

Detail Syllabus for Engg. Entrance Competitive  
Exam (lateral entry)  
- 2024

Contents: Theory

Chapter	Name of the Topic
1.	<p><b>ATOMIC STRUCTURE</b></p> <p>Introduction of Atom</p> <p>Fundamental Practices of Atom-protons, neutrons, electrons.</p> <p>Their mass, charge location</p> <p>Definition of Atomic number, atomic mass, simple numerical problems based on atomic number and atomic mass number, Isotopes and Isobars definition, distinction and suitable examples</p> <p>Bohr's theory of hydrogen atom.</p> <p>Modern atomic structure</p> <p>Orbits and orbitals, sub energy levels.</p> <p>Pauli's exclusion principle</p> <p>Hunds rule</p> <p>Filling of electron in Sub-shells by Aufbau Principle (<math>Z=1-30</math>).</p> <p>Concept of variable valency with examples of 'ous' &amp; 'ic' compounds</p> <p>Nuclear stability</p> <p>Mass defect and binding energy -numerical problems.</p>
2.	<p><b>Electro Chemistry</b></p> <p>Arrhenius theories of Ionization. Degree of Ionization, Strong and Weak electrolytes.</p> <p>Electrochemical series and their applications.</p> <p>Electrolysis of <math>\text{CuSO}_4</math> solution using platinum electrodes, and copper electrodes.</p> <p>Applications of electrolysis, such as electroplating &amp; electro refining.</p> <p>Faraday's laws of electrolysis and numerical problems based on these laws.</p> <p>Conductivity of an electrolyte.</p> <p>Solubility product and common ion effect</p> <p>Specific conductivity</p>
3.	<p><b>Water</b></p> <p>Sources &amp; their physical and Chemical Characteristic of water.</p> <p>Purification of drinking water, Sedimentation, Coagulation, Filtration, Sterilization, (chlorination, Ozonization, ultra - violet rays, Boiling &amp; Aeration)</p> <p>Hard and soft water and causes of hardness.</p> <p>Types of hardness, degree of hardness in ppm of <math>\text{CaCO}_3</math> Equivalent.</p> <p>Effect of hard water in Domestic and Industrial application. Effect of hard water n steam generation, boiler scales and sludge formation.</p> <p>Removal of hardness of water by</p> <ol style="list-style-type: none"> <li>Lime - soda process,</li> <li>Permutite process</li> <li>Ion exchange method.</li> <li>PH &amp; POH value of water and its application in domestic &amp; industrial purposes.</li> </ol>
4.	<p><b>Material</b></p> <p>Occurrence of metals, definition of metallurgy, ore and mineral.</p> <p>Processing of ore -stages of extraction of metal from it's ore.</p> <p>Extraction of Iron in the form of Pig iron in blast furnace. Reactions in the blast Furnace.</p> <p>Types of carbon steel, based on the percentage of carbon. Heat treatment to steel such as hardening, tempering, annealing &amp; normalizing.</p> <p>Physical properties and applications of some commonly used metals such as - Fe, Cu, Al, Cr, Ni, Sn, Pb, Zn, Co, Ag, W.</p> <p>Chemical properties of metals and their compounds.</p>
5.	<p><b>Alloys</b></p> <p>Definition of Alloys, types and purpose.</p> <p>6.2) Preparation of binary alloy by fusion method and compression method. 6.4) A. Alloy, steel and their Applications:- effect of addition of C, Mn, V, W, Ni, Cr, Co, and Si. On steel</p> <p>6.5) Ferrous &amp; Non - ferrous alloys.</p>
	<p><b>Corrosion</b></p> <p>Definition of corrosion.</p> <p>Types of corrosion.</p>

