

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [BATCH 2015-18]

B.A./B.Sc. FOURTH SEMESTER (January – June) 2017

Mid-Semester Examination, March 2017

Date : 18/03/2017

PHYSICS (General)

Time : 12 noon – 1 pm

Paper : IV

Full Marks : 25

[Use a separate Answer Book for each group]

Group – A

Answer any two questions :

[2×5]

1. Draw the circuit diagram of a full-wave rectifier using (a) centre-tap connection and (b) bridge connection. Explain the working of each. What is the PIV in each case? [2+2+1]
2. Calculate the ripple factor of a full wave rectifier. [5]
3. Explain the working principle of transistor. [5]

Group – B

Answer any three questions :

[3×5]

4. a) A man on a pickup truck (moving with uniform velocity) throws a ball straight up. If the air resistance is neglected, the man on the truck observes the ball moves in a vertical path. An observer on the ground observes the path of the same ball as a parabola. Does these observations contradict the principle of Galilean relativity? Explain your answer. [1]
b) Why there is a contradiction between Galilean relativity and Maxwell's law of electromagnetism? [1]
c) If we assume the Maxwell's laws of electromagnetism are true in all inertial frames then we are forced to abandon the notions of absolute frame. Why? [1]
d) Show that the velocity of a particle in time like interval can't exceed the speed of light. [1]
e) Show that the speed of light is invariant. [1]
5. a) What do you mean by length contraction? Derive an expression for length contraction. [2]
b) A certain young body decides on her 21st birthday that it is time to get thinner. She weighs 100kg. She has heard that if she makes fast enough she will appear thinner to her stationary friends.
i) How fast must she move to appear thinner by a factor of 50%? [1]
ii) At this speed what will her mass appear to be to her stationary friends? [1]
iii) If she maintains her speed until the day she calls her 29th birthday. How old will her stationary friends claim she is according to their measurements? [1]
6. a) Why in photoelectric effect experiment the maximum kinetic energy of ejected electron doesn't depend on the intensity of the incident radiation? [1.5]
b) Why there is no photoelectric effect if the wavelength of the incident radiation is above a certain cutoff wavelength? [1.5]
c) Light of wavelength $3000\text{\AA}$ falls on a metal surfaces having a work function of 2.3eV . Calculate the maximum velocity of the ejected electrons ($h = 6.6 \times 10^{-34}\text{Js}$, $m_e = 9.1 \times 10^{-31}\text{kg}$). [2]
7. a) What are Miller indices. [2]
b) Draw plane [110] [1]

- c) The first order Bragg reflection is formed when X-rays of wavelength $0.842 \text{ \AA}$ is made incident on a crystal at glancing angle $8^\circ 35'$. What will be the glancing angle for third order reflection? [2]
8. a) ${}_Z A^x$ represents an atom. Find expression for binding energy of the atom. [3]
- b) The half-life of radon is 4 days. After how many days will only $\frac{1}{10}$ th of a radon sample be left behind? [2]

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