BRAINWARE UNIVERSITY

Term End Examination 2018 - 19

Programme – B.Tech. in Electronics & Communication Engineering/ B.Tech. in Computer Science & Engineering

Course Name - Physics

Course Code – BPHY010101

(Semester – 1)

Time allotted: 3 Hours   **Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Question)   10 x 1 = 10

1. *Choose the correct alternative from the following*

(i)   For a particle executing SHM, the phase difference between displacement and velocity is
   a. π b. 0
   c. $\pi/2$ d. $-\pi/2$

(ii) If ω is the natural frequency of an oscillator and b is the damping factor (b=β/(2m)) where β is force per unit velocity, the quality factor of the oscillator is given by
   a. ω/b b. $\omega/(2b)$
   c. $2\omega/b$ d. b/ω

(iii) For small value of damping constant, the resonance is
   a. flat   b. sharp
   c. remains same   d. none of these

(iv) For interference of light, the two sources should be
   a. Spherical   b. non-coherent
   c. coherent   d. cylindrical

(v) In Young's double slit experiment, coherent waves are produced by means of

    a. division of wave front   b. division of amplitude

    c. refraction   d. none of these

(vi) Radii of Newton's rings are proportional to

    a. square root of natural numbers   b. square of the natural number

    c. natural number   d. none of these

(vii) Two sources will be coherent if they

    a. have a constant wavelength   b. have a constant phase difference

    c. have a constant amplitude   d. none of these

(viii) In diffraction, the size of the obstacle should be such that it

    a. is comparable to the wavelength of the light used   b. is greater than the wavelength of the light used

    c. has no connection with the wavelength of the light used   d. none of these

(ix) The plane of vibration makes an angle θ with that of polarization. The value of θ is

    a. $0°$ b. $90°$

    c. $45°$ d. none of these

(x) The optic axis is a direction along which

    a. the O-ray travels faster than E-ray   b. the E-ray travels faster than O-ray

    c. both O-ray and E-ray travel with the same velocity   d. none of these

Group – B

(Short Answer Type Questions)   3 x 5 = 15

Answer any *three* from the following

2. (a) Calculate the time period of vibration of the liquid column of length 'l' in a U-tube, if the liquid is depressed in one arm ['d' is the density of the liquid, 'A' is the cross sectional area of the tube.]   2

    (b) The displacement (y) of a moving particle at any instant of time 't' is given by $y = a \sin\alpha t + b \cos\alpha t$. Show that the motion is simply harmonic. Here α is a constant   3

3. Differentiate between free and damped vibration. Write down the differential equation of a damped harmonic oscillator and solve it.   1+4

4. Fraunhofer diffraction pattern is observed by a double slit having slit width a=0.16 nm and the separation between the slit b=0.8 mm. Find the missing orders.

    5

5. Explain what is meant by acceptance angle in an optical fiber. Find an expression for it in a step index optical fiber. Define also the numerical aperture and write down its expression.   5

6. In Michelson Interferometer, 1000 fringes cross the field of view when the movable mirror is displaced through 0.293 mm. Calculate the wavelength of light.   5

Group – C

(Long Answer Type Questions)   3 x 15 = 45

Answer any *three* from the following

7. (a) Show that the dark and bright fringes produced in Young's double slit experiment are equally spaced.   5

   (b) In Young's double slit experiment, the separation between the slits in 1.2 mm and the fringe spacing is 0.5 mm on a screen placed at a distance of 1 m from the slits. Find the wavelength of light.   5

   (c) A convex lens of focal length 40 cm is used to focus the Fraunhofer diffraction pattern of a single slit of 0.3 mm width. Calculate the distance of 1st order dark band from the central band. Take the wavelength of light $\lambda = 589$ nm.   5

8. (a) Elucidate stationary sound waves.   5

   (b) Define phase velocity and group velocity. Establish a relation between them in a dispersive medium.   4+6

9. (a) Show that the velocity of sound in air is given by $\sqrt{\dfrac{\gamma P}{\rho}}$ where P is the pressure, ρ is the density and γ is the ratio of specific heat of air at constant pressure and of constant volume.   10

(b) The wavelength of sound wave of frequency 500 Hz is found to be 0.68 m at STP. If density of air at STP is 1.29 Kg/m^3, calculate the ratio of two specific heats of air. 5

10. (a) Write short note on Nicol prism. 5

(b) State and explain Brewster's law of polarization. 5

(c) Write what you know about Polaroid. 2

(d) What is the refractive index of glass, if light of wavelength 546 nm is plane polarized when reflected at an angle of $60°$. Calculate also the angle of refraction. 3

11. (a) Distinguish between spontaneous and stimulated emission of radiation. 2+2

(b) What is population inversion? Why do you need population inversion in a laser? 2+2

(c) Elucidate the physical significance of Einstein's A and B coefficients. 3

(d) Find the ratio of rate of spontaneous emission to that of stimulated emission at $T = 10^3$ K for microwave of frequency 10^9 Hz. Give your comment on the result. 3+1