Multiple choice questions (only one answer correct).   **1X4 = 4**

1.When area of cross-section of a pipe increases the velocity of flow of the liquid:
    a. increases   b. decreases
    c. becomes zero   d. remains same

2. Dimensional formula of stress is same as that of:
    a. Force   b. Impulse
    c. Pressure   d. Strain

3. The formula for escape velocity at distance r from center of mass of a planet of mass M:
    a. $\sqrt{\dfrac{GM}{r}}$ b. $\sqrt{\dfrac{2GM}{r}}$
    c. $\sqrt{\dfrac{GM}{2r}}$ d. $\sqrt{\dfrac{4GM}{r}}$

4.The efflux velocity of liquid from a tank filled with liquid of density ρ upto height H:
    a. $\sqrt{2\rho H}$ b. $\sqrt{2gH}$
    c. $\sqrt{\dfrac{2gH}{\rho}}$ d. $\sqrt{2\rho g}$

Fill in the blanks   **1 X 2 = 2**

5. The Bernoulli's theorem does not hold for …………… flow.
6. The force applied by earth on a body of mass 'm' on its surface …………. (G- universal gravitational constant, M – mass of earth, R- radius of earth)

Answer in one-line   **1 X 2 = 2**

7. What is modulus of elasticity?
8. What is pascal law?

Assertion and Reasoning (Tick the correct option)   **1 X 1 = 1**

9. Assertion: It is easier to cut the bread with sharp knife than with a blunt knife
   Reason: Pressure. Pressure = Force/Area

    1. Both assertion and reason are true and the reason is the correct explanation of assertion
    2. Both assertion and reason are true but the reason is not the correct explanation of assertion
    3. Assertion is true and the reason is false
    4. Assertion is false and the reason is true

Short Answer question   **2X3 =6**

10. Define surface tension. Write its SI units.
11. Define Young's modulus, Bulk modulus and shear modulus with dimensions.
12. Define equation of continuity. Prove that AV = constant (where symbols have standard meanings).

    3 X 2 = 6

13. Explain Kepler laws of planetary motion.
14. What is excess pressure in drop. Derive expression for it.

15 Case study question   **1X4 = 4**

Earth's Satellite
Earth satellites are objects which revolve around the earth. Their motion is very similar to the motion of planets around the Sun. In particular, their orbits around the earth are circular or elliptic. Moon is the only natural satellite of the earth with a near circular orbit with a time period of approximately 27.3 days which is also roughly equal to the rotational period of the moon about its own axis. Also, the speed that a satellite needs to be travelling to break free of a planet or moon's gravity well and leave it without further propulsion is known as escape velocity. For example, a spacecraft leaving the surface of earth needs to be going 7 miles per second or nearly
25000 miles per hour to leave without falling back to the surface or falling into orbit.
Answer the questions:

(i) The ratio of escape velocity at earth (v_e) to the escape velocity at a planet (v_p), whose radius and mean density are twice as that of earth is
(a) $1:2\sqrt{2}$
(b) 1: 4
(c) 1: $\sqrt{2}$
(d) 1: 2

(ii) Gas escapes from the surface of a planet because it acquires an escape velocity. The escape velocity will depend on which of the following factors?
(a) Mass of the planet
(b) Mass of the particle escaping
(c) Temperature of the planet
(d) None of the above

(iii) The escape velocity of a satellite from the earth is v_e. If the radius of earth contracts to $(1/4)^{th}$ of its value, keeping the mass of the earth constant, escape velocity will be
(a) doubled
(b) halved
(c) tripled
(d) unaltered

(iv) A satellite S is moving in an elliptical orbit around the earth. The mass of the satellite is very small as compared to the mass of the earth, then
(a) the angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant
(b) the total mechanical energy of S varies periodically with time
(c) the linear momentum of S remains constant in magnitude
(d) the acceleration of S is always directed towards the centre of the earth

Long answer questions   **2X5 = 10**
16.State and prove Bernoulli's theorem for fluid. Give the assumptions used in deriving it.
<div align="center">Or</div>
   Derive an ascent formula for the rise of liquid in capillary tube and discuss the result obtained.

17. What is escape speed. Prove that $V_e = \sqrt{2}V_o$.
<div align="center">Or</div>
   How acceleration due to gravity varies with height and depth. Derive expression for variation of acceleration due to gravity with rotation of earth.