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Total Number of Pages: 02

B.Tech  
15BS1102

2<sup>nd</sup> Semester Back Examination 2016-17

PHYSICS

BRANCH: ALL

Time: 3 Hours

Max Marks: 100

Q.CODE: Z778

Answer Part-A which is compulsory and any four from Part-B.

The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 Answer the following questions: *multiple type or dash fill up type* (2 x 10)

- The speed of a longitudinal wave propagating in a medium of density  $6 \times 10^3 \text{ kg/m}^3$  and bulk modulus  $1.2 \times 10^8 \text{ N/m}^2$  is \_\_\_\_\_.
- The phenomenon of interference is used to prove that light is \_\_\_\_\_.
- Newton's ring illustrates the phenomenon of \_\_\_\_\_.
- When viewed in white light, soap bubbles show colour because of \_\_\_\_\_.
- The substance that rotate the plane of polarisation are said to be \_\_\_\_\_.
- Stoke's Theorem connects \_\_\_\_\_ to \_\_\_\_\_.
- If  $\nabla^2 \phi = 0$  then \_\_\_\_\_ is solenoidal.
- \_\_\_\_\_ is the SI unit and \_\_\_\_\_ is dimensional formula of the Poynting vector.
- From Bohr theory for hydrogen atom, the allowed energy of the higher excited state is \_\_\_\_\_.
- If the ground state energy of a particle trapped in an infinite deep potential well is E, \_\_\_\_\_ is its energy in the 2<sup>nd</sup> excited state.

Q2 Answer the following questions: *Short answer type* (2 x 10)

- Two simple pendulum of mass 'm' and length 'l' each, are coupled by a spring of force constant 'k'. write the expression for frequency of normal modes of vibration of the coupled system.
- What do you mean by coherent sources.
- Two straight and narrow parallel slits 1mm apart are illuminated by monochromatic light. Fringes are formed on the screen held at a distance of 100cm from the slits are 0.50mm apart. What is the wavelength of light?
- Differentiate between Fresnel and Fraunhofer diffraction.
- Explain the meaning of plane of polarisation and plane of vibration.
- Write Maxwell's equation in integral form.
- Express the electric field **E** and magnetic field **B** in terms of scalar potential and vector potential.
- What is pair production.
- Write the Schrodinger's time dependent and time independent wave equation?
- Find the wave function for a system represented by the Eigen functions  $\Psi_1, \Psi_2, \Psi_3$  having probabilities 1/2, 1/3, 1/6 respectively.

**Part – B (Answer any four questions)**

- Q3** a) Explain what do you understand by SHM. Define amplitude, time period and phase of a body executing SHM. (5)
- b) A harmonic wave is represented by the wave function  $\Psi(x, t) = (3\text{cm})\sin(0.6x - 2.2t + \pi)$ , where x is in cm and t is in s. Determine the amplitude, frequency, wavelength, phase velocity and phase constant of the wave. (5)
- c) Starting from the differential equation of a damped oscillator, write the solution for under damped oscillatory motion. Graphically show the variation of amplitude with time. Mention the condition for critical damping. (5)
- Q4** a) Monochromatic light from a narrow slit falls on two parallel slits and the interference fringes are obtained on a screen. Calculate the spacing between the consecutive maxima and minima. Discuss about the shape of fringes. (6)
- b) What do you understand by diffraction of light? Distinguish clearly between interference and diffraction of light. (4)
- c) What is Zone Plate? Describe how it forms an image of an object and derive an expression for its focal length. (5)
- Q5** a) Describe the construction of a Nicol prism. Explain how it produces polarized light. (7)
- b) In Newton's ring arrangement the radii of  $n^{\text{th}}$  bright rings with an air film and liquid film are 1.2 mm and 1.0 mm respectively. Calculate the refractive index of the liquid. (4)
- c) Critical angle in certain substance is  $30^\circ$ . What is the polarizing angle of the substance. (4)
- Q6** a) Derive constraint equation for electromagnetic field. (6)
- b) Derive the relation between electric current density and electric charge density. (5)
- c) Write the physical significance of Maxwell's equation (4)
- Q7** a) Prove the Transverse nature of electromagnetic waves. (7)
- b) Justify Poynting theorem is a statement of conservation of energy in electromagnetic field. (4)
- c) A point source emits light with power 250W. Find the average value of poynting vector and 'rms' values of electric and magnetic fields at a distance of 2m from the screen. (4)
- Q8** a) Discuss about photo electric effect and derive stopping potential. (5)
- b) Using Heisenberg's uncertainty principle, show that the ground state energy of harmonic oscillator is non zero. (5)
- c) Explain Compton scattering and obtain the expression for Compton shift. (5)
- Q9** a) Find out Eigen values and Eigen function for a particle confined between two perfectly rigid walls separated by a distance 'a'. (7)
- b) Compare allowed energy states for particle in a Box and Harmonic Oscillator. (4)
- c) 12 million electrons with energy 3.0eV are incident on a potential barrier of 9.0eV high and 0.5nm width. Calculate how many electrons will tunnel through the Barrier. (4)