Class12-Physics-JEE-Mains-Formulas

October 18, 2025

Chapter	Concept	Formula / Key Point
Electrostatics	Coulomb's Law	$F = k\frac{q_1 q_2}{r^2}$, $k = \frac{1}{4\pi\epsilon_0}$
	—	—
	Electric Field	$\vec{E} = \frac{\vec{F}}{q}$, $E = k\frac{Q}{r^2}$
	—	—
	Electric Potential	$V = k\frac{Q}{r}$, $V = \frac{W}{q}$
	—	—
	Capacitance	$C = \frac{Q}{V}$, $C = \frac{\epsilon_0 A}{d}$ (parallel plate)
	—	—
Current Electricity	Ohm's Law	$V = IR$
	—	—
	Resistivity	$R = \rho\frac{L}{A}$
	—	—
	Power	$P = VI = I^2 R = \frac{V^2}{R}$
	—	—
	Kirchhoff's Laws	Junction: $\sum I_{in} = \sum I_{out}$ Loop: $\sum V = 0$
	—	—
Magnetic Effects of Current & Magnetism	Biot-Savart Law	$d\vec{B} = \frac{\mu_0}{4\pi}\frac{I d\vec{l} \times \hat{r}}{r^2}$
	—	—
	Force on Moving Charge	$\vec{F} = q\vec{v} \times \vec{B}$
	—	—
	Force on Current-Carrying Wire	$\vec{F} = I\vec{L} \times \vec{B}$
	—	—
	Torque on Current Loop	$\tau = NIAB\sin\theta$
	—	—
Electromagnetic Induction & AC	Faraday's Law	$\mathcal{E} = -\frac{d\Phi_B}{dt}$
	—	—
	Self-Inductance	$L = \frac{N\Phi}{I}$
	—	—

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	Impedance in RLC Circuit	$Z = \sqrt{R^2 + (X_L - X_C)^2}$
	—	—
	Reactance	$X_L = \omega L,\ X_C = \frac{1}{\omega C}$
	—	—
Optics	Lens Formula	$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$
	—	—
	Magnification	$m = \frac{v}{u}$
	—	—
	Snell's Law	$n = \frac{\sin i}{\sin r}$
	—	—
	Lens Maker's Formula	$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$
	—	—
	Wave Optics	$d \sin\theta = n\lambda$ (Diffraction/Interference)
	—	—
Modern Physics	Photoelectric Effect	$K.E_{max} = h\nu - \phi$
	—	—
	de Broglie Wavelength	$\lambda = \frac{h}{p}$
	—	—
	Nuclear Decay Law	$N = N_0 e^{-\lambda t},\ T_{1/2} = \frac{\ln 2}{\lambda}$
	—	—
	Mass-Energy Relation	$E = mc^2$
	—	—
Semiconductor Electronics	Diode	Forward bias conducts, Reverse bias blocks current
	—	—
	Zener Diode	Voltage regulation
	—	—
	Transistor	Amplification & Switching
	—	—
Communication Systems	Modulation	AM: Amplitude Modulation, FM: Frequency Modulation
	—	—
	Bandwidth	Range of frequencies for signal transmission
	—	—
Space / Astrophysics	Hubble's Law	$v = H_0 d$
	—	—
	Doppler Effect for Light	$\frac{\Delta\lambda}{\lambda} = \frac{v}{c}$ (redshift/blueshift)
	—	—

Chapter	Concept	Formula / Key Point
	Schwarzschild Radius (Black Hole)	$R_s = \frac{2GM}{c^2}$
	—	—
	Escape Velocity	$v_e = \sqrt{\frac{2GM}{R}}$
	—	—
	Luminosity of Star	$L = 4\pi R^2 \sigma T^4$
	—	—
	Wien's Displacement Law	$\lambda_{max}T = b$ $(b = 2.9 \times 10^{-3}\text{m K})$
	—	—
	Kepler's Laws	$T^2 \propto r^3$ (3rd Law)