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Register Number:

Date :

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

B.Sc. – II SEMESTER

SEMESTER EXAMINATION – April 2017

**PH: 215 : 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:

1a) Bring out the concept of neutral surface and obtain an expression for bending moment.   b) What are torsional oscillations? Derive an expression for the time period of such       oscillations. (7+3)

2a) Give the theory of drop weight method of finding surface tension. Name the factors       affecting the surface tension.

 b) Arrive at Stoke’s law through dimensional analysis. (6+4)

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

   b) Find the expression for gravitational potential due to spherical shell for a point outside        the shell. (3+7)

4 a) Define simple harmonic motion and show that mechanical energy is conserved during         simple harmonic motion.

b) Treat the simple pendulum as linear harmonic oscillator and find its time period.

(6+4)

5 a) Explain the concept phase velocity and group velocity.

 b) Analyse a square wave using Fourier theorem. (2+8)

6 a) Deduce Wien’s law and Rayleigh-Jean’s law from Planck’s law.

b) Obtain the relation between solar constant and surface temperature of sun.

   c) How can we measure temperature of sun using Wien’s displacement law? (5+3+2)

**PART-B**

Answer any **four** of the following:

7. A metal wire of length 3 m and diameter 1 mm is stretched by a weight of 10 kg. If    Young’s modulus for its material is 12.5 x 1010 N/m2 and Poisson’s ratio for it is 0.26,    calculate the change in diameter produced.

8. Water flows through a horizontal pipe line of varying cross-section. At a point where the     pressure of water is 0.05m of mercury the velocity of flow is 0.25 m/s. Calculate the     pressure at another point where velocity of flow is 0.4 m/s. Density of water 1000 kg/m3and density of mercury 13600 kg/m3.

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9. If the mass of sun is 2 x 10 30 kg, distance of earth from the sun is 1.5 x 10 11 m and     period of revolution of the earth around the sun is 365.3 days, find the value of G.

10. A body oscillates with SHM according to equation, x = 5 Cos (2π t +π/4). Distance is      measured in meter and time in second. At t = 1.5 s, calculate the (a) displacement, (b)      speed and (c) acceleration of the body.

11. A string of mass 2.5 kg is under a tension of 200 N. The length of the stretched string is      20m. If the transverse pulse is produced at one end of the string, how long does the      disturbance take to reach the other end?

12. A filament is radiating maximum energy at a wavelength of 2.16 x 10 -6 cm. Find the net      amount of heat energy lost per second per unit area. The temperature of surrounding air      is 13 ˚C. Stefan’s constant = 5.67x10-8 Jm-2s-1K-4, Wien’s constant = 2.889x10-3 mK.

**PART-C**

13. Answer any **five** of the following:

a) Why do we prefer steel to copper in manufacture of spring?

b) Why water flowing through a narrow tube is more streamlined than that flowing through a      broader one?

c) If the force of gravity acts on all bodies in proportion to their masses, then why doesn’t a     heavy body fall faster than a light body?

d) Find what fraction of the total energy is potential energy when the displacement is one-     half of the amplitude?

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

f) The distance between two consecutive nodes in a stationary wave is 25 cm. What is the      frequency of the wave if the velocity of wave is 300 m/s?