits, Q-factor, AC Machines: alternator, Induction motor, synchronous motor.

UNIT-II: Industrial electronics: Photo transistor, photo conductive device, photo multiplier, solar cell, opto-coupler, dot matrix and seven segment displays, bar graph, induction heating, dielectric heating and resistance welding, generation and applications of ultrasonic's.

Control engineering: Basics of open loop and closed loop control systems. Linear, nonlinear systems, time -variant and time- invariant system, continuous data, sampled data & Digital control systems - Transfer functions, block diagram reduction properties and limitations of T.F., masons gain formula - signal flow graphs - Time response of first order and Second order system - concept of stability (Routh- Hurwitz).

UNIT-III: Electronics: Resistor, Capacitor and Inductor specifications, chokes, self inductance, mutual inductance, AF, RF Chokes and applications of transformers, basics of switches , fuses , relays, microphones and loudspeakers, PCB's, conducting materials, Semi conductor materials, insulating materials, PN junction formation, forward and reverse biasing voltages, formation, working and configurations of PNP and NPN transistors, Zener diode and its applications, varactor, tunnel diode and its applications, FET, MOSFET, UJT, SCR, TRIAC, DIAC,

diode as rectifier, half wave, fullwave rectifier, need of filter and classification, working of clipper and clamper using diodes.

Amplifiers: RC coupled amplifier, transformer coupled amplifier, Darlington and cascaded amplifier, Class-A and Class-B push-pull amplifier, complementary type power amplifier, oscillator principle, RC phase shift and wiens bridge oscillator, collpits, Hartley oscillator, Boot strap sweep circuit, current sweep circuit using transistor, bistable, astable and monostable multivibrator using transistor. Transistor as amplifier in different configurations, AC and DC load line, biasing methods, operating points, stabilization techniques, direct coupled amplifier, differential amplifier, positive and negative feedback amplifiers.

Types of ICs: Based on integration (SSI, MSI, LSI, VLSI) heat sinks

UNIT-IV: Digital Electronics: Number systems, Different postulates, demorgan's theorem, simplification of Boolean expressions, K-map (up to 3 variables reductions), logic gates, half adder, full adder, serial adder, parallel adder, 2's complement subtractor RS, T, D and Master-slave JK type flip-flops and encoders, decoders, 4x1 mux, 1x4 demux, counters, ring counter, synchronous, asynchronous counters and working, decade counter, ripple counter, binary counter, Registers, shift registers, universal shift register, basic memories (RAM and ROM), ADC (Counter method, Successive approximation method) and DAC. (R-2R method, Binary weighted method)

UNIT-V: Electronic Measuring instruments: Analog Instruments – Extension of range of Ammeter, Voltmeter and Ohmmeter using PMMC, rectifier type voltmeter and ammeter, principle of moving iron instrument – FET voltmeter – Differential voltmeter, resistance measurement using wheat stone bridge, Maxwell bridge, schearing bridge, Megger – Digital multimeter, digital LCR meter, digital instruments – Ramp – successive approximation – digital frequency meter. CRO – CRT – time base generator – deflection sensitivity – triggered sweep circuits – CRO applications: storage oscilloscopes, Digital oscilloscopes – dualtrace oscilloscope – AF Oscillator – RF Signal generator – Function generator – Q meter– Distortion Factor Meter – Digital IC tester – logic analyzer, XY recorders, plotters.

UNIT-VI: Process Instrumentation: Fundamentals of instrumentation, basic transducer theory for the measurement of displacement (LVDT, Potentiometer, inductive, capacitive), RVDT, angular velocity (moving iron, moving coil type), temperature (liquid filled in thermometers, Thermometers, RTD, Thermo couple, thermister, Pyrometers, bimetallic strips), pressure (elastic elements, Strain gauge, piezo electric), force balance transducer, pressure multiplier, dead weight tester, Flow (bernoulies theorem, Head type flow meters, rota meter, Electromagnetic flow meter, anemometers, Ultrasonic flow meter), mechanical flow meters, thermal flow meters, pneumatic transmitters, PH, conductivity, weight, humidity, different methods of level measurement, viscosity and density, flame sensors, leak detectors, noise sensors, torque transducers.

Measurement of various Parameters in : power plants, petro chemical, iron and steel, papter and pulp plants.

UNIT-VII: Process Control: Different process variables ,process characteristics, On-off Control, Proportional, Integral and Derivative Controlllers, PID Controller, Tuning of PID Controller, Actuators (Pneumatic, electro-pneumatic Hydraulic) I to P, P to I converters, solenoid valve, stepper motor actuator, basics of control valves, Cascade Controller, Ratio Controller, feed forward control systems, Adaptive Control, Line Diagrams, Letter Codes, standards.

Safety Management : safety procedures, safety performance, product testing, documentation.

UNIT-VIII: Communications and Linear IC Applications: Need and Types of Modulation, SSB, DSB and VSB transmission, AM and FM Transmitters, AM and FM Detectors, Basics of Pulse Modulation and Applications, Optical- Fiber Communication, modern communication systems, RADAR, satellite communication, GSM, SIM CARD of cell phones, CDMA-channel allocation – compare with GSM.

