ENGINEERING MATHEMATICS AND APPLIED SCIENCE

(COMMON TO ALL BRANCHES)

ENGINEERING MATHEMATICS   Max Marks : 40 Marks

LINEAR ALGEBRA

Unit-1: MATRICES &DETERMINANTS: **06 Mark**
Basic concepts of Matrices(Addition, Subtraction and Multiplication) ,Determinants: Problems on finding unknown quantity in a 2nd and 3rd order determinants using expansion. Solving simultaneous linear equations using determinant method (Cramer's rule up to 3rd order).

Matrices: Minors, Cofactors, Adjoint and Inverse of matrices of 2nd order. Characteristic equation and roots of a square matrix.

ALGEBRA

Unit-2: VECTORS: **03 Marks**

Magnitude of a vector. Position vector. Expression of vector in terms of position vectors. Vector in plane and in space in terms of unit vectors i, j and k respectively. Product of vectors. Scalar and vector product. Applications of dot and cross products i.e., Projection of vector on another vector, Area of parallelogram and area of triangle. Work done by a force and moment of force.

Unit-3: PROBABILITY: **01 Marks**

Random Experiments, Sample Space, Events, Types of Events, Algebra of Events, Complementary event, the events A or B, A and B,A but not B, Mutually Exclusive Events, Exhaustive events, Simple problems.

TRIGONOMETRY

Unit-4: ALLIED ANGLES AND COMPOUND ANGLES: **06 Marks**
Signs of Trigonometric ratios, Trigonometric ratios of Allied Angles in terms of θ. Formulae for Sin(A±B), Cos(A±B) & tan(A±B) and problems on them. Multiple and sub multiple angle formulae for 2A & 3A and simple problems. Transformation formulae on sum or difference into products & products into sum or difference and problems on them.

Unit-5: Complex numbers: **01 Mark**
Definition of complex number in the form of $a + ib$. Conjugate of complex number. Algebra of complex numbers, modulus and principal value of argument of complex number. Polar form $Z = r(Cos\theta + iSin\theta)$.

INTRODUCTION TO CALCULUS

Unit-6: Limits: **03 Marks**
 Evaluation of limit of functions by factorization, rationalization, limits when n→∞. Problems on algebraic limits based on formula $\lim_{x \to a} \frac{x^n - a^n}{x-a} = n.a^{n-1}$. Problems on trigonometric limits based on formula $\lim_{\theta \to 0} \frac{\sin \theta}{\theta} = 1$

CO-ORDINATE GEOMETRY

Unit-7: Straight Lines:-   **02 Marks**

Problems on different forms of equations of straight lines such as:

$$y = mx+c, \quad (y-y_1) = m(x-x_1), \quad (y-y_1) = \frac{y2-y1}{x2-x1} \cdot (x - x1)$$

Problems on equation of lines through a point and parallel or perpendicular to a given line. Finding Slope ,X-intercept and Y- intercept of general equation $ax + by + c = 0$.

DIFFERENTIATION

Unit-8:   **06 Marks**

Problems on rules of differentiation: (Sum rule, product rule and quotient rule). Problems on function of a function and inverse trigonometric functions. Derivative of implicit functions, and parametric functions and problems. Successive differentiation up to second order and problems on them. Differentiation of Logarithmic functions of types u^v, Where u and v are functions of x, Simple problems.

APPLICATIONS OF DIFFERENTIATION

Unit-9:   **02 Mark**

Equations of tangent and normal to the curve y = f(x) at a given point and problems. Derivative as a rate measure i.e.to find the rate of change of displacement, velocity, radius, area, volume using differentiation and problems on them.

INTEGRAL CALCULUS

Unit-10:   **05 Marks**

Rules of integration and problems. Problems on integration by the method of substitution and by parts.

DEFINITE INTEGRALS

Unit-11:   **02 Mark**

Simple problems on definite integrals. Problems on applications of definite integrals such as area and volume.

DIFFERENTIAL EQUATIONS

Unit-12:   **03 Mark**

Order and Degree of Differential Equations, Formation of differential equation by eliminating arbitrary constants up to second order. Problems on solution of linear differential equations of first order by variable separable method and integrating factor method.

