CLASS - 9

Motion

1) Speed = $\frac{\text{Distance}}{\text{time}}$ 2) Accl^n = $\frac{\text{change in speed}}{\text{time}} = \frac{v-u}{t}$

3) Eqns of motion (a) $v = u + at$ (b) $s = ut + \frac{1}{2}at^2$ (c) $v^2 = u^2 + 2as$

Forces

1) Force, $F = ma$ 2) Momentum, $P = MV$ 3) Conservation of momentum, $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Gravitation

1) Newton's law of gravitation, force, $F = \frac{G \cdot m_1 m_2}{r^2}$

2) Accl^n due to gravity, $g = \frac{GM}{R^2}$ 3) Kepler's 3rd law, $T^2 = kr^3$

4) Concept of free fall (a) $v = gt$ (b) $s = \frac{1}{2}gt^2$ (c) $v^2 = 2gs$.

Floatation

1) Pressure, $P = \frac{F}{A}$ 2) Density = $\frac{\text{Mass}}{\text{volm}}$ 3) Relative density = $\frac{\rho}{\rho_w}$.

Work, Energy & Power

1) Work = Force x displacement 2) Potential energy = Mgh 3) KE = $\frac{1}{2}mv^2$

4) Power = work/time

CLASS-10

Light

1) Mirror formula, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ 2) Magnification, $M = \frac{V}{u} = \frac{h_2}{h_1}$

3) Lens formula $\frac{1}{v} - \frac{1}{u} = \frac{1}{F}$ 4) Law of refraction, $n = \frac{\sin i}{\sin r}$

5) Refractive index, ${}_1n_2 = \frac{v_1}{v_2}$ or ${}_2n_1 = \frac{v_2}{v_1}$ 6) Absolute RI, $n = \frac{V_{air}}{V_{med}}$.

Electricity

1) Electric current, $I = \frac{q}{t}$ 2) Potential difference, $V = \frac{W}{Q}$

3) Ohm's law, $V = IR$ 4) Resistivity, $\rho = \frac{RA}{L}$ 5) Conductivity = $\frac{L}{RA}$

6) Resistors in series, $R_s = R_1 + R_2 + \dots + R_N$ 7) Resistors in parallel, $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$ 8) Electric power, $P = \frac{W}{t} = VI = I^2R$

9) Electric energy, $E = Pt = VIt$ 10) Joule's law, $H = I^2Rt$

CLASS - 11 / 12

Measurement

1) Dimensional analysis 2) Errors ⓐ Relative error, $= \frac{\Delta am}{am}$
ⓑ % error $= \frac{\Delta am}{am} \times 100$ ⓒ Multiplication / Division of errors.

Vectors

1) Resultant vectors & direction by parallelogram law $R = \sqrt{P^2 + Q^2 + 2PQ\cos\theta}$
2) Resolution of vectors, $R = \sqrt{R_x^2 + R_y^2}$ 3) Angle, $\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right)$
3) Dot product $\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y + A_z B_z$
4) Cross product $\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix}$ 5) Area of parallelogram $= |\vec{A} \times \vec{B}|$
5) sine of angle bet^n vectors, $\theta = \sin^{-1}\left(\frac{\vec{A} \times \vec{B}}{|A|\,|B|}\right)$

Projectile motion

1) x - component of velocity, $u\cos\theta = \frac{x}{t}$
2) Y - component of velocity, $u\sin\theta = \frac{y}{t}$

$\therefore y = ut\sin\theta - \frac{1}{2}gt^2$

3) Eq^n of trajectory, $y = x\tan\theta - \left(\frac{g}{2u^2\cos^2\theta}\right)x^2$
4) Time of flight, $T = \frac{2u\sin\theta}{g}$ 5) Horizontal range, $R = \frac{u^2\sin 2\theta}{g}$
6) Max^m Height, $H = \frac{u^2\sin^2\theta}{2g}$

Circular motion

1) Relation between linear speed & angular speed, $v = r\omega$.
2) Angular acceleration, $\alpha = \frac{\omega_2 - \omega_1}{t}$
3) linear acc^n, $a = r\alpha$.
4) Resultant acc^n, $\vec{a} = \vec{a}_T + \vec{a}_r$ $\therefore |\vec{a}| = \sqrt{a_T^2 + a_r^2}$
5) Centripetal & centrifugal forces $F = \pm mv^2/r = \pm mr\omega^2$
6) Safety speed of vehicle
   ⓘ on unbanked road, $v = \sqrt{\mu rg}$
   ⓘⓘ on banked road $v_{max} = \sqrt{rg\left(\frac{\mu + \tan\theta}{1 - \mu\tan\theta}\right)}$

