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Date : 15-4-19

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

B.Sc. – II SEMESTER

SEMESTER EXAMINATION – April 2019

**PH: 215 : Properties of Matter, Waves and Radiation**

**Time : 2½ hrs**  **Max. Marks: 70**

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

**Supplementary candidates only.**

**Attach the question paper with the answer booklet**

**PART – A**

Answer any **four** of the following: (4X10=40)

1a) Explain stress-strain curve for a metallic wire.

  b) Show that depression of the free end of a light cantilever, when the end is loaded, is        proportional to the cube of its length. (3+7)

2a) Explain the term surface energy. Derive the relation between surface energy and surface        tension.

b) Define coefficient of viscosity of a liquid. Obtain an expression for terminal velocity when        a small sphere falls through a viscous liquid. (5+5)

3a) State and prove Kepler’s III law of planetary motion for a circular orbit.

b) Obtain an expression for the gravitational potential due to a thin uniform spherical shell        at a point outside the shell. (4+6)

4a) Set up a general differential equation of motion of simple harmonic oscillator and       obtain its solution.

b) Show that for a body executing SHM the acceleration leads the velocity by π/2 and       displacement by π. (7+3)

5a) Find the expression for velocity of a wave on a string.

  b) State and explain Fourier theorem. (6+4)

6a) Draw the black body spectra and write its characteristics.

b) Deduce Planck’s equation for black body radiation. (3+7)

**PART-B**

Answer any **four** of the following: (4X5=20)

7. A bronze bar 1.7 m long and 50 mm in diameter is subjected to a tensile stress of    70 x 106 N/m2. Calculate the extension produced in the bar and the work done during the    process. Young’s modulus bronze is 8.5 x 1010 N/m2.

8. Calculate the mass of water flowing in 10 minutes through a tube of 0.1 cm in diameter,     40 cm long, if there is constant pressure head of 20 cm of water. The coefficient of     viscosity for water is 8.9x10-4 Ns/m2. Density of water 1000 kg/m3.

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9. Find the distance of a point from the earth’s centre where the resultant gravitational field     due to the earth and the moon is zero. The mass of the earth is 6x1024 kg and that of     moon is 7.4 x 1022 kg. The distance between the earth and the moon is 4 x 105 km.         (neglect the rotation)

10. The moment of inertia of the disc used in a torsion pendulum about the suspension wire      is 0.2 kg-m2. It oscillates with a period of 2 s. Another disc is placed over the first one and      the time period of the system becomes 2.5 s. Find the moment of inertia of the second           disc about the wire.

11. The displacement of a particle of a string carrying a travelling wave is given by       y= 3 Sin 6.28(0.5x - 50 t). Find (a) the amplitude (b) the wavelength (c) the frequency       and (d) the speed of the wave.(distance is measured in meter and time in seconds)

12. If the wavelength corresponding to maximum intensity is 5800 A˚ and Wien’s constant is      0.0029 mK, calculate the temperature and the radiant energy emitted by the spherical      black body of radius 5 m. σ = 5.67 x 10-8 Wm-2K-4.

**PART-C**

Answer any **five** of the following: (5X2=10)

a) Two steel wires of the same radius have their lengths in the ratio of 1:2. If they are     stretched by the same force, then will the ratio of strains produced in the two wires is 1:2?     Justify your answer.

b) Two soap bubbles have radii in the ratio 2:1. What is the ratio excess of pressure inside      them?

c) Is it necessary for the plane of the orbit of a satellite to pass through the centre of the    earth? Justify.

d) Can a pendulum clock be used in an earth’s satellite? Give reason.

e) In which of the following case the body reaches equilibrium position faster (i) critical        damping (ii) under damping (iii) over damping? Explain.

f) The phase difference between two points is π/3. If the frequency of wave is 50 Hz. Then     what is the distance between two points? (Given v = 330 m/s)