APPLIED SCIENCE

Max. Marks: 40 Marks

UNIT-I   MECHANICS: **07 Marks**

 Units : Unit ,types of units, SI unit- Basic and Supplementary units, advantages
Measuring instruments: Vernier calipers-principle and least count. Screw gauge-principle, ZE, ZC, pitch and least count- simple problems on vernier calipers and screw gauge.
Scalars and vectors: scalar and vector with example, resultant, equilibrium, equilibrant. Laws of vectors-parallelogram law of vectors, triangle law of vectors, Lami's theorem. Expression for magnitude and direction of resultant of two vectors acting at a point. Rectangular component of resolution of a vector-simple problems on laws of vectors.
Parallel forces: Types of parallel forces, moment of force, couple, moment of couple ,simple problems on moment of force.

UNIT-II   PROPERTIES OF SOLIDS AND LIQUIDS: **07Marks**

Properties of solids: Deforming force, elasticity and plasticity with examples,
stress and its types with example, strain and its types with example, Hooke's Law, Modullie of elasticity and its types- simple problems on stress and strain.
Properties of Liquids: Thrust and pressure ,expression for pressure at a point inside the liquid at rest-simple problems.
 Surface tension: Cohesive and Adhesive forces with examples, surface tension, factors affecting surface tension, application of surface tension. Capillarity and its applications.
Viscosity: viscosity, expression for co-efficient of viscosity, effect of temperature on viscosity of liquid and gas, applications of viscosity- simple problems on co-efficient of viscosity.

UNIT-III HEAT AND PROPERTIES OF GASES: **05 Mark**
Concept of Heat and Temperature: Heat and Temperature , Specific Heat of substance,
Transmission of Heat: conduction ,convection and radiation with example, Applications of conduction and convection and radiation.
 Gas laws: Boyle's law, Charle's law and Gay- Lussac's law (statement with expression),expression PV=nRT, C_p and C_v and its relation-simple problems on gas laws.

UNIT-IV WAVE MOTION: 08Marks

Simple Harmonic Motion: Periodic motion with example, SHM , expression for displacement of a particle executing SHM.
Wave: Wave motion, wave period , wave frequency, wave amplitude, wave length and wave velocity, , relation between wave frequency , wave length and wave velocity-problems on V=nλ. Mechanical waves and Non-Mechanical waves with examples, Longitudinal and Transverse waves with example.
Propagation of sound waves in air: Newton – Laplace's formula for velocity of sound in air and various factors affecting velocity of sound in air.
Vibrations: Free vibration ,forced vibration and resonance with example. Laws of transverse vibration of stretched string, expression for fundamental frequency of vibration of stretched string –simple problems on fundamental frequency.
Stationary waves: Stationary waves and its characteristics, beat, beat frequency, application of beats.

UNIT- V   MODERN PHYSICS: 05 Mark

Electromagnetic waves : Electromagnetic waves and its properties, electromagnetic spectrum and its applications.
Laser: Laser, properties of laser and its applications.
Nano-technology: Nanotechnology, advantages and dis-advantages of nanotechnology.
Communication system: Basic elements of communication system, advantages and dis-advantages of satellite communication system,
Optical fibre: Optical fibre-principle and its applications.

UNIT-VI   INDUSTRIAL CHEMISTRY 08 Marks

Electrolysis: Electrolyte, types of electrolyte with example, electrolysis, Postulates of Arrhenius theory of electrolytic dissociation, Faraday's First and Second law of electrolysis-simple problems on Faraday's laws.
Corrosion: Corrosion, conditions for corrosion, preventive methods of corrosion.
Batteries: Battery, classification and its application.
Fuel cells: Fuel cell, types and advantages of fuel cells.
Metallurgy: Definition of mineral, ore, flux, slag and alloys. Purpose of making alloys and its applications.
Polymers: polymers and its types, application of polymers.
Composite materials: Composite material and its types, advantages and dis-advantages of composite material.
pH Value: pH value of a solution , pH scale, application of pH in different fields.