# AIEEE Physics Quick Review

## GRAVITATION

- Newton's Law of Gravitation: $F = G\frac{m_1 m_2}{d^2}$
- Variation of 'g' - Effect of altitude:
  $g_1 = g\left(1-\frac{2h}{R}\right)$
- Effect of depth: $g_1 = g\left(1-\frac{d}{R}\right)$
- Gravitational Field Strength:
  $\vec{E}_g = \frac{\vec{F}}{m_0} = \frac{m_0\vec{g}}{m_0} = \vec{g}$

## ROTATORY MOTION

- Torque or Moment of force: $\vec{\tau} = \vec{r}\times\vec{F}$
- Moment of Inertia: $I = mr^2$
- Parallel Axes Theorem: $I = I_C + Md^2$
- Perpendicular Axes Theorem: $I_X + I_Y = I_Z$
- Angular Momentum: $L = I\omega$
- Relation between Torque & Angular Momentum: $\tau = I\alpha$
- Law of conservation of angular momen-tum: $I_1\omega_1 = I_2\omega_2$
- Rotational Kinetic Energy:
  $K.E_{rot} = \frac{1}{2}I\omega^2 = \frac{L^2}{2I}$
- Total Kinetic Energy of a Rolling Body:
  $KE_{trans} : KE_{rot} : KE_{tot.} = 1 : \frac{K^2}{R^2} : \left(1+\frac{K^2}{R^2}\right)$

## ELECTRO MAGNETIC INDUCTION

- Paradise Law of EMI: $\varepsilon = -N\times\frac{d\phi}{dt}$
- Motional EMF in translatory Motion: $E = BL\nu$
- Self Inductance: $e = -L\left(\frac{di}{dt}\right)$
- Initial Inductance: $e = -M\frac{di}{dt}$
- Self Inductance of a solenoid: $L = \frac{\mu_0 N^2 A}{l}$
- Mutual Inductance of a solenoid:
  $M = \mu_0 n_p N_s A$
- Transformer - Voltage Ratio: $\frac{V_1}{V_2} = \frac{N_1}{N_2}$
- Current Ratio: $\frac{V_2}{V_1} = \frac{I_1}{I_2} = \frac{N_2}{N_1}$
- Growth of Current in L - R Circuit:
  $i = i_0\left(1-e^{\frac{-Rt}{L}}\right)$
- Growth of charge in C-R Circuit:
  $q = q_0\left(1-e^{\frac{-t}{CR}}\right)$

## ALTERNATING CURRENT

- R.M.S. value of AC ($I_{rms}$):
  $I_{rms} = \frac{I_0}{\sqrt{2}} = 0.707\,I_0 = 70.7\%$ of $I_0$
- Inductive Reactance ($X_L$): $X_L = \omega L = 2\pi fL$
- Capacitive Reactance ($X_C$):
  $X_c = \frac{1}{\omega C} = \frac{1}{2\pi fC}$
- AC through a Resistor:
  Peak value of current, $I_0 = \frac{E_0}{R}$
- AC through an Inductor:
  Peak value of current, $I_0 = \frac{E_0}{\omega L}$
- AC through a Capacitor:
  Peak value of current, $I_0 = \frac{E_0}{\left(\frac{1}{\omega C}\right)}$
- AC through CR series Circuit:
  Peak value of current, $I_0 = \frac{E_0}{\sqrt{R^2 + X_C^{\ 2}}}$
- AC through LC Series Circuit:
  Peak value of current, $I_0 = \frac{E_0}{(X_L - X_C)}$
- AC through LR Series Circuit:
  Peak value of current, $I_0 = \frac{E_0}{\sqrt{R^2 + X_L^{\ 2}}}$
- AC through LCR Series Circuit:
  Peak value of current, $I_0 = \frac{E_0}{\sqrt{R^2 + (X_L - X_C)^2}}$
- Quality factor of a Resonance Circuit:
  $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$

## OPTICS

- Lens Maker's Formula: $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$
- Thin Lenses in Contact: $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3} + \ldots\ldots -$ Lenses Separated by a Distance:
  $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$
- Methods of minimizing Chromatic Aberr-ation: When two thin lens-es are in contact
  $\frac{\omega_1}{f_1} + \frac{\omega_2}{f_2} = 0$
- When two lenses are separated by a distance 'd' is ($\omega_1 = \omega_2$) $d = \frac{\omega_1 f_2 + \omega_2 f_1}{\omega_1 + \omega_2}$
- When two lenses are made of same material ($\omega_1 = \omega_2$) $d = \frac{f_1 + f_2}{2}$
- Ramsden's Eye - Peace: Its effective focal length is 3f/4
- Huygen's Eye Piece: Its effective focal length 3f/2
- Phase difference = $2\pi/\lambda$(path difference)
- Young's Double Slit Experiment: The resultant intensity of two waves is
  $I = R^2 = 4a^2\cos^2\frac{\delta}{2}$

## KINEMATICS

- If a bullet looses$(1/n)^{th}$ of its velocity while passing through a plank, then the no. of su-ch planks required to just stop the bullet is
  $\frac{n^2}{2n-1}$
- The velocity of a body becomes $\left(\frac{1}{n}\right)^{th}$ of its initial velocity after a displacement of 'x', then it will come to rest after a further displacement of $\frac{x}{n^2-1}$
- Body Projected Vertically up: a = -g

  a) $v = u - gt$  b) $s = ut - \frac{1}{2}gt^2$

  c) $v^2 - u^2 = -2gh$  d) $s_n = u - \frac{g}{2}(2n-1)$

- $H_{max} = \frac{u^2}{2g}$
- Ablique Projectile - Equation of Projectile:
  $y = [\tan\theta]x - \left[\frac{g}{2u^2\cos^2\theta}\right]x^2 = Ax - Bx^2$
- Horizontal Projectile-Equation of Horizontal Projectile:
  $y = \frac{1}{2}g\left[\frac{x}{u}\right]^2 = \left(\frac{g}{2u^2}\right)x^2$

**READY RECKNOR:** Give top priority to (1) Most important topics (2) Be thorough in important topics.

**MOST IMPORTANT TOPICS**

Modern Physics, Electrostatics, Magnetic effects of current and earth's magnetism, Heat & Thermodynamics, SHM and Oscillations, Current electricity.

**IMPORTANT TOPICS**

Gravitation & Rotational Mechanics, EMI, AC & EM waves, Optics, Kinematics.

**HOW TO REVISE PHYSICS:**

It is very important on the part of the student to stay in touch with every subject and with all the topics.

☞ **STEP ONE:**

Divide topics into 3 categories i.e.,
Category
(1) Topics in which you are very confident.
(2) Topics which require little revision but you are ok.
(3) Difficult topics which require lot of revision

☞ **STEP TWO:**

If you are using 9 hours for revision and 3 hours need to be allotted for Physics. Give 2 hours of your time to concentrate on the difficult topics you have identified. 1 hour to the topics for which little revision is required. Go for thorough revision of the theory and then attack the questions in a systematic manner only on the topics you have covered on that day. A quick review of the key on your own will give you a clear idea on the topics which you have to revisit. This is how you need to consolidate and strengthen yourself.

☞ **STEP THREE:**

To stay in touch with all topics in any given exercise (if the questions are all categories into different levels) start attempting even numbered questions first from all the topics. This will give you "time" to go through all the topics. After completing go for odd numbered questions in level - I. The same may be repeated for Level - II and Level - III questions.

☞ **STEP FOUR:**

Write as many grand tests as possible. Analyse the answers and try to rectify the mistakes.