Computer Networking: LAN, WAN, INTERNET, E-MAIL, ONLINE CHAT, Newsgroup, Video Conference, concept of VoIP, Network security, VPN, PPP, Routers, ISDN, VSAT, features of ATM, Modem and cable Modem.

Characteristics of Operational Amplifier: Applications of Operational Amplifier like (Summer, Integrator, Differentiator, Inverter, Voltage Follower, V to I Converter, I to V Converter, opamp based LPF, HPF, BPF, BSF comparator, Isolation amplifier, Square wave Generator, triangular wave generator, Mono Stable Multivibrator, Astable multi-vibrator, Wien-bridge Oscillator, Instrumentation Amplifier, Schmitt Trigger, ADC and DAC), Applications of 555 timer IC (mono stable, astable square wave generator and applications), regulated power supply using 78XX regulator.

UNIT-IX: Analytical and biomedical instrumentation: Electromagnetic Spectrum, Beer Lamberts Law, Mono Chromator, Light Sources and Detectors, Spectrophotometer (UV, Visible, IR), Flame Photometer, Spectrofluorometer, Interferometer, Refractometer, Polarimeter, Different types of Gas Analyzer, Mass Spectrometer, Liquid Chromatography and Gas Chromatography, Basics of Diagnostic Equipment ECG, EEG, EMG, Blood flow, Blood pressure measurement, Pace Maker, Defibrillator, X-Ray Equipment., CAT, MRI.

Nuclear Instrumentation: alpha, beta, gamma, particles radiations, neutron radiation, different detection methods of radiation applications of analytical instruments in clinical labs, pharmaceutical industry, rapid control of fertilizers with auto-analyzers, air quality monitoring system hazardous pollutants in the air.

UNIT-X: Microcontroller & PLCs: Architecture and Instruction set, Programming concepts of 8051 Micro controller, interfacing peripherals (8255, 8251, 8257 and 8259) and applications of 8051. Basics of PLC- Architecture and instruction set of PLC and PLC ladder diagrams of various applications SCADA, DDC, DCS, DAS, ROBOT, CNC, DATA LOGGERS.

Embedded Systems: Real time operations, software and hardware architecture, processors, serial communications, USB, features of RISC and CISC.

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MODEL QUESTIONS FOR ELECTRONICS AND INSTRUMENTATION ENGINEERING

MATHEMATICS

1. If $\begin{bmatrix} x & 1 & 1 \\ 2 & 3 & 4 \\ 1 & 1 & 1 \end{bmatrix}$ is a singular matrix, then the value of x is.
 1) -4 2) -3 3) -2 4) 1
2. The number of solutions of the equation $\tan^2 \theta = \frac{1}{3}$ are
 1) 2 2) 3 3) 4 4) None
3. The focus of the parabola $y^2 - x - 2y + 2 = 0$ is
 1) $(\frac{1}{4}, 0)$ 2) (1, 2) 3) $(\frac{3}{4}, 1)$ 4) $(\frac{5}{4}, 1)$
4. $\int_0^{\frac{\pi}{2}} \log \tan x \, dx =$
 1) 1 2) 0 3) $2\log 2$ 4) none

PHYSICS

1. Dimensional formula for Energy is
 1) MLT^{-2} 2) ML^2T^{-2} 3) ML^2T^2 4) MLT^2
2. A body is thrown up vertically with a velocity of 19.6m/s. The maximum height reached by the body is ($g=9.8m/s^2$)
 1) 19.6m 2) 19.6m/s 3) 19.8m 4) 19.8m/s.
3. Gases obey Boyle's law
 1) at high temperature and low pressures only
 2) at low temperature and high pressures only
 3) at high temperature and high pressures only
 4) at all temperatures and all pressures
4. A work done by a man in carrying a load of 30kg over his head when he travels a distance 5m in horizontal direction is ($g=9.8m/s^2$)
 1) 1470J 2) 0 J 3) 1470m 4) 150 J

CHEMISTRY

1. Which of the following orbital has less energy
 1) 3P 2) 3d 3) 4d 4) 4f
2. Which of the following element has stable electronic configuration?
 1) H 2) He 3) Li 4) Be
3. The pH of 0.001M NaOH is
 1) 1 2) 3 3) 11 4) 14
4. Brass is an alloy of
 1) Cu + Sn 2) Cu + Zn 3) Cu + Zn + Ni 4) Fe + Cr + Ni

ELECTRONICS AND INSTRUMENTATION ENGINEERING

1. To design mod-10 counter, how many flip-flops are required
1) 3 2) 2 3) 4 4) 1
2. Thermocouple is used to measure _____ parameters.
1) Temperature 2) Displacement 3) Torque 4) Density
3. ECG is used to measure the bio electric potentials from the _____
1) heart 2) lungs 3) brain 4) muscles
4. The following device is a final control element _____
1) actuator 2) computer 3) PLC's 4) Microprocessor
5. Which device has high input impedance _____
1) SCR 2) Diode 3) UJT 4) MOSFET

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