6.	<p><b>Atmospheric corrosion.</b>  Mechanism of atmospheric corrosion.  Types of oxide films.  Factors affecting rate of atmospheric corrosion.</p>
	<p><b>Electro-chemical corrosion.</b>  Mechanism of electro-chemical corrosion.  Galvanic cell corrosion, concentration cell, Oxidation Concentration cell, Corrosion.  Factors affecting rate of electro-chemical corrosion.  Protection of metals from corrosion.  Processes of protection, cathodic protection, organic coating, Inorganic coating, and metallic coating.  Metallic coating - hot, Dipping - Galvanizing, Tinning, cementation, Sherardizing, metal-cladding, spraying.</p>
7.	<p><b>Paints &amp; Varnishes</b>  Principle constituents of paint, such as pigments, Vehicle, thinner, Drier, Extender, Plasticizer.  Methods of application of paint such as brushing, spraying, dipping, roller, coating.  Failure of paint film  Characteristics of good varnishes  Introduction of Enamels</p>
8.	<p><b>Lubricants</b>  Function of lubricants &amp; types of lubricants, solid, Semisolid, and liquid.  Characteristics and properties of lubricant.  Selection of lubricant for machines working under different conditions.</p>
9.	<p><b>Non-Metallic Materials</b>  Plastics: Formation of plastics (polymer) by addition such as polythene, polystyrene, PVC and Teflon and condensation such as Nylon &amp; Bakelite.  Types of plastics. Thermosoftening and Thermosetting. Compounding of plastics by fillers, plasticizers, accelerators, pigments. Properties of plastics and their engineering applications.  Rubber :  a. Types of rubber. Natural &amp; Synthetic rubber  b. Limitations of natural rubber. c. Vulcanization of rubber.  d. Properties and engineering applications of synthetic rubber.  <b>Insulating Materials:</b> Characteristics of good insulating materials.  Glass, types and applications of glass - wool thermo Cole, asbestos.  Cement , their chemical composition and properties.</p>
10.	<p><b>Pollution &amp; its control</b>  12.1 Pollution, types, its causes, impact and preventions.  Air pollution, water pollution and land pollutions.  Environmental Impact and their assessment.</p>

# Engineering Physics

Chapter	Name of the Topic
01	<p><b>UNITS AND MEASUREMENTS</b>                      Need of measurement and unit in engineering and science, definition of unit, requirements of standard unit, systems of units-CGS, MKS and SI, fundamental and derived quantities and their units Definition of dimensions with examples, principle of homogeneity of dimensions, limitations of dimensions. Definition of accuracy, precision and error, estimation of errors - absolute error, relative error and percentage error, rules and identification of significant figures.                      (Numericals on percentage error and significant figures)</p>
02	<p><b>MECHANICS</b>  <b>2.1 Kinetics</b>                      Definitions of momentum, impulse, impulsive force, Statements of Newton's laws motion and with equations, Applications of laws of motion- Recoil of gun, Motion of two connected bodies by light inextensible string passing over smooth on impulse, recoil velocity and motion of lift.)</p> <p><b>2.2 Angular pulley, Motion of lift.</b>                      (Numericals Motion                      Definition of angular displacement, angular velocity and angular acceleration, relation between linear velocity and angular velocity, definition of simple harmonic motion (SHM), SHM as a projection of uniform circular motion on any diameter, equation of SHM, derivation of displacement, velocity and acceleration of a body executing SHM.</p>
03	<p><b>Work, Power, Energy</b>                      Definition of work, power and energy, equations for P.E. &amp; K.E., Work-Energy principle, Representation of work by using graph, work done by a torque (no derivation)                      (Numericals on work, potential and kinetic energy)</p>
4	<p><b>GENERAL PROPERTIES OF MATTER</b>  <b>4.1 Elasticity</b>                      Deforming force, restoring force, elastic and plastic body, stress and strain with their types. elastic limit, Hooke's law, Young's modulus, bulk modulus, modulus of rigidity and relation between them (no derivation).                      (Numerical on stress, strain and Young's modulus)</p> <p><b>4.2 Surface Tension.</b>                      Molecular force, cohesive and adhesive force, Molecular range, sphere of influence, Laplace's molecular theory, Definition of surface tension and its S.I. unit, angle of contact, capillary action with examples, shape of meniscus for water and mercury, relation between surface tension, capillary rise and radius of capillary (no derivation), effect of impurity and temperature on surface tension                      (Numerical on relation between surface tension, capillary rise and radius) 2</p>
	<p><b>4.3 Viscosity</b>                      Definition of viscosity, viscous force, velocity gradient, Newton's law of viscosity, coefficient of viscosity and its S.I. unit, streamline and turbulent flow with examples, critical velocity, Reynolds's number and its significance, derivation of viscous force for free fall of spherical body through viscous medium, upthrust, terminal velocity, Stoke's law (statement and formula). (Numerical on coefficient of viscosity, Reynolds number and Stoke's formula)</p>
5	<p><b>HEAT</b>  <b>Transmission of heat and expansion of solids:</b>                      Three modes of transmission of heat -conduction, convection and radiation, good and bad conductor of heat with examples, law of thermal conductivity, coefficient of thermal conductivity and its S.I. unit, Definition of linear, areal and cubical expansion and relation between them. (no derivation)                      (Numericals on law of thermal conductivity, and coefficients of expansions)</p>
	<p><b>6.1 SOUND</b>                      Definition of wave motion, amplitude, period, frequency, and wavelength, relation between velocity, frequency and wavelength, longitudinal and transverse wave, definition of</p>