2) Period of conical pendulum, $T = 2\pi\sqrt{\frac{l\cos\theta}{g}}$

3) Tension on string of conical pendulum, $T' = Mg\left(1+\frac{R'}{h}\right)^{1/2}$

Rotational dynamics

1) Moment of inertia, $I = \Sigma m r^2$
2) KE of rotating body, $= \frac{1}{2} I\omega^2$
3) KE of rolling body $= \frac{1}{2} MV^2\left(\frac{R^2+K^2}{R^2}\right)$
4) Angular momentum of rotating body, $L = I\omega$
5) Torque acting on rotating body, $\tau = I\alpha$.
6) Parallel axes theorem, $I_0 = I_c + Mh^2$
7) Perpendicular axes theorem, $I_z = I_x + I_y$
8) MI of (a) rod (b) ring (c) disc (d) sphere
9) Conservation of angular momentum; $I_1\omega_1 = I_2\omega_2$

Gravitation

1) Critical speed, $V_c = \sqrt{\frac{GM}{R}}$ 2) Escape speed, $V_e = \sqrt{\frac{2GM}{R}}$
3) Acceleration due to gravity at depth 'd'; $g_d = g\left(1-\frac{d}{R}\right)$
4) " at height 'h'; $g_h = g\left(1-\frac{2h}{R}\right)$
5) " at latitude ϕ', $g' = g - R\omega^2\cos^2\phi$.
7) Binding energy of satellite (a) at height; $E = \frac{-GMm}{2(R+h)}$
(b) at earth $E = -\frac{GMm}{R}$

Fluid Mechanics

1) Pascals law $\frac{F_1}{A_1} = \frac{F_2}{A_2}$ 2) Liquid pressure, $P = h\rho g$
3) Surface tension, $T = \frac{F}{L}$ 4) Surface energy, $E = T.dA$.
5) Pressure diff (a) inside bubble, $= \frac{4T}{r}$ (b) inside drop $= \frac{2T}{r}$
6) Height of capillary rise, $h = \frac{2T\cos\theta}{r\rho g}$
7) Height & radius of capillary, $h_1 r_1 = h_2 r_2$ Relation bet.
8) Stoke's law for viscous force, $F = 6\pi r v \eta$.
9) Terminal velocity, $V_d = \frac{2}{9}\frac{r^2(\rho-\sigma)g}{\eta}$.

Current Electricity

1) Kirchhoff's laws (a) $I = I_1 + I_2 + \dots$
(b) $\Sigma IR + \Sigma E = 0$.

2) Wheatstone's network $\frac{R_1}{R_2} = \frac{R_3}{R_4}$

3) Unknown resistance by meterbridge, $X = R\left(\frac{l_x}{100 - l_x}\right)$

4) Resistance of galvanometer, $G = R\left(\frac{l_G}{100 - l_G}\right)$

5) Potential gradient, $K = \frac{V}{L} = \frac{\left(\frac{E}{R+r}\right)R}{L}$

6) Comparision of emfs (a) direct method, $\frac{E_1}{E_2} = \frac{l_1}{l_2}$
(b) combination, $\frac{E_1}{E_2} = \frac{l_1 + l_2}{l_1 - l_2}$

7) Internal resistance of cell, $r = R\left(\frac{l_1 - l_2}{l_2}\right)$

8) Ammeter, $S = \left(\frac{I_g}{I - I_g}\right)G$ 9) voltmeter, $R = \frac{V}{I_g} - R$

Magnetic effect of electric current

1) Magnetic field due to point charge, $B = \frac{\mu_0}{4\pi}\frac{q(\vec{v} \times \vec{r})}{r^3}$

2) Biot - Savart's law, $B = \frac{\mu_0}{4\pi}\frac{(d\vec{l} \times \vec{r})}{r^3}$

3) Magnetic field due to (a) straight wire, $B = \frac{\mu_0}{4\pi}\frac{I}{r}(\sin\theta_1 + \sin\theta_2)$
(b) infinite straight wire, $B = \frac{\mu_0 I}{2\pi r}$

4) Magnetic field due to circular loop (a) at centre, $B = \frac{\mu_0 N I}{2r}$
(b) at axis, $B = \frac{\mu_0 n I a^2}{2(a^2 + x^2)^{3/2}}$

5) Magnetic induction along axis of solenoid, $B = \frac{\mu_0 n I}{2}(\cos\theta_1 - \cos\theta_2)$

6) Force acting on moving charge, $F = qvB\sin\theta = IlB\sin\theta$

7) Torque acting on circular loop, $\tau = MB\sin\theta$.

8) Ampere's circuital law $\oint \vec{B} \cdot d\vec{l} = \mu_0 I$.