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 Register Number:

 Date :

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

B.Sc. – II SEMESTER

SEMESTER EXAMINATION – April 2019

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

**Time : 2½ 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 Young’s modulus and bulk modulus.

   b) Obtain an expression for the depression at the free end of a thin beam clamped        horizontally at one end and loaded at the other. (2+8)

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

    b) Calculate the gravitational potential due to a spherical shell at a point outside the shell.                                                                                                                       (4+6)

3. a) Derive Stokes formula by the method of dimensions in the case of a small sphere          falling through a viscous liquid. Give the significance of Reynold’s number.

    b) Show that surface energy per unit area of a surface is numerically equal to the surface          tension.                                                                 (6+4)

4. a) Compose the resultant of two simple harmonic motions having same time period and         acting perpendicular to each other.

    b) Find the expression for the time period of a simple pendulum.   (6+4)

5. a) Write any two forms of progressive wave equation.

    b) Obtain the expression for power transmitted by a sine wave.

 c) Give the difference between phase velocity and group velocity    (2+6+2)

6. a) Write the characteristics of black body spectrum.

    b) Arrive at the relation between solar constant and surface temperature of Sun.

    c) State Fourier theorem and write the mathematical expressions for Fourier series.                                                                                                                                      (3+4+3)

**PART-B**

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

7. Calculate the work done in producing an extension of 2 cm in a steel wire of length 2 m     and diameter 1 mm. Young’s modulus of steel is 20x1010 N/m2.

8. Show that the force $\vec{F}=yz\hat{i}+zx\hat{j}+xy\hat{k}$ is a conservative force.

9. Calculate the work done by a boy in making a soap bubble of diameter 1.4 cm by blowing.     The surface tension of the soap solution is 0.03 N/m.

10. A particle executes SHM with amplitude of 10 cm and frequency 2 Hz. At t=0, the       particle is at a point where, potential and kinetic energy are same. Find the equation of       displacement of the particle.

11. A string is stretched by suspending a load of 5 kg. The mass per unit length of the string      is 5 g/m. A wave is set up in the string by oscillating one of the ends with a frequency of      250 Hz and amplitude 5mm. Calculate the velocity, wavelength and propagation constant      of the wave. Given g = 10 m/s2

12. A black sphere of diameter 8 cm is heated to 227oC when the surrounding temperature      is 27oC. What is the rate at which energy is radiated?

 Stefan’s constant 5.67x10-8W/m2-K4

**PART-C**

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

a) Steel girders are made in the form of I-section. Give reason.

b) Why do two ships moving fast and close to each other are likely to collide?

c) If a particle executes SHM with a frequency f, what is the frequency with which its     potential energy oscillates?

d) On which kind of damping does the shock absorber work - under damping, over     damping or critical damping?

e) Does the time period of geostationary satellite depend on its mass? Explain.

f) Why does a blackened platinum wire while heating gradually appears first red, then blue?