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Register Number:

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

**B.Sc. PHYSICS – II SEMESTER**

**SEMESTER EXAMINATION: APRIL 2017**

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

**Time-2 ½ hrs Max Marks: 70**

This paper contains two printed pages and three parts

**PART A**

Answer any **four** of the following. Each question carries 10 marks. (4x10 = 40)

1. a) Define three modulii of elasticity.

b) Derive an expression for the depression produced in the case of a cantilever of           rectangular cross section. (3+7)

2. a) State Bernoulli’s theorem.

b) Derive Poiseuille’s formula for steady flow of a liquid through a narrow tube. (2+8)

3. a) State Kepler’s laws of planetary motion.

b) Define orbital velocity and obtain an expression for the same.

c) Derive Kepler’s 3rd law from Newton’s laws of motion. (3+4+3)

4. a) Obtain an expression for the time period of a compound pendulum.

b) Assuming the equation for the superposition of two SHM’s, show that the resultant of           two SHM’s at right angles to each other with a phase difference of zero is a straight           line. (7+3)

5 .a) State Fourier theorem.

b) Determine the fourier co-efficients of a square wave. (2+8)

6. a) Define solar constant.

     b) Deduce Planck’s equation for black body radiation. (2+8)

**PART B**

Solve any **four** of the following. Each problem carries 5 marks. (4x5 = 20)

7. A steel wire of radius 3mm is bent into an arc of a circle of radius 150cm. Calculate the     bending moment and maximum stress. Young’s modulus = 20 x 1010N/m2

8. If radius of the earth is 6400km, find the height of geostationary satellite.

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9. If excess pressure inside a soap bubble is equal to the pressure of 0.2m height of an oil     column of density 800kg/m3, surface tension is 0.075N/m, find the radius of the soap     bubble. Also calculate the surface energy of the bubble.

10. A body executes SHM and has velocities 80cm/s and 60cm/s when the displacements       are 3cm and 4cm respectively. Calculate the amplitude of vibration. Also calculate the       time taken to travel 2.5cm from the mean position.

11. A progressive wave is represented by the equation y = 0.01 sin π (0.4t - 2x). What is the       rate of flow of energy through unit area of air if air density is 1.29kg/m3. All quantities are       in SI units.

12. If the wavelength corresponding to maximum intensity is 5500Ao and Wien’s constant is       0.0029mK, calculate the temperature and the radiant energy emitted by the spherical       black body of radius 5m. σ = 5.67x10-8Wm-2k-4

**PART C**

13. Answer any **five** of the following. Each question carries 2 marks. (5x2 = 10)

a) What happens to the work done during the stretching of a wire?. Explain.

b) If a big soap bubble is connected to a small soap bubble using a drinking straw, the big       bubble becomes still bigger. Why?

c) No work is done in moving an object from one point to another on the surface of a      spherical shell. Explain.

d) A hollow sphere is filled with water and used as a pendulum bob. If water is allowed to          flow slowly through a hole at the bottom, how will the period change? Explain.

e) A small creature moves with constant speed in a vertical circle on a bright day. Does its      shadow formed by the sun on a horizontal plane move in a simple harmonic motion?.      Explain.

f) What is the resultant of two identical waves of equal amplitude and wavelength travelling     in opposite directions along the same straight line?. Write one characteristic of such     wave.