

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), May 2015

B. Tech./B. Tech+M. Tech/B. Tech+MBA (Branch: Common to all), Semester II

Roll No.....

PH201: Engineering Physics-I

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer. CONFIDENTIAL
4. Mobiles are not allowed during examination.
5. Non-programmable calculator is allowed.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

i. The postulates of special theory of relativity are valid for

- (a) inertial frame (b) both inertial and non-inertial frame
(c) non-inertial frame (d) neither inertial, nor non-inertial frame

ii. The momentum for a photon of energy E is given by

- (a) E/c^2 (b) E/c^4 (c) E/c (d) E/c^3

iii. In GM Counter, quenching means.....

- (a) preventing fresh avalanche (b) producing fresh avalanche
(c) measuring particles energies (d) none of above

iv. For ionization counters, energy is required to produce one ion pair

- (a) 35 eV (b) 10 eV (c) 25 eV (d) 20 eV

v. In conventional light sources

- (a) different atoms emit radiation at different times
(b) there is no phase relation between the emitted photons
(c) different atoms emit photons in different directions
(d) all

vi. Under population inversion, the number of atoms in the higher energy states is _____ than in the lower energy state.

- (a) lesser (b) larger (c) both a & b (d) none



- vii. Optical fibres guide light waves by
 (a) interference of waves (b) diffraction of waves
 (c) polarization of waves (d) by total internal reflection of waves
- viii. Sommerfeld's free electron gas model of metals follows the Fermi-Dirac statistics. (Yes/No)
- ix. The degree of degeneracy of the energy level ($14h^2/8ma^2$) of a particle in the cubical potential box of side a
 (a) 6 (ii) 9 (iii) 12 (iv) 15
- x. Which of the following statements about the energy in a quantum is true?
 (a) varies directly with frequency (b) same for all frequencies
 (c) varies inversely with frequency (d) none of the above



Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

- i. Write Lorentz transformation equations and explain how it differs from Galilean transformation.
- ii. What are inertial and non-inertial frame of references?
- iii. Define Poynting theorem.
- iv. Why semiconductor is an insulator at $T = 0$ K but becomes conducting when $T \sim 300$ K.

Q.3A What is Sommerfield's free electron gas model of metals? Derive an expression for Fermi energy of metals. 05

Q.3B Find the velocity of the particle, when its mass increases by three times of rest mass. 05

Q.4A Derive expressions for the maximum acceptance angle of an optical fibre. Explain the advantages of optical communication system over the conventional ones? 05

Q.4B The numerical aperture of an optical fibre is 0.39. If the difference in the refractive index of the material of its core and cladding is 0.05, calculate the refractive index of material of the core. 05

Q.5A Explain construction and working of GM Counter with neat diagram. Define characteristics of quenching agent in GM Counter. 05

Q.5B A GM counter counts to a maximum of 5000 counts per minute. If its efficiency is 95%, calculate the paralysis time of the counter. 05

Q.6A Write down Schrodinger's wave equation for a particle in a three dimensional box. Solve it to get Eigen functions and show that Eigen values are discrete. 05

Q.6B A free particle is confined in a cubical box of side 'a'. Write the Eigen values and Eigen functions for an energy state represented by $n_x + n_y + n_z = 5$. What is the order of degeneracy in this case? 05

OR

Q.6B Electrons with energy 1 eV are incident on a barrier 5 eV high and 5 Å wide. Find their respective transmission probabilities. 05

Q.7A Curl $\text{grad } \Phi = 0$ where Φ is a scalar field. 05

Q.7B Define divergence of a vector field and explain its physical significance. 05

OR

Q.7B Derive Maxwell's equations in differential form and outline their physical meaning. 05

Q.8 State the fundamental postulate of the special theory of relativity. Derive an expression of energy-mass relation $E = mc^2$. 10

Q.9A Describe with a neat diagram the construction and working of the proportional counter. Explain how output voltage pulse depends on energy of the ionizing particle. 10

Q.9B Explain essential requirements for producing laser action. Describe construction and working of semiconductor laser. 10

OR

Q.9B What is tunnel effect? Prove that reflection probability for rectangular potential barrier $R < 1$ even if particle energy E is less than the barrier height V_0 . 10