

B.Sc. (With Credits)-Regular-Semester 2012 Sem I
1S-PHY 102 - Physics Paper - II
(Waves, Properties of Matter and Kinetic Theory)

P. Pages : 3

Time : Three Hours



GUG/W/16/3322

Max. Marks : 50

- Notes :
1. All the questions are compulsory.
 2. Draw neat labelled diagrams wherever necessary.

1. Either :

- a) i) What are transverse wave and longitudinal wave? Mention at least three differences between them. 3
- ii) Obtain an expression for speed of transverse wave in string. 5
- iii) Calculate the velocity of transverse wave produced in a vibrating string of mass per unit length 0.005 kg/m, when tension of 50N is applied on it. 2

OR

- b) i) What are torsional oscillations? 1
- ii) Obtain an expression for torque per unit twist of a cylindrical wire of length ℓ and radius r . 4
- iii) Obtain an expression for time period of torsional pendulum. 3
- iv) Calculate the torque which must be applied to a wire of length 2.5m and diameter 2mm in order to twist its one end through 18° , other end being fixed. Modulus of rigidity of wire is $5 \times 10^{10} \text{ N/m}^2$. 2

2. Either :

- a) i) Define coefficient of viscosity and state its SI unit and dimension. 2
- ii) Obtain an expression for coefficient of viscosity by using Poiseuille's flow method. 5
- iii) Calculate the mass of water flowing in 10 minutes through a tube of 0.1 cm in diameter and 40 cm long under a constant pressure head of 20cm of water. Coefficient of viscosity of water = $3.9 \times 10^{-4} \text{ N sec m}^{-2}$. 3

OR

- b) i) Derive Van der Waal's equation of state of an ideal gas. 3
- ii) Deduce an expression for critical constants in terms of the constant of the Van der Waal's equations. 4
- iii) Calculate the values of Van der Waal's constants 'a' and 'b' for Helium, when critical pressure is $0.23 \times 10^6 \text{ N/m}^2$ and critical volume is $58 \times 10^{-8} \text{ m}^3/\text{mole}$. 3

3. Either :
- Explain the working of magnetostriction generator for the production of an ultrasonic waves. 2½
 - What is Poisson's ratio? Find its limiting values lies between -1 to 0.5. 2½
 - Derive Stoke's law by using dimension method. 2½
 - Find the rms speed of nitrogen molecule in air at 27°C. Given $R = 8.31 \text{ J/mole/k}$ molar mass of nitrogen = $2.8 \times 10^{-3} \text{ kg/mole}$. 2½

OR

- Derive relation between phase velocity and group velocity. 2½
 - Calculate the Poisson's ratio for silver. Given Young's modulus for silver is $7.25 \times 10^{10} \text{ N/m}^2$ and Bulk modulus is $11 \times 10^{10} \text{ N/m}^2$. 2½
 - State Bernoulli's theorem. Derive an expression of continuity for flow of incompressible liquid in tubes. 2½
 - State and prove law of Equipartition of energy. 2½
4. Either :
- Discuss the effect of density, pressure and temperature on velocity of sound wave in gaseous medium. 2½
 - Assuming the relation between Y , K and η and prove that $\frac{9}{Y} = \frac{1}{K} + \frac{3}{\eta}$. 2½
 - What is surface film? Derive relation between surface tension and surface energy. 2½
 - Calculate the critical temperature of a gas for which $a = 3.64 \times 10^5 \text{ Nm}^4/\text{kg mole}^2$, $b = 4.28 \times 10^{-2} \text{ m}^3/\text{kmole}$, $R = 8.314 \text{ J/kg mole K}$. 2½

OR

- State any four applications of ultrasonic waves. 2½
 - Obtain an expression for External bending moment of beam. 2½
 - An air bubble of radius 0.3 mm is situated just below the surface of water. Calculate the excess of pressure inside the air bubble. Given :- surface tension of water = $7.5 \times 10^{-2} \text{ N/m}$. 2½
 - State the limitations of Van der Waal's equation. 2½
5. Solve **any ten** from followings.
- What is principle of super position of wave? 1
 - State any two properties of ultrasonic wave. 1

- c) What is piezoelectric effect? 1
- d) State Hook's law of elasticity. 1
- e) What is Elastic limit? 1
- f) What is plane of bending? 1
- g) Find the dimension of coefficient of viscosity. 1
- h) What is terminal velocity? 1
- i) Explain why dry steel needle floats on a water. 1
- j) State any two assumptions of kinetic theory of gases. 1
- k) What is degree of freedom. 1
- l) Define mean free path of molecule. 1
