



BRAINWARE UNIVERSITY

Term End Examination 2022

**Programme – B.Tech.(CSE)-2018/B.Tech.(ECE)-2018/B.Tech.(ECE)-2019/B.Tech.
(CSE)-2019/B.Tech.(CSE)-2020/B.Tech.(ECE)-2020**

Course Name – Physics

Course Code - BPHY010101/BSC(ECE)102/BSC(CSE)102

(Semester I)

Full Marks : 60

Time : 2:30 Hours

[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)

1 x 15=15

1. *Choose the correct alternative from the following :*

- (i) The intensity of central maximum due to double slit diffraction pattern is -----times greater than that of single slit pattern.
 - a) 8
 - b) 3
 - c) 4
 - d) 2
- (ii) The optic axis is a direction along which
 - a) The O-ray travels faster than the E-ray
 - b) The E-ray travels faster than the O-ray
 - c) Both O-ray and E-ray travel with the same velocity
 - d) None of these
- (iii) If white light is used in Newton's rings experiment, then
 - a) A number of coloured rings will be observed
 - b) No rings will be observed
 - c) Black and white rings will be observed
 - d) None of these
- (iv) The SI unit of the force constant of a spring is given by
 - a) Nm
 - b) Nm^{-2}
 - c) Nm^{-1}
 - d) N
- (v) The time period of a simple pendulum of infinite length is given by
 - a) Finite
 - b) Zero
 - c) Infinite
 - d) None of these
- (vi) Wave front means
 - a) All particles in it have same phase
 - b) All particles have opposite phase of vibrations
 - c) Few particles are in same phase, rest are in opposite phase
 - d) None of these
- (vii) If ω_0 is the angular frequency of a body and k is the damping constant, then its quality factor is

- a) ω_0/k b) $2\omega_0/k$
 c) $\omega_0/2k$ d) none of these
- (viii) When light is reflected from glass at the polarizing angle, then choose the correct option
 a) The reflected and refracted rays are parallel b) The reflected and refracted rays are perpendicular
 c) The electric vector is perpendicular to the reflecting plane d) None of these
- (ix) A double slit interference experiment is carried out in air and the entire arrangement is dipped in water. The fringe width
 a) Increases b) Decreases
 c) Remains unchanged d) Fringe pattern disappears
- (x) Which of the following is not essential for simple Harmonic motion?
 a) Inertia b) Gravity
 c) Restoring force d) Elasticity
- (xi) A particle of mass 10 gm lies in a potential field $V = 50x^2 + 100$. The value of frequency of oscillations in Hz is
 a) 5 Hz b) $5/\pi$ Hz
 c) $10\pi/3$ Hz d) none of these.
- (xii) The action of Nicol prism is based on the phenomenon of
 a) Scattering b) Double refraction
 c) Refraction d) Reflection
- (xiii) In Newton's ring experiment, coherent waves are produced by means of
 a) Division of wave front b) Diffraction
 c) Division of amplitude d) None of these
- (xiv) The quality factor Q for an L-C-R circuit is
 a) $\omega R/L$ b) ωLR
 c) $\omega L/R$ d) $R/\omega L$
- (xv) Radii of Newton's rings are proportional to
 a) Square root of natural number b) Square of natural number
 c) Natural number d) None of these

Group-B
 (Short Answer Type Questions)

$3 \times 5 = 15$

2. Establish the relation between path difference and phase difference. (3)
3. What do you mean by acceptance angle and Numerical aperture of an optical fiber? (3)
4. Stimulated emission is used in laser action instead of spontaneous emission. Justify your answer? (3)
5. Calculate intensity of the wave $y(x,t) = 0.002 \sin(400t - 10x)$. (3)

OR

Explain plane of polarization and plane of vibration with a diagram. (3)

6. Distinguish between group velocity (v_g) and phase velocity (v_p)? (3)

OR

Illustrate the working principle of Nicol prism as polarizer. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. A Newton's ring experiment is performed with a source of light having two wavelengths λ_1 and λ_2 . It is found that the n^{th} dark ring due to λ_1 coincides with $(n+1)^{\text{th}}$ dark ring due to λ_2 . If the radius of curvature of the Plano-convex lens is R, then prove

$$\text{that the radius of the } n^{\text{th}} \text{ order dark ring for } \lambda_1 \text{ is given by } \sqrt{\frac{\lambda_1 \lambda_2}{\lambda_1 - \lambda_2} R}.$$

8. Explain the terms a) Ordinary Ray and b) Extraordinary Ray. (5)

9. Estimate the thickness of a mica sheet required to make a quarter wave plate for $\lambda = 546 \text{ nm}$. (5)
The refractive indices for the O-ray and E-ray in mica are 1.586 and 1.592 respectively.

10. What do you mean by monochromatic light? Define Temporal coherency and spatial coherency. (5)

11. A vibrator of 10 g mass is acted on by a restoring force of 15 dyne/cm and a damping force 2 dyne/cm. Find whether the motion is over damped or oscillatory. (5)

OR

In a Young's double slit experiment, the distance between the slits is 0.1mm and the perpendicular distance of the screen from the plane of the slits is 50cm. Find the separation on the screen between maxima for violet light ($\lambda = 400 \text{ nm}$) and the red light ($\lambda = 700 \text{ nm}$) in the first order. (5)

12. What do you mean by total internal reflection and critical angle? Explain with a diagram. (5)

OR

The intensity distribution for a single-slit Fraunhofer diffraction is given by (5)

$I = I_0 \left(\frac{\sin^2 \alpha}{\alpha^2} \right)$ where $\alpha = \frac{\pi b \sin \theta}{\lambda}$, where b is the width of the slit and λ is the wavelength of light. Show that secondary maxima are given by the equations $\tan \alpha = \alpha$