	stationary wave , node and antinode, forced and free vibrations, definition of resonance with examples, derivation of formula for velocity of sound with end correction. ( Numericals on relation $v = n\lambda$ and resonance)
6	<b>6.2 Acoustics of Building</b> Acoustics-concept and definition, Intensity and loudness of sound, echo, Reverberation standard reverberation time, Sabine's formula, Conditions for good acoustics, Factors affecting Acoustical planning of auditorium. (Numericals on Sabine's formula)
7	<b>7.1 Properties of light</b> Reflection, refraction, Snell's law, physical significance of refractive index, definition of dispersion of light along with ray diagram. (Numericals on refractive index)
8	<b>8.1- Electric field</b> Electric charge, Coulomb's inverse square law, Definition of unit charge, Electric field, Electric lines of force and their properties, Electric field intensity, Electric flux, Electric flux density. (Numericals on Coulombs law, Electrical Intensity)
	<b>8.2 Electric Potential</b> Concept of potential, Definition and unit, Potential due to point charge using integration method, Potential difference between two points, Definition of dielectric strength and breakdown potential. (Numericals on electric potential)
	<b>Modern Physics</b> <b>Band Theory of Solids</b> Energy levels in solids, Valence & conduction bands, forbidden gap, Conductors, Semiconductors and Insulators, Intrinsic and Extrinsic Semiconductors, p-type and n-type semiconductors, P-N junction diode-forward and reversed biased characteristics. (No Numerical)
9	<b>9.1.2 Photo electricity</b> Concept of photon, Plank's hypothesis, properties of photon, photo electric effect, Laws of photoelectric effect, work function, Einstein's photoelectric equation( no derivation), Basic Concept of Solar Energy. (Numericals on Energy of photon, work function, photoelectric equation)
	<b>9.1.3 LASER</b> Properties of laser, Characteristics and applications of laser.
	<b>9.1.4 X-rays</b> Introduction to X-rays, production of X-rays using Coolidge tube, minimum wavelength of X-rays, properties and applications. of X-rays (Numerical on minimum wavelength of x-rays)
10	<b>9.1.5 Introduction to nanotechnology</b> Definition of nanoscale, nanometer & nanoparticle, applications of nanotechnology- electronics, automobiles, medical, textile, cosmetics, environmental, space and defence.
11	<b>Non- Conventional Sources of energy</b> Introduction- Non Renewable and renewable (Alternate) energy sources, Examples- Solar Energy, Wind Energy, Tidal Energy, Geo-Thermal Energy and Bio-Mass. Advantages and disadvantages of renewable energy.

