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**PHYSICS PAPER - I : PHY - 111**  
**Mechanics and Properties of Matter**  
**(112101)**

P. Pages : 4

Time : Two Hours

Max. Marks : 60

**Instructions to Candidates :**

1. Do not write anything on question paper except Seat No.
2. Graph or diagram should be drawn with the black ink pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and carry equal marks.
5. Figures to the right indicating full marks.
6. Draw neat and labelled diagram wherever necessary.
7. Use logarithmic table or standard electronic calculator is allowed.

1. a) Attempt **any six** of the following. Select the correct option and rewrite the following. 6

- i) The time period of compound pendulum is given by .....

a)  $T = 2\pi\sqrt{\frac{k^2}{l}}$

b)  $T = 2\pi\sqrt{\frac{k^2 + l^2}{lg}}$

c)  $T = 8\pi\sqrt{\frac{k^2 + l^2}{g}}$

d)  $T = 4\pi\sqrt{\frac{k^2 + l^2}{lg}}$

- ii) The bending of beam determines .....

- a) Acceleration due to gravity
- b) Modulus of rigidity
- c) Youngs modulus
- d) None of these

- iii) Centre of suspension and centre of oscillation for katers pendulum are .....

- a) Same
- b) Different
- c) Interchangeable
- d) Not interchangeable

- iv) S.I. unit of Young's modulus is .....
- a)  $\text{N}^2/\text{cm}$                       b)  $\text{N}/\text{cm}^2$
- c)  $\text{N}^2/\text{m}$                         d)  $\text{N}/\text{m}^2$
- v) The angle of contact for mercury with glass is
- a) obtuse                          b)  $90^\circ$
- c) Acute                            d)  $0^\circ$
- vi) Surface tension of most of liquids decrease with
- a) Decrease of Pressure      b) Rise of temperature
- c) Rise of pressure             d) Decrease of temperature
- vii) According to Bernoulli's theorem the sum of the energies possessed by a flowing liquid at any point is .....
- a) Predictable                    b) Constant
- c) Unpredictable                d) Not constant
- viii) The coefficient of viscosity of liquid can be experimentally determined by .....
- a)  $\eta = \frac{\pi^2 P r^2}{8 l v}$                       b)  $\eta = \frac{\pi P r^4}{2 l v}$
- c)  $\eta = \frac{\pi P r^4}{8 l v}$                       d)  $\eta = \frac{\pi P^2 r^2}{8 l v}$

b) Attempt any six of the following answer in one sentence.

- i) What is meant by point or centre of oscillation.
- ii) Write the expression for centre of gravity of Bifilar pendulum with parallel threads.
- iii) What is neutral axis ?
- iv) Write any two examples of plastic body.
- v) Write unit of surface tension in CGS system.
- vi) What is cohesion ?
- vii) Write the dimension of coefficient of viscosity.
- viii) Write poiseuille's formulae for the flow of liquid through a capillary tube.

2. Attempt **any six** of the following. 12

- i) What is bifilar pendulum.
- ii) Draw the neat labelled diagram of katers pendulum.
- iii) What is meant by beam ?
- iv) Define elasticity. Give it's examples.
- v) State unit and dimensions of surface tension.
- vi) Define angle of contact.
- vii) The layer of castor oil 6 mm thick moves with the speed of 3 cm/sec. What is velocity gradient ?
- viii) Explain streamline flow.
- ix) Define axis of bending and neutral axis.

3. Attempt **any four** of the following. 12

- i) Show that the time period of compound pendulum.
- ii) An air bubble of radius 0.1 mm is situated just below the surface of water, calculate the gauge pressure (excess of pressure) inside the air bubble. Surface tension of water =  $7.2 \times 10^{-2}$  N/m
- iii) State the basic assumptions for theory of bending.
- iv) Define coefficient of viscosity and write it's S.I. unit.
- v) Discuss factors affecting surface tension.
- vi) Explain experimental determination of coefficient of viscosity of liquid by Poiseuilles method.

4. Attempt **any three** of the following. 12

- i) A heavy uniform rod of length 90 cm swings in a vertical plane about a horizontal axis passing through it's one end. Calculate the position at which a concentrated mass may be placed so that of swing remains unaltered.

- ii) Describe Katers pendulum.
- iii) Derive an expression for depression of beam supported at the ends and loaded at the middle.
- iv) Show that the bending moment of beam is  $\frac{Ylg}{R}$
- v) Discuss an equation of continuity.

5. Attempt any two of the following.

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- i) Define S.T. show that the excess pressure acting on the curved surface of curved membrane is given by,  $P = 2T \left( \frac{1}{r_1} + \frac{1}{r_2} \right)$ , where  $r_1$  and  $r_2$  are radii of curvature and T is S.T. of membrane.
- ii) What is torsional pendulum ? Derive an expression for rigidity modulus by torsional oscillation.
- iii) What is cantilever ? Derive an expression for the depression of free end of cantilever fixed at one end and loaded at the other end.

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