STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2019-20)
SUBJECT CODE : 19PH/AC/PM13
B.Sc. DEGREE EXAMINATION NOVEMBER 2019
BRANCH I - MATHEMATICS
FIRST SEMESTER

COURSE	:	ALLIED – CORE
PAPER	:	PHYSICS FOR MATHEMATICS - I
TIME	:	3 HOURS

MAX. MARKS : 100

SECTION – A   (25 MARKS)

ANSWER ALL QUESTIONS:

I   CHOOSE THE CORRECT ANSWER: **(10 x 1=10 marks)**

1.   In a simple pendulum of length l bob is pulled aside from its equilibrium position through an angle θ and released .The bob passes through the equilibrium position with speed
      (a) $\sqrt{2gl(1 + cos\theta)}$ (b) $\sqrt{2gl sin\theta}$

      (c) $\sqrt{2gl}$ (d) $\sqrt{2gl(1 - cos\theta)}$

2.   A ball is thrown vertically downwards from a height of 20m with an initial velocity v_0.It collides with the ground loses 50 percent of its energy in collision and rebounds to the same height. The initial velocity v_0 is:
      (a) $20ms^{-1}$ (b) $28ms^{-1}$ (c) $10ms^{-1}$ (d) $14ms^{-1}$

3.   300 J of work is done in sliding a 2 Kg block up an inclined plane of height 10 m. Taking g = 10 $m/_{s^2}$,work done against friction is
      (a) 100 J   (b) Zero   (c) 1000 J   (d) 200 J

4.   A mass m is suspended from a two coupled springs, connected in series. The force constant for springs are k_1 and k_2. The time period of the suspended mass will be
      (a) $T = 2\pi\sqrt{\frac{m}{k_1-k_2}}$ (b) $T = 2\pi\sqrt{\frac{mk_1k_2}{k_1+k_2}}$

      (c) $T = 2\pi\sqrt{\frac{m}{k_1+k_2}}$ (d) $T = 2\pi\sqrt{\frac{m(k_1+k_2)}{k_1k_2}}$

5.   A bar of length 1 m, breadth 0.02 m and thickness 0.005 m is supported at its ends and loaded in the middle. The depression observed in the middle is 1.96 x 10^{-3} m when a load of 0.1 kg is placed. Calculate the young's modulus of the material
      (a) 1.96 x 10^{-11}Nm^{-2} (b) 1.6 x 10^{-11}Nm^{-2}
      (c) 4 x 10^{-11}Nm^{-2} (d) 1.023 x 10^{-11}Nm^{-2}

6.   The Rain Drop falling through air, if the terminal velocity of the drop is 1.2 x $10^{-2}ms^{-1}$.Find the radius of the drop of water.
      (a) 6.223 x 10^{-6}m   (b) 0.086 x 10^{-2}m
      (c) 9.968 x 10^{-6}m   (d) 3.3 x 10^{-6}m

7.   A particle moving on the circumference of a circle. The Number of degrees of freedom is
      (a) 2   (b) 3   (c) 1   (d) 4

8. The four wires are made up of same material. Which of these will have the largest extension when the same tension is applied
    - (a) Length =100cm,Diameter =1mm
    - (c) Length =200cm,Diameter =2mm
    - (b) Length =300cm,Diameter =3mm
    - (d) Length =50cm,Diameter =0.5mm

9. A moving clock appears to be slow down to a stationary observer this effect is called
    - (a) Length contraction
    - (b) Lorentz Transformation
    - (c) Twin paradox
    - (d) Time Dilation

10. The concept of length contraction means the original length
    - (a) Increase
    - (b)decrease
    - (c) remains same
    - (d) neither increase nor decrease

II. Fill in the blanks :   (5 x 1 = 5 marks)

11. Change of momentum is equal to _____
12. The maximum displacement of a vibrating particle is called its_____
13. The dimensional formula for surface tension_____
14. The flow is steady as long as the velocity of liquid does not exceeds the limiting value called the _____
15. The Generalized coordinate for a system of N particles Constrained by m equation is

    _____

III. Answer Briefly :   (5 x 2 =10 marks)

16. Distinguish Impulse and impact.
17. What are constraints?
18. Define Poisson's ratio.
19. Explain critical velocity.
20. What is Meson Paradox?

SECTION – B
ANSWER ANY FIVE QUESTIONS: (5 x 6 = 30)

21. A ball moving with velocity 2m/s collides head on with another stationary ball of double the mass. If the coefficient of restitution is 0.5 then find their velocities after collision.

22. If two springs are connected in series and parallel, what is its equivalent spring constant?

23. The velocities of a particle executing SHM are 4 cm s^{-1} and 3 cm s^{-1}, when its distance from the mean position is 2 cm and 3 cm respectively. Calculate its amplitude and time period.

24. How fast would a rocket have to go relative to an observer for its length to be contracted to 99 percent of its original length.

25. The material has Poisson's ratio 0.5. If the uniform rod of it suffers a longitudinal strain of 2×10^{-3} , What is the percentage increase in volume?

26. A liquid drop of diameter D breaks up into 27 tiny drops. Find the resulting change in energy. Take surface tension of the liquid as σ.

27. Explain the principle of virtual work and D' Alembert's principle.

SECTION – C
ANSWER ANY THREE QUESTIONS: **(3 X 15 = 45)**

28. Explain the elastic collision of two different masses and discuss their velocities after collision with the special cases.

29. Explain the lagrangian equation and the applications of Lagrangian equation in Atwood's machine and simple pendulum.

30. Derive an expression for the torsional couple per unit twist and the period of oscillation of torsional pendulum.

31. Explain the molecular theory of surface tension and how to determine the surface tension and interfacial surface tension by drop weight method.

32. State and explain the basic postulates of Einstein's special theory of relativity. Derive the Lorentz space –time transformation formulae. Discuss length contraction and time dilation.

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