No. of Printed Pages – **3** **PY101**

**Roll No.** | | | | | | | | | | |

# B. TECH.

## SECOND SEMESTER EXAMINATION, 2016-17

## PHYSICS

Time : **3 Hours** Max. Marks : **60**

**Note :** **(i)** Attempt **ALL** questions.
**(ii)** Choices are given in each question set.

**1.** Attempt any **Four** of the following questions: **3 x 4 = 12**

**(a)** Show that V=1/r satisfied Laplace's equation.

**(b)** State and prove uniqueness theorem.

**(c)** Show that the normal component of electric displacement $\vec{D}$ and the tangential component of electric field $\vec{E}$ are continuous at the charge free interface between two dielectrics.

**(d)** Use Laplace's equation to find the capacitance of a parallel plate capacitor. Boundary conditions are at x=0, $V=V_1$ and at x=d, $V=V_2$.

**(e)** Calculate numerical value for V and $\rho_v$ at point P in free space if:

$$V = \frac{4yz}{x^2+1} \; at \; P\,(1,2,3).$$

**(f)** Derive the expression for the Potential energy of a system of discrete charges.

**2.** Attempt any **Four** of the following questions: **3 x 4 = 12**

**(a)** Explain with the help of suitable diagram how Fresnel's biprism produces coherent sources. Also derive the expression for fringe width for this.

**(b)** What is Rayleigh's criterion of resolution? Derive the expression for resolving power of a grating.

**(c)** In a double slit arrangement fringes are produced using light of wavelength 4800Å. One slit is covered by a thin plate of glass of refractive index 1.4 and the other slit by another plate of glass of the same thickness but of refractive index 1.7. On doing so the central bright fringe shifts to the position originally occupied by the fifth bright fringe from the centre. Find out the thickness of the fringes.

**(d)** Two plane glass surfaces in contact along one edge are separated at the opposite edge by a thin wire. If 20 interference fringes are observed between these edges in red light of wavelength 7460Å at normal incidence, what is the thickness of the wire?

**(e)** Two waves of amplitude 'a' and '2a' interfere with each other. At a point where phase difference is 3π/2, what would be the intensity?

**(f)** Consider the formation of Newton's rings by monochromatic light of wave length 6000 Å. The point of contact is perfect and dark. if we slowly raise the lens vertically above the plate, the central spot becomes bright. Find out the distance by which the lens has been raised.

**3.** Attempt any **Two** of the following questions: **6 x 2 = 12**

**(a)** Give a brief account of Fresnel's theory of optical rotation. Also calculate the velocities of ordinary and extraordinary rays in calcite crystal in a plane perpendicular to the optic axis. Given that $\mu_0 = 1.6589,\ \ \mu_e = 1.4864,$ c = 3 x $10^8$m/sec.

**(b)** What is the principle behind the functioning of an optical fibre? Also, calculate the numerical aperture and hence the acceptance angle for an optical fibre for which the core and the cladding refractive indices are 1.46 and 1.41 respectively.

**(c)** What is laser? Give the construction and working of He-Ne laser.





**4.** Attempt any **Two** of the following questions: **6 x 2 = 12**

**(a)** What is the Give the theory of flow (Poiseuille's formula) of a liquid through a uniform capillary tube? Mention the limitations of the formula. Also explain the necessary correction in the formula and give the nature of temperature dependence of viscosity.

**(b)** Derive the expression $E = \sqrt{m_0^2c^4 + p^2c^2}$ where the symbols have their usual meaning. Derive the relation between the kinetic energy and momentum of a particle which is moving with a velocity only slightly less than velocity of light.

**(c)** Explain the Michelson-Morley experiment. What was motivation behind the experiment? A clock keeps correct time. With which speed should it be moved relative to an observer so that it may appear to lose 4 minute in 24 hours?

**5.** Attempt any **Two** of the following questions: **6 x 2 = 12**

**(a)** Derive an expression for Compton shift.

**(b)** State Heisenberg uncertainty principle and Give an estimate of size of Hydrogen atom using Heisenberg's uncertainty principle.

**(c)** Solve Schrodinger's wave equation for a one dimensional potential box and also plot probability density for the first three energy state. An electron is bound in a one dimensional potential box which has a width of 2.5x$10^{-10}$m. Assuming the height of the box to be infinite calculate the lowest two permitted energy values of the electron.