

**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.**  
**(For candidates admitted during the academic year 2023-2024)**

**B.Sc. DEGREE EXAMINATION NOVEMBER 2023**  
**BRANCH III - PHYSICS**  
**FIRST SEMESTER**

**COURSE : MAJOR – CORE**  
**PAPER : PROPERTIES OF MATTER AND SOUND**  
**SUBJECT CODE :23PH/MC/PS14**  
**TIME :3 HOURS**

**MAX. MARKS : 100**

Q. No.	SECTION A 20 x 1 = 20 marks	CO	KL
	<b>Answer ALL the questions</b>		
1	The Young's modulus of a perfect rigid body is a) infinity      b) zero      c) unity      d) constant	<b>1</b>	<b>1</b>
2	According to Hooke's law of elasticity, if stress is increased, then the ratio of stress to strain a) remains constant      b) increases c) decreases      d) becomes zero	<b>1</b>	<b>1</b>
3	The SI unit of torsion is a) N m      b) N/m c) Nsm <sup>-2</sup> d) Nm <sup>2</sup>	<b>1</b>	<b>1</b>
4	Modulus of rigidity is the ratio of a) Stress to strain b) tensile stress to tensile strain c) compressive stress to compressive strain d) shear stress to shear strain	<b>1</b>	<b>1</b>
5.	The work done in blowing a soap bubble of radius R is W <sub>1</sub> and that to a radius 3R is W <sub>2</sub> . The ratio of work done is a) 1:3      b) 3:1      c) 1:9      d) 9:1	<b>1</b>	<b>1</b>
6	A water drop is divided into 27 equal droplets. The pressure difference between the inner and outer side of the big drop will be a) Same as that for smaller droplet b) 1/3 of that for smaller droplet c) 1/6 of that for smaller droplet d) Twice of that for smaller droplets	<b>1</b>	<b>1</b>
7	Dimension of surface tension a) M <sup>1</sup> T <sup>2</sup> b) M <sup>1</sup> T <sup>-2</sup> c) M <sup>-1</sup> T <sup>2</sup> d) M <sup>0</sup> T <sup>-2</sup>	<b>1</b>	<b>1</b>
8	Expression for excess pressure 'P' inside a liquid drop a) P = 2T/R b) P = T/R c) P = 4T/R d) P = 2T/3R	<b>1</b>	<b>1</b>
9	What happens to the viscosity of liquid with the increase in temperature a) It increases b) It decreases c) It may increase or decrease d) No change	<b>1</b>	<b>1</b>

10	The unit of coefficient of viscosity is a) $\text{Ns/m}^2$ b) $\text{Nm/s}$ c) $\text{Ns/m}$ d) $\text{Nm/s}^2$	1	1
11	A ball is falling freely in a viscous liquid. If the radius of the ball is doubled, its terminal velocity will become a) Doubled    b) Half    c) One fourth    d) Four times	1	1
12	Critical velocity of the liquid a) Decreases when radius decreases b) Increases when radius decreases c) Decreases when density increases d) Increases when density increases	1	1
13	The particle of the medium vibrates in the transverse wave a) At a right angle to the direction of wave motion b) Along the direction of the wave motion c) Opposite to the direction of the wave motion d) Do not vibrate	1	1
14	Lissajous figures are used for measuring a) Current    b) Frequency    c) Resistance    d) Voltage	1	1
15	The gap between a consecutive node and anti-node in a stationary wave is? a) $\lambda/2$ b) $\lambda$ c) 2    d) $\lambda/4$	1	1
16	Wave has simple harmonic motion whose period is 4 second while another wave which also possesses simple harmonic motion has its period 3 second. If both are combined, then the resultant wave will have the period equal to a) 4 second    b) 7 second    c) 12 second    d) 3 second	1	1
17	The time gap between the initial direct sound and the reflected sound up to a minimum audibility level is called a) Reverberation time    b) Absorption time c) Sabine    d) Reflection time	1	1
18	Which of the following types of absorbents can absorb the sound of any frequency? a) Resonant panels    b) Cavity resonators c) Porous materials    d) Composite types	1	1
19	Staircase in a hall is covered with carpets to reduce a) Reverberation    b) Echelon effect c) Resonance    d) Focusing	1	1
20	Ultrasonic waves produce a) Heating effect in the medium    b) Cavitation c) Stationary waves    d) All the above	1	1
<b>Q. No.</b>	<b>SECTION B</b> <b>10 x 2 = 20 marks</b>	<b>CO</b>	<b>KL</b>
	<b>Answer ALL the questions</b>		
21	Define Poisson's ratio.	2	2
22	Distinguish uniform and non uniform bending.	2	2
23	Mention any two applications of surface tension.	2	2
24	Why do small bubbles have excess pressure?	2	2
25	Define coefficient of viscosity.	2	2
26	Write the formula for Bernoulli's principle.	2	2
27	What is Lissajous figure?	2	2
28	How do you find the velocity of a transverse wave?	2	2
29	Define reverberation time.	2	2
30	What are ultrasonic waves?	2	2

