SYLLABUS FOR ELECTRICAL & ELECTRONICS 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 Crammer'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 Movire'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 $dy/dx + Py = Q$, 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+2π).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-parallelogram 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 Cp and Cv-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 stetting 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 .

ELECTRICAL & ELECTRONICS ENGINEERING (100 Marks)

UNIT I: - BASIC ELECTRICAL ENGINEERING
Ohms and Kirchhoff's Laws, star/delta transformation, Network theorems, work Power and Energy, Heating effects of Electric current, Magnetic effects of Electric current, Electromagnetic Induction, Electrostatics, Types of Electrical Engineering Materials – Conducting, Semi-conducting, Magnetic, Insulating, Di-electric materials – Properties and Uses - Special purpose materials, Batteries.

UNIT II: - D.C. MACHINES, BATTERIES & MEASURING INSTRUMENTS
D.C. Generators: Construction, Operation, types, EMF Equation, Windings, Armature reaction, Characteristics, Efficiency and Parallel operation, Applications.
DC Motors: Principle of operation, Back EMF, Torque Equation, Types, Characteristics, Starters, Speed Control, Losses, Efficiency and Testing.
Measuring Instruments: Classification, Deflection, Controlling and damping torques, Construction, Working errors, shunts and multipliers - Principle of Operation of moving Coil, Moving Iron, Dynamometer type, Induction type meters, Instrument Transformers, Induction type Energy meter, Measurement of Resistance, Meggar, Potentiometer, Transducers and Sensors – Types, Thermistor, Thermocouple, Pressure Transducers and Strain gauges. Electronics and digital instruments.

UNIT III: - A.C. CIRCUITS AND TRANSFORMERS:
A.C. Circuits: Fundamentals, Series and parallel R-L-C Circuits, Resonant circuits, Polyphase Circuits, Measurement of power by 2 Wattmeter's method.
Transformer: Single-phase Transformer, Construction, Operation, Equivalent circuit, regulation, efficiency, Testing and Parallel operation, Accessories of Transformers and Cooling. Three-phase Transformers, Auto-Transformers**.**

UNIT IV: - A.C. MACHINES
Alternators: Construction, Operation, EMF equation, regulation, testing and parallel Operation.
Synchronous Motors: Operation and performance, effects of field excitation, 'V'-Curve and inverted 'V'- Curve, methods of Starting and uses. Hunting and its effects.
Three-Phase induction Motors: Construction, Principle of Operation, Torque Equation, Slip-torque characteristics, losses, efficiency, testing, speed control, starters, double-cage motor and applications.

Single-phase Motors: Induction Motor: Types, Principle of operation, applications. Commutator motors: Types, Principle of operation and applications.

UNIT V:-POWER SYSTEM GENERATION & PROTECTION

Generating Stations: Convenntional and Non-conventional sources of energy, working, Components, Comparison of Thermal, Hydel, Nuclear and Gas Power stations. Renewable energy sources, Pollution control, Combined Working, Power Stations auxiliaries, Characteristic Curves and Important Terms, types of tariffs, power factor correction and economy. Sources of energy.

Power Systems Protection: Circuit Breakers – Types, Principles of operation and uses, Current Limiting, fuses and reactors, Relays – Classification, Principle of Operation of Induction type over current relay, Directional over current relays, distance relays, Protection of alternators, Transformers, Bus-bars, Transmission lines and feeders, Lightening arrestors, neutral grounding.

UNIT VI: - TRANSMISSION AND DISTRIBUTION

Transmission and distribution: Types of supply systems, Transmission line parameters, inductance and capacitance, performance of short and medium lines, regulation, Ferranti effect, Corona, Skin effect, Basic concepts of HVDC Transmission, advantages and disadvantages of HVDC Transmission. Components of lines, supports, conductor spacing, ground clearance and sag, insulators, voltage distribution across the string, string efficiency, methods of improving string efficiency. Earthing and layout of sub-stations. Cables – Classification, insulation resistance, specifications. Distribution – Radial and ring distributors, variation of load voltage.