# Engg. Mathematics

Chapter	Name of the Topic
<b>1</b>	<b>ALGEBRA</b>
	<b>1.1 Prerequisites</b> <b>Revision of</b> 1.1.1 Arithmetic, Geometric and Harmonic Progressions, 1.1.2 Formula of nth term and sum to n-terms of A.P. and G.P. 1.1.3 Expression of $\sum n^2$ and $\sum n^3$ . 1.1.4 Quadratic equations with real coefficients and relation between their roots & coefficient
	<b>1.2 Logarithms:</b> 1.2.1 Definition of logarithm (Natural and Common logarithm.) 1.2.2 Laws of logarithm 1.2.3 Examples based on 1.2.1 to 1.2.2
	<b>1.3 PARTIAL FRACTION</b> 1.3.1 Definition of polynomial fraction proper & improper Fractions and definition of partial fractions. 1.3.2 To Resolve proper fraction into partial fraction with denominator containing non repeated linear factors, repeated linear factors and irreducible non repeated Quadratic factors. 1.3.3 To resolve improper fraction into partial fraction.
	<b>1.4 DETERMINANT AND MATRICES.</b> <b>Determinant</b> 1.4.1 Definition and expansion of determinants of order 2 and 3. 1.4.2 Cramer's rule to solve simultaneous equations for 2 and 3 unknowns. <b>Matrices</b> 1.4.3 Definition of a matrix of order m X n and types of Matrices with examples. 1.4.4 Algebra of matrices such as equality, addition, Subtraction, scalar multiplication and multiplication. 1.4.5 Transpose of a matrix. 1.4.6 Minor, cofactor of an element of a matrix, adjoint of matrix and inverse of matrix by adjoint method.

	<p><b>1.4 BINOMIAL THEOREM</b></p> <p>1.4.1 Definition of factorial notation, definition of permutation and combinations with formula (without proof).</p> <p>1.4.2 Derivation of simple identities and solution based on it.</p> <p>1.4.3 Binomial theorem for positive index.</p> <p>1.4.4 General term, Middle term, independent term and coefficient of <math>x^n</math></p>
	<b>TRIGONOMETRY.</b>
2	<p><b>2.1 REVISION</b></p> <p>2.1.1 Measurement of an angle (degree and radian). Relation between degree and radian.</p> <p>2.1.2 Trigonometrical ratios of <math>0^\circ</math>, <math>30^\circ</math>, <math>45^\circ</math>, <math>60^\circ</math>, <math>90^\circ</math>, <math>90^\circ \pm \theta</math>, <math>180^\circ \pm \theta</math> and <math>360^\circ \pm \theta</math></p> <p>2.1.3 Fundamental identities.</p>
	<p><b>2.2 TRIGONOMETRIC RATIOS OF ALLIED, COMPOUND, MULTIPLE &amp; SUBMULTIPLE ANGLES</b> (Questions based on numerical computations, which can also be done by calculators, need not be asked particularly for allied angles).</p>
	<p><b>2.3 Transformation formula of Product into sums or difference and vice versa, simple problems based on it</b></p>
	<p><b>2.4 INVERSE TRIGONOMETRIC RATIOS</b></p> <p>2.4.1 Definition of inverse trigonometric, ratios, Principal values of inverse trigonometric ratios.</p> <p>2.4.2 Relation between inverse trigonometric ratios.</p>
	<b>COORDINATE GEOMETRY</b>
3	<p><b>3.1 POINT AND DISTANCES</b></p> <p>3.1.1 Distance formula, Section formula, midpoint, centroid of triangle.</p> <p>3.1.2 Area of triangle and condition of collinearity.</p>
	<p><b>3.2 STRAIGHT LINE</b></p> <p>3.2.1 Slope and intercept of straight line.</p> <p>3.2.2 Equation of straight line in slope point form, slope-intercept form, two-point form, two-intercept form, normal form. General equation of line.</p> <p>3.2.3 Angle between two straight lines condition of parallel and perpendicular lines.</p> <p>3.2.4 Intersection of two lines.</p> <p>3.2.5 Length of perpendicular from a point on the line and</p>

