**ST.JOSEPH’S COLLEGE (AUTONOMOUS), BANGALORE-27**

B.Sc. PHYSICS - II SEMESTER

SEMESTER EXAMINATION – APRIL 2020

**PH 218: Properties of Matter, Waves and Radiation**

**Time: 2 ½ hrs Max. Marks: 70**

This question paper has **two** printed pages and **three** parts

**PART-A**

Answer any **four** of the following.     (4x10=40)

1. a) Define bulk modulus, rigidity modulus and Poisson’s ratio.

b) What is neutral surface of a beam? Derive an expression for the bending moment of a

beam of circular cross section. (3+7)

2. a) Explain terminal velocity. Find Stokes’ formula by method of dimensions.

b) Deduce an expression for the excess of pressure acting on one side of a curved liquid

film over the other side. (4+6)

3. a) Describe how the resultant of two simple harmonic motions at right angles to each other

having equal periods and amplitudes but with phase difference 90 is a circle.

b) From the equation of motion of a simple harmonic oscillator find its velocity and

acceleration. (6+4)

4. a) Show that the areal velocity of the radius vector for a particle under a central force is

constant.

b) Obtain an expression for the gravitational potential due to a spherical shell at a point

outside the shell. (3+7)

5. a) Mention any three characteristics of wave motion.

b) State Fourier theorem. Determine the values of co-efficients in the Fourier series.

(3+7)

6. a) What is a black body? Explain the distribution of energy in the black body spectrum.

b) Show that Wien’s and Rayleigh-Jean’s law can be obtained from Planck’s law for black

body radiation. (5+5)

**PART-B**

Answer any **four** of the following.                                                                         (4x5=20)

7. How much will a 3 m long copper wire of diameter 0.4 mm elongates if a weight of 10 kg is

suspended from one end and the other end is fixed. Also calculate the elastic potential

energy of the wire in the stretched condition. Young’s modulus of copper Y=10x1010 Nm-2.      g = 9.8m/s2

PH-218-C

8. In a Poiseuille’s experiment the following observations are made. Volume of water

collected in 5 minutes is 60 cc, pressure head of water is 0.4 m, length of capillary tube is

0.7 m and radius of capillary tube is 0.52 mm. Calculate the coefficient of viscosity of water.      g = 9.8m/s2

9. A satellite revolves in a circular orbit at height of 200 km from the surface of the earth. The

period of revolution of satellite is 90 minutes and the mean radius of the earth is 6x106 m.

Calculate the average density of earth.

10. The particle executing S.H.M. has a mass 2 gm and frequency of vibration 12 Hz. It is

oscillating with an amplitude of 4 cm. Calculate the total energy of the particle. At what

displacement is potential energy equal to kinetic energy?

11. The equation Y = 4 sin 2**(- )** represents a wave. Find a) amplitude b) linear velocity

and c) the angular velocity.

12. A black body at 300 K is allowed to cool in an evacuated enclosure maintained at melting

ice at the rate of 0.35 Ks-1. If the mass, specific heat and surface area of the body are

0.032 kg, 420 Jkg-1K-1 and 8x10-4 m2 respectively, calculate the Stefan’s constant.

**PART-C**

13. Answer any **five** of the following.                                                                                [5x2 =10]

a) Torsion of a cylinder is an example of pure shear. Justify.

b) Explain why water on a clean glass surface tends to spread out while mercury on the

same surface tends to form drops.

c) Two artificial satellites one closer to the surface and the other far away are revolving

around the earth. Which has larger speed? Explain.

d) Under what condition the period of oscillation of a compound pendulum is minimum?

e) How does the damping affect the frequency of a mechanical oscillator?

f) Are phase velocity and group velocity the same in a non dispersive medium? Explain