Q. No.	SECTION C Answer any TWO questions	2 × 20 = 40 marks	CO	KL
31	A) Determine the young's modulus of the material of the beam subject to uniform bending using the pin and microscope arrangement. (10 Mark)		3	3
	B) Elucidate the theory and experimental method for determining the rigidity modulus of a wire using torsion pendulum. (10 Mark)		4	4
32	A) Obtain an expression for the excess pressure inside the spherical soap bubble and a spherical liquid drop. (10 Mark)		3	3
	B) Describe Jaegar's method of studying the variation of surface tension of water with temperature. (10 Mark)		4	4
33	A) Derive Poiseuille's formula for the rate of flow of liquid through a capillary tube. (10 Mark)		3	3
	B) Elucidate the characteristics of a simple harmonic motion and obtain its equation. (10 Mark)		4	4
34	A) Explain the production of ultrasonic waves by piezoelectric method. (10 Mark)		3	3
	B) Derive Sabine's formula for reverberation time and explain its significance. (10 Mark)		4	4
Q. No.	SECTION D Answer any FOUR questions	4 x 5 = 20 marks	CO	KL
35	A steel wire with a diameter of 2 mm and a length of 5 meters is suspended vertically from a fixed point. A weight of 500N is hung from the lower end of the wire, causing it to stretch by 5 mm. Calculate the Young's modulus of the steel.		5	5
36	The pressure of air in a soap bubble of $7 \times 10^{-3}$ m diameter is $8 \times 10^{-3}$ m of water above the atmospheric pressure. Calculate the surface tension of the soap solution.		5	5
37	In an experiment with Ostwald viscometer, the time of flow of water and ethanol are 80 second and 175 second at $20^{\circ}\text{C}$ . The density of water = $0.998 \text{ g cm}^{-3}$ and that of ethanol = $0.790 \text{ g cm}^{-3}$ . The viscosity of water at $20^{\circ}\text{C}$ is 0.01008 poise. Calculate the viscosity of ethanol.		5	5
38	An observer observes two moving trains, one reaching the station and other leaving the station with equal speed of $8 \text{ ms}^{-1}$ . If each train sounds its whistles with frequency 240 Hz, then calculate the number of beats heard by the observer. Assume the speed of sound in air is $330 \text{ ms}^{-1}$ .		5	5
39	A hall of volume $5500 \text{ m}^3$ is found to have a reverberation time of 2.3 second. The sound absorbing surface of the hall has an area of $750 \text{ m}^2$ . Calculate the average absorption coefficient		5	5
40	Calculate Reynolds number, if a fluid having viscosity of $0.4 \text{ Ns/m}^2$ and relative density of $900 \text{ Kg/m}^3$ through a pipe of 20 mm with a velocity of 2.5 m.		5	5

\*\*\*\*\*