



**DBY-2**

Seat No. \_\_\_\_\_

**B. Sc. (Physics) (Sem. II) (CBCS) Examination**

**July - 2022**

**201 : Wave, Optics & Semiconductor Devices**

*(New Course)*

Time :  $2\frac{1}{2}$  Hours]

[Total Marks : 70

- Instructions :** (1) All questions are compulsory.  
(2) Symbols have their usual meaning.  
(3) Figures on right hand side indicate full marks.

- 1 (a) Objective type questions : 4
- (1) Write the types of wave motion.
  - (2) Write the equation of standing wave.
  - (3) Define intensity of sound waves.
  - (4) What is amplitude at node points ?
- (b) Answer in brief : (any 1 out of 2) 2
- (1) Calculate the speed of sound if  $r = 1.4$ , pressure of air = 101325 Pa and density of air ( $\rho$ )  $1.29 \text{ kgm}^{-3}$ .
  - (2) A string of length 2 m and having linear mass density  $m = 7.5 \times 10^{-4} \text{ kgm}^{-1}$  is fixed at one end and 3 kg weight is attached at the other end. Find the speed of transverse waves along the string (take  $g = 10 \text{ ms}^{-1}$ ).
- (c) Answer in detail : (any 1 out of 2) 3
- (1) Explain the formation of Standing Wave.
  - (2) A Sonometer Wire having linear mass density  $m = 0.002 \text{ kg m}^{-1}$  and tension of 20N is applied on it. At resonance the length of the wire is 0.125 m between the bridges producing a loop calculate the frequency of vibrating wire.
- (d) Write a note on : (any 1 out of 2) 5
- (1) Explain Beat in detail.
  - (2) Discuss Doppler effect.

- 2** (a) Objective type questions : **4**
- (1) Draw the symbol of Zener diode.
  - (2) What is a rectifier ?
  - (3) Draw the symbol of NPN **OR** PNP transistor.
  - (4) A transistor can be operated with its emitter junction \_\_\_\_\_ biased (Forward, Reverse)
- (b) Answer in brief : (any 1 out of 2) **2**
- (1) For full wave rectifier circuit if maximum load current is  $50\sqrt{2}$  mA then find r.m.s. value of load current.
  - (2) A power supply delivers 10 Vdc with a ripple of 0.5 Vac (r.m.s). Calculate ripple factor.
- (c) Answer in detail : (any 1 out of 2) **3**
- (1) Explain working of transistor.
  - (2) A power supply of 120 V is connected with Zener diode of 60 V. If current limiting resistance and load resistance of the circuit is  $5000\ \Omega$  and  $10,000\ \Omega$  respectively then find the voltage drop across series resistance.
- (d) Write a note on : (any 1 out of 2) **5**
- (1) What is the Zener diode ? Explain in detail.
  - (2) Describe the filter circuit in detail.
- 3** (a) Objective type questions : **4**
- (1) The velocity of light is minimum in vacuum. (True/False)
  - (2) The central region in Newton's ring is \_\_\_\_\_. (bright, dark)
  - (3) Whose angle of deviation is minimum ? (red ray, violet ray)
  - (4) \_\_\_\_\_ cannot produce two coherent sources. (Prism, Lloyd's mirror)

- (b) Answer in brief : (any 1 out of 2) 2
- (1) The narrow and parallel slits  $10^{-3}$  m apart are illuminated with a light of wavelength  $590 \times 10^{-9}$  m. The interference pattern is observed at a distance of 0.3 m from the slits. Calculate the fringe width.
  - (2) If distance between two slits is  $10^{-3}$  m and the width of fringes formed on the screen is  $200 \times 10^{-6}$  m and distance between the slits and screen is 0.5 m then calculate the wavelength of light used.
- (c) Answer in detail : (any 1 out of 2) 3
- (1) Discuss Huygen's principle.
  - (2) Calculate the 4th dark ring if wavelength of light =  $5000 \times 10^{-10}$  m and radius of curved surface is 0.5 m.
- (d) Write a note on : (any 1 out of 2) 5
- (1) Explain Lloyd's single mirror with the formula of wavelength of light.
  - (2) Explain Newton's ring and derive the formula for the radius.
- 4 (a) Objective type questions : 4
- (1) Define diffraction.
  - (2) Define Transmitting Grating.
  - (3) What is interference ?
  - (4) Give the name of diffraction.
- (b) Answer in brief : (any 1 out of 2) 2
- (1) Find the radius of 4th zone of a zone plate of focal length 0.5 m for a light of wavelength  $5 \times 10^{-7}$  m.
  - (2) A parallel beam of light is allowed to be incident normally on a plane grating having 6000 lines per cm. and a second order spectral line is observed to be deviated through  $30^\circ$ . Calculate the wavelength of spectral line.

- (c) Answer in detail : (any 1 out of 2) 3
- (1) Comparison between zone plate and convex lens.
  - (2) The radius of the second ring of a zone plate is  $2 \times 10^{-3}$  m. If the plane waves of wavelength  $5 \times 10^{-7}$  m falls on the plate, find the second focus of the plate.
- (d) Write a note on : (any 1 out of 2) 5
- (1) Describe the construction and theory of Zone Plate.
  - (2) Discuss Frounhofer diffraction at plan diffraction grating.
- 5 (a) Objective type questions : 4
- (1) State Fermat's principle.
  - (2) State Malus law.
  - (3) Our eye can distinguish between polarized light and unpolarized light. (True/False)
  - (4) Intensity of light depends on amplitude (True/False)
- (b) Answer in brief : (Any 1 out of 2) 2
- (1) A ray of light is incident on the surface of a glass plate of refractive index 1.732 at the polarizing angle. Calculate the angle of polarization.
  - (2) The polarizing sheets have their polarizing direction parallel so that intensity of the transmitted light is maximum ( $I_0$ ). If one of the sheet be turned by  $60^\circ$  then what will be the intensity of transmitted light ?
- (c) Answer in detail : (any 1 out of 2) 3
- (1) Discuss properties of Nodal Points.
  - (2) If extra focal object distance is 30 cm and extra focal image distance is 40 cm then calculate the focal length of the equifocal optical system.
- (d) Write a note on : (any 1 out of 2) 5
- (1) Describe the construction, working, and action of a Nicol Prism.
  - (2) Prove laws of reflection using Fermat's principle.