UNIT VII: - ELECTRIC TRACTION

Electric Traction: Systems of Train Electrification, Speed-time Curves for different services, Schedule speed, Tractive Effort, Specific Energy Consumption, Traction system auxiliaries, Traction motor, Supply systems – train lighting systems.

UNIT VIII: - ELECTRICAL INSTALLATION AND ESTIMATION

Electric Wiring: Tools, Wires, Types of wiring, Accessories, Lamp Circuits, Estimating and costing of domestic, industrial, power, irrigation pump sets, over head lines and 11KV Substations, Rural electrification, departmental tests, earthing, maintenance of electrical machines.

UNIT IX: - BASIC ELECTRONICS AND DIGITAL ELECTRONICS

Semi-Conductor devices: Resistance, Color codes, capacitance, specifications, inductance types, N type & P type, Zener diode, PNP and NPN Transistors, Transistor configurations, characteristics, half and full wave rectifiers, Bridge rectifiers, Filters, Zener diode regulation.

Special devices: UJT, FET, MOSFET, LED, SCR, Opto Coupler, Photo diode, Photo Transistor, CRO and Timers.

Amplifiers: Types, Principles of operation, Characteristics.

Oscillators: Types, operation and application of each. Modulation and detection, AM & FM.

Digital Electronics: Different numbering systems, inter conversions, Boolean Algebra, Logic families, performance of AND, OR, NOT, NOR, NAND, EX-OR gates, combinational Logic Circuits, sequential logic circuits, Registers and Memories, A/D and D/A converters, counters and flip-flops.

UNIT X: - POWER ELECTRONICS AND MICRO CONTROLLER

Power Electronic Devices: Construction and working of SCR, GTOSCR, DIAC, TRIAC, IGBT, LASCR, Volt-ampere characteristics, Triggering of SCR using UJT, Protection.

Converters, AC regulators, Choppers, Inverters and Cycloconverters: Types of Converters, working of AC regulators and Choppers. Types of inverters, Principles of working of Cycloconverters.

Speed Control of DC/AC motors and application of power devices: Speed control of D.C. Shunt Motors by using converters and choppers, Speed control of Induction motor by using V/F Control, applications.

Micro Controllers: Architecture of 8051, instruction set of 8051, programming concepts, applications.

UNIT XI – Electric lighting, illumination, MHCP, MSCP, MHSCP Design of lightings schmemes for indoor, factory, out door, street lighting schemes-Heating-Direct, indirect heating. Welding-Refrigerator, Airconditioner and Auto Electric circuits – Power saving Devices.

Electric Drives-selection of motors, AC and DC types-rating-load-Equalization – use of fly wheel-types of enclosures and Bearings – reduction of noise.

Electric braking – Types – AC & DC – Plugging, Rheostatic and Regenerative braking.

Domestic Application and industrial application of Drives.

UNIT XII: Testing of Electrical Domestic Equipment and Appliances, principle, construction, working, fault findings, Dismantling, Assembling and Testing.

UPS and SMPS-Disturbances and Spikes in Supply Voltage.

Maintenance of Electrical Power Devices, Inverters, Batteries AC & DC Motors, Starters, Air Conditioners, Power transformers distribution transformers, circuit breakers.

Need of safety-Equipment use in electrical and general safety-types electrical hazards causes first aid-Do's and Don'ts of electrical supervisor at sub station-Fire extinguishers.

* * *

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) 2log2   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 thrownup 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 obeys 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 workdone 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

ELECTRICAL AND ELECTRONICS ENGINEERING

1. In the 2-wattmeter method of measuring 3-phase power, the two watt meters indicate equal and opposite reading, then the power factor angle is_____ degrees lagging.
    1) 60^0 2) 0^0 3) 30^0 4) 90^0

2. A 63 kVA, 11kV/400kV transformer, the full load copper losses are 1600W. The copper losses at half-full load is _____
    1) 800W   2) 200W   3) 400W   4) 1600W

3. Induction watt-hour meters are free from_____ errors
    1) Phase   2) Creeping   3) Temperature   4) frequency

* * *