(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 9913 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. I) ODD SEMESTER THEORY EXAMINATION 2010-11

PHYSICS

Time : 3 Hours *Total Marks : 100*

Note : (1) Attempt **all** the questions.

(2) Marks of each question are shown against it.

(3) The physical constants are given in the last.

1. Attempt any **four** parts of the following : **(5×4=20)**

(a) Discuss the objective and outcome of Michelson-Morley experiment.

(b) What do you understand by time dilation ? How the time dilation experimentally verified ?

(c) With what velocity should a spaceship fly so that every day spent on it may correspond to three days on the earth's surface ?

(d) Calculate the percentage contraction of a rod moving with a velocity 0.8c in a direction inclined at 60° to its own length.

(e) Derive relativistic formula for the variation of mass with velocity.

(f) The total energy of a moving meson is exactly twice its rest energy. Find the speed of the meson.

2. Attempt any **two** parts of the following : **(10×2=20)**

(a) (i) What are the coherent sources ? How are they obtained in practice ?

(ii) A glass plate 0.40 micron thick is illuminated by a beam of white light normal to the plate. The index of refraction of the glass is 1.50. What wavelengths within the limits of the visible spectrum (400 μm- 700 μm) are strongly reflected by the plate ?

(b) Derive an expression for the intensity distribution due to Fraunhofer diffraction at a single slit. Show that the intensity of the first subsidiary maximum is about 4.5% of that of the principal maximum.

(c) (i) What do you understand by the resolving power of a grating ? Derive its expression.

(ii) Calculate the minimum number of lines in a grating which will just resolve the wavelengths 5890A° and 5896A° in the second order.

3. Attempt any **two** parts of the following : **(10×2=20)**

(a) (i) Explain the Huygens theory of double refraction in an uniaxial crystal.

(ii) Calculate the thickness of doubly refracting crystal required to introduce a path difference of $\lambda/2$ between the ordinary and extraordinary rays when $\lambda = 6000A°$ and refractive indices for ordinary and extraordinary rays are 1.65 and 1.48 respectively.

(b) (i) Show that the plane polarized and circularly polarized lights are the special cases of elliptically polarized light.

(ii) A 5% solution of cane sugar placed in a tube of length 40 cm causes the optical rotation of 20°. How much length of 10% solution of the same substance will cause 35° rotations ?

(c) What are the essential conditions for laser action ? Describe the working of four level lasers with neat and clean diagram.

4. Attempt any **two** parts of the following : **(10×2=20)**

(a) Write down the Maxwell equations in free space and derive wave equations from it showing that speed of wave is equal to the speed of light.

(b) What is Poynting vector ? Derive Poynting theorem for conservation of energy in electromagnetic fields. Explain each term of the theorem.

(c) What is magnetization curve ? Explain residual magnetism, coercive force and hysteresis.

5. Attempt any **four** parts of the following : **(4×5=20)**

(a) Derive Bragg's law for the diffraction of X-rays of crystals.

(b) An X-ray photon is found to have its wavelength doubled on being scattered through 90°. Find the wavelength and energy of the incident photon.

(c) Explain the phase and group velocities of matter wave and show that $V_p . V_g = C^2$.

(d) Find the de-Broglie wavelength of a 15 k eV electron.

(e) Derive the time dependent Schröedinger wave equation.

(f) Calculate the energy difference between the ground and the first excited state for an electron in a one-dimensional rigid box of length 10^{-8} cm.

Physical Constants

Planks Constant	$h = 6.63 \times 10^{-34}$ Js
Velocity of light in free space	$c = 3 \times 10^{8}$ m/s
Rest mass of electron	$m_e = 9.1 \times 10^{-31}$ kg
Electronic charge	$e = 1.6 \times 10^{-19}$ C