UG — Phy (C – 102)

2019

Time : 3 hours

Full Marks : 60

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer five questions in which

Q. No. 1 is compulsory.

1. Choose the correct answer from the given alternatives : 1×12 = 12

(a) The relation between Y, η and σ is :

(i) $\dfrac{Y}{\eta} = 2(1+\sigma)$

(ii) $Y = 2\eta (1 + \sigma)$

(iii) $\eta = 2Y (1 + \sigma)$

(iv) $\sigma = 2Y (1 + \sigma)$

(b) With the rise in temperature the value of elastic modulli :

(i) Increase

(ii) Decrease

(iii) Remain constant

(iv) No change

(c) If r is the radius of the capillary tube, then the volume of liquid flowing out of it per second is proportional to :

(i) r

(ii) r^2

(iii) r^4

(iv) $\dfrac{1}{r^4}$

(d) Surface tension arises due to :

(i) Cohesive molecular forces

(ii) Adhesive molecular froces

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(iii) Frictional forces

(iv) Tension in the liquid

(e) A liquid will not wet a solid surface if the angle of contact is

(i) $0°$

(ii) $45°$

(iii) $60°$

(iv) Obtuse

(f) The flattening of the Earth is due to

(i) Coriolis force

(ii) Centrifugal force

(iii) Magnetic force

(iv) None of these

(g) The rest mass of photon is

(i) $+1$

(ii) -1

(iii) 0

(iv) None of these

(h) The reduced mass of a two particle system is given by :

(i) $\mu = m_1 + m_2$

(ii) $\mu = \sqrt{m_1 m_2}$

(iii) $\dfrac{1}{\mu} = \dfrac{1}{m_1} + \dfrac{1}{m_2}$

(iv) $\mu = \sqrt{\dfrac{m_1 m_2}{m_1 + m_2}}$

(i) Lorentz transformations reduce to Galilean transformation if :

(i) $v = c$

(ii) $v \gg c$

(iii) $v \ll c$

(iv) None of these

(j) The bending moment depends on :

(i) Young's modulus

(ii) Bulk modulus

(iii) Modulus of rigidity

(iv) Poisson's ratio

(k) Mayer's equation determines :

  (i) Viscosity of water

  (ii) Viscosity of gas

  (iii) Both (i) and (ii)

  (iv) None of these

(l) Length construction happens only :

  (i) Perpendicular to direction of motion

  (ii) Along the direction of motion

  (iii) Parallel to direction of motion

  (iv) All of the above

2. (a) Deduce Euler's equation of motion of fluid using equation of continuity.   6

    (b) State and prove Kepler's third law of planetary motion.   6

3. Define a cantilever. Obtain an expression for Young's modulus of the material of a beam supported at its ends and loaded at the centre.

$$2+10 = 12$$

4. Describe, in detail, Rankine's method of determining viscosity of gas.   12

5. State and explain the principle of virtual work and apply it to obtain the excess pressure over a curved membrane. $2+4+6 = 12$

6. Describe, with theory, Quincke's method of measuring surface tension of a liquid.   12

7. Define centrifugal and coriolis forces. Derive an expression for the forces activng on a particle moving in a uniformly rotating frame of reference. $4+8 = 12$

8. Describe Michelson-Morley experiment and show how the negative result of this

experiment related to the special theory of relativity. $\qquad$ 10+2 = 12

9. Derive an expression for relativistic Doppler Effect of light. What are red and blue shifts ? $\qquad$ 9+3 = 12

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