DBY-003-1012002 Seat No. _____

B. Sc. (Sem. II) (W.E.F. 2016) Examination

July - 2022

Physics - 201

(Waves, Optics & Semiconductor Devices)

Faculty Code : 003
Subject Code : 1012002

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

1 (a) Answer each question. **4**

(1) According to Newton the propagation of sound in air is an _____ process.

(2) What are longitudinal waves ?

(3) What are nodes ?

(4) Sound waves are _____ kind of waves.

(b) Answer in short : (any one) **2**

(1) A simple progressive wave is represented by the equation $y = 0.5 \sin (314t - 12.56\,x)$; where x and y are in meters and t is in sec. Find (a) amplitude and (b) wavelength.

(2) A wire 50 cm long and of mass 6.5×10^{-3} kg is stretched so that it makes 80 vibrations per second. Find the stretching force in kg weight.

(c) Answer in brief : (any one) **3**

(1) Define intensity and loudness. Express loudness in decibel.

(2) What is Doppler Effect ? Derive the equation for apparent frequency when the source is moving towards a stationary listener.

(d) Answer in detail : (any one) **5**

(1) Derive Newton's formula for velocity of sound in air and apply Laplace's correction.

(2) Derive the equation for the velocity of transverse waves in a stretched string.

2 (a) Objective type questions : **4**

(1) The forward characteristics is not a straight line hence semiconductor diode is a non-linear conductor. (True/False)

(2) What is the use of filter circuit in rectifier ?

(3) Draw the symbol of NPN and PNP transistors and specify the leads.

(4) Define β gain of a transistor.

(b) Answer in short : (any one) **2**

(1) A crystal diode having internal resistance $r_f = 20\,\Omega$ is used for the half wave rectification. If the applied voltage, $V = 50 \sin \omega t$ and load resistance $R_L = 780\,\Omega$ then, find (i) I_m, I_{dc}, I_{rms} and (ii) a.c. input power.

(2) In a common base connection the current amplification factor is 0.9. If the emitter current is 1mA, determine the value of base current.

(c) Answer in brief : (any one) **3**

(1) Prove that the maximum efficiency of a half wave rectifier is 40.6%.

(2) Explain working of an NPN transistor.

(d) Answer in detail : (any one) **5**

(1) Describe the action of : (i) choke input filter and (ii) capacitor input filter.

(2) Describe input and output characteristics of CE transistor connection.

3 (a) Objective type questions : **4**

(1) The velocity of light is minimum in vacuum. True or False.

(2) Name the two different techniques for obtaining interference.

(3) In Newton's ring the central ring is _____.

(4) What is meant by coherent source ?

(b) Answer in short : (any one) 2

(1) Distance between two slits is 0.1 mm and the width of the fringes formed on the screen is 5mm. If the distance between the screen and the slit is 1m, calculate the wavelength of light used.

(2) If a Newton's ring experiment the diameter of the 5th ring was 0.3 cm and that of 25th ring was 0.8 cm. If the radius of the curvature of the Plano-convex lens is 100 cm, then find the wavelength of light used.

(c) Answer in brief : (any one) 3

(1) Explain Fresnel's biprism in detail.

(2) Explain interference by reflected light.

(d) Answer in detail : (any one) 5

(1) Explain Newton's ring in detail.

(2) Write a note on Young's double slit experiment.

4 (a) Objective type questions : 4

(1) What is diffraction ?

(2) In Fraunhoffer diffraction the source and screen are effectively at infinity. True or False.

(3) The area of a zone plat = $\pi b\lambda$. True or False.

(4) Draw the graph showing the intensity variation in single slit diffraction.

(b) Answer in short : (any one) 2

(1) What is the radius of the first zone of a zone plate of focal length 0.2 m for a light of wavelength $5000\,\text{Å}$?

(2) Monochromatic light of wavelength 6560×10^{-8} cm falling normally on a grating is diffracted at an angle of 18^{o} 14' from the normal. Find the total number of lines on the grating.

(c) Answer in brief : (any one) 3

(1) Distinguish between prism spectra and grating spectra.

(2) Distinguish between Fresnel diffraction and Fraunhoffer diffraction.

(d) Answer in detail : (any one) **5**

(1) Explain single slit diffraction in detail.

(2) Explain the construction and action (theory) of a zone plate.

5 (a) Objective type questions : **4**

(1) What is polarization ?

(2) State Malu's law.

(3) Angle of deviation is minimum for _____ colour.

(4) The unit of dispersive power is _____.

(b) Answer in short : (any one) **2**

(1) Determine the Brewster's angle for glass refractive index 1.5 immersed in water of refractive index 1.33.

(2) Calculate the dispersive power for crown glass from the given data. μ_v = 1.523 and μ_R = 1.5145.

(c) Answer in brief : (any one) **3**

(1) Explain polarization by reflection and also find the expression for Brewster's law.

(2) Derive law of reflection by Fermat's principle.

(d) Answer in detail : (any one) **5**

(1) Write a note on Nicol prism.

(2) Define cardinal points of a lens system.
