

B.Sc. DEGREE EXAMINATION NOVEMBER 2019  
BRANCH III - PHYSICS  
FIRST SEMESTER

COURSE : MAJOR – CORE

PAPER : PROPERTIES OF MATTER AND SOUND

TIME : 3 HOURS

MAX. MARKS : 100

SECTION – A

ANSWER ALL QUESTIONS:

(25 MARKS)

I.CHOOSE THE CORRECT ANSWERS:

(10 x 1 = 10 marks)

- In an experiment to determine the Young's modulus of a wire, the length of the wire and the suspended mass are doubled. Then the Young's modulus of the wire
  - Becomes four times
  - becomes double
  - becomes half
  - remains unchanged
- Shearing strain and stress for a cylinder
  - increases from the axis of the cylinder to its surface
  - decreases from the axis of the cylinder to its surface
  - remains constant
  - none of the above
- The height of water in a capillary tube of radius 2 cm is 4 cm. What should be the radius of the capillary tube, if water should rise 8 cm in the tube?
  - 1 cm
  - 0.1 cm
  - 2 cm
  - 4 cm
- When two capillary tubes of different diameters are dipped vertically the rise of the liquid is
  - same in both tubes
  - more in the tube of larger diameter
  - less in the tube of smaller diameter
  - more in the tube of smaller diameter
- The operation of McLeod gauge is based on the principle of
  - Boyle's law
  - Charles law
  - Pascal's law
  - McLeod's law
- The viscosity of oil decreases when temperature
  - decreases
  - increases
  - is constant
  - 373 K
- A sound source sends waves of 400 Hz. It produces waves of wavelength 2.5 m. The velocity of sound waves is
  - 100 m/s
  - 1000 m/s
  - 160 m/s
  - 625m/s
- The distance between a compression and the next rarefaction of a longitudinal wave is
  - $\frac{\lambda}{4}$
  - $\lambda$
  - $\frac{\lambda}{2}$
  - $\frac{\lambda}{8}$

9. An ultrasonic wave is sent from a ship towards the bottom of the sea. The time interval between sending and receiving the wave is 1.6s. What is the depth of the sea, if the velocity of the wave in seawater is 1400m/s?  
 a) 1120 m                      b) 560 m                      c) 1400 m                      d) 112 m
10. Sound produced from equally spaced steps in a staircase at regular intervals is due to \_\_\_\_\_  
 a) reverberation effect                      b) noise effect  
 b) absorption effect                      d) Echelon effect

**II. FILL IN THE BLANKS :****(5 x 1 = 5 marks)**

11. If by applying a force, the shape of a body is changed, then the corresponding stress is \_\_\_\_\_
12. For water and glass, the angle of contact is \_\_\_\_\_
13. The property of fluid that describes its internal resistance is known as \_\_\_\_\_
14. Waves that travel in a direction perpendicular to the direction of vibration are known as \_\_\_\_\_
15. \_\_\_\_\_ are produced if the reverberation time is too large.

**III. ANSWER BRIEFLY:****(5 X 2 = 10 marks)**

16. Show that the theoretical limiting values of Poisson's ratio are -1 and 0.5.
17. What is angle of contact?
18. Define terminal velocity.
19. What are beats?
20. Give any two applications of ultrasonics in industries.

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

21. A uniform steel wire of length 2.5 m and density 8 gm/cm<sup>3</sup> weighs 50 g. When the wire is stretched by a force of 10kgwt, the length increases by 2 mm. Calculate the Young's modulus of steel.
22. Calculate the work expended in spraying a drop of water 1 mm radius into a million droplets all of same size. Surface tension of water is  $7.2 \times 10^{-2} \text{ Nm}^{-1}$ .
23. A capillary tube of  $10^{-3}$ m diameter and length 0.25 m is connected horizontally to a vessel kept full of alcohol of density 0.8 g/cc. The depth to the centre of the tube is 0.25 m. If the viscosity of alcohol is 0.012 C.G.S units, find the mass of the liquid that will flow in 5 minutes.

24. A body of mass 1 kg is executing simple harmonic motion given by  $y = 6.0 \cos(100t + \frac{\pi}{4})$  cm. What is the (i) amplitude of displacement (ii) frequency (iii) initial phase (iv) velocity and (v) acceleration?
25. A lecture hall 15 m x 8 m x 3 m is heavily damped with absorption coefficient 0.3. Calculate its reverberation time.
26. Show that the excess of pressure across a curved liquid surface is  $\sigma \left\{ \frac{1}{R_1} + \frac{1}{R_2} \right\}$
27. Obtain an expression for depression produced at the free end of the cantilever, when the weight of the beam is negligible.

### SECTION – C

ANSWER ANY THREE QUESTIONS:

( 3 x 15 = 45 )

28. a) Obtain an expression for the twisting couple of a cylinder.  
b) Describe the experimental procedure to determine the rigidity modulus of a wire using torsion pendulum.
29. Describe the Quincke's method of determining the surface tension of mercury.
30. a) Derive Poiseuille's formula for the rate of flow of a liquid in a capillary tube.  
b) Water flows through a horizontal capillary tube of 1 mm internal diameter and length 70 cm under a pressure of a column of water 30 cm in height. Find the rate of flow of water through the capillary tube.  $\eta = 10^{-3} \text{ Nsm}^{-2}$ .
31. Explain Doppler's effect. Derive an expression for the change in frequency of a note when  
a) observer is at rest and source is in motion  
b) observer is in motion and source at rest  
c) observer and source in motion.
32. What is meant by reverberation? Derive Sabine's formula for reverberation time and hence determine the absorption coefficient.

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