	perpendicular distance between parallel lines.
	<b>3.3 CIRCLE</b> 3.3.1 Equation of circle in standard form, centre – radius form, diameter form, two – intercept form. 3.3.2 General equation of circle, its centre and radius, simple problem
4	<b>VECTORS</b>
	4.1 Definition of vector, position vector, Algebra of vectors (Equality, addition, subtraction and scalar multiplication) 4.2 Dot (Scalar) product with properties. 4.3 Vector (Cross) product with properties.
05	Function, Limit and Continuity
	<b>Function</b> 5.1.1 Definitions of variable, constant, intervals such as open, closed, semi-open etc. 5.1.2 Definition of Function, value of a function and types of functions, Simple Examples. 5.1.3 Definition of sinh x, cosh x and tanh x and some hyperbolic identities. <b>5.2 Use the concepts of Limit and Continuity for solving the problems</b> 5.2.1 The concept and meaning of $\lim_{x \rightarrow a} f(x) = l$ and the properties of limits. 5.2.2 Mention the Standard limits $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$ , $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ , $\lim_{x \rightarrow 0} \frac{\tan x}{x}$ , $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$ , $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$ , $\lim_{x \rightarrow 0} (1 + x)^{\frac{1}{x}}$ , $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$ etc. 5.2.3 Evaluate the limits of the type $\lim_{x \rightarrow \infty} \frac{f(x)}{g(x)}$ 5.2.4 Simple example on Limits of algebraic, trigonometric, exponential and logarithmic functions. 5.3 Concept of continuity of a function at a point and in interval with some examples related to "whether a given function is continuous or not".

## 6. Differentiation and its meaning in engineering situations

- 6.1 Concept of derivative of a function  $y = f(x)$  from first principle as

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$
 And standard notations to denote the derivative of a function.

- 6.2 Derivatives of elementary functions like  $x^n$ ,  $a^x$ ,  $e^x$ ,  $\log x$ ,  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $\sec x$ ,  $\operatorname{cosec} x$ ,  $\cot x$  and inverse circular function using the first principles.

- 6.3 Rules for differentiation of sum, difference, scalar multiplication, product and quotient of functions with illustrative and simple examples.

- 6.4 Differentiation of a function of a function (Chain rule) with illustrative examples such as

(i)  $\sqrt{t^2 + \frac{2}{t}}$  (ii)  $x^2 \sin 2x$  (iii)  $\frac{x}{\sqrt{x^2 + 1}}$  (iv)  $\log(\sin(\cos x))$ .

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- 6.5 Derivatives of Inverse Trigonometric functions and some examples using the Trigonometric transformations.

- 6.6 Differentiation of a function with respect to another function and also differentiation of parametric functions with examples.

- 6.7 Derivative of some simple hyperbolic functions (without proof).

- 6.8 Differentiation of implicit function with examples.

- 6.9 Differentiation of Logarithmic function with examples like  $[f(x)]^{g(x)}$ .

- 6.10 Concept of higher order derivatives (second and third order) with examples.

- 6.11 Concept of function of several variables. Partial differentiation and difference between the ordinary and partial derivatives with simple examples.

## **7. Applications of the Differentiation**

### 7.1 Geometrical Meaning of Derivatives

7.1.1 State the geometrical meaning of the derivative as the slope of the tangent to the curve  $y=f(x)$  at any point on the curve.

7.1.2 Concept of slope of tangent. Equation of tangent and normal to the curve  $y=f(x)$  at any point on it.

7.1.3 Angle between two curves with illustrative examples.

### 7.2 Use Derivatives to find extreme values of functions.

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7.2.1 Concept of increasing and decreasing functions.

7.2.2 Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.

7.2.3 Extreme values (maxima or minima) of a function of single variable - simple problems yielding maxima and minima.

### 7.3 Concept of Derivatives as Rate Measure

7.3.1 Problems based on Rates and Motion

### 7.4 Use Derivatives to find Radius of Curvature.