B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2013)

Fourth Semester

MECHANICAL ENGINEERING

U13MET401: Fluid Mechanics and Machinery

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. A streamline is a line
    a) which is along the path of a particle
    b) which is always parallel to the main direction of flow
    c) across which there is no flow
    d) on which tangent drawn at any point gives the direction of velocity

2. The falling drops of water become sphere due to ---------.

3. The buoyant force on an object is dependent on
    a) Object's density
    b) Ssubmerged volume of the object
    c) Mass of the object
    d) Shape of the object

4. Continuity equation deals with the law of conservation of ----------.

5. In laminar flow
    a) Re>2000
    b) 2000<Re>4000
    c) Re>4000
    d) Re<2000

6. When the fluid is rest, the shear stress is ---------.

7. Jet Ratio of pelton wheel turbine is equal to
    a) $\dfrac{\text{Velocity of the Pelton wheel}}{\text{Velocity of jet}}$
    b) $\dfrac{\text{Pitch Diameter of the Pelton wheel}}{\text{Diameter of jet}}$
    c) $\dfrac{\text{Pressure Head of pelton wheel}}{\text{Kinetic Head of jet}}$
    d) $\dfrac{\text{Velocity of the Jet}}{\text{Velocity of Pelton wheel}}$

8. ---------------------- is the inward flow Reaction Turbine.

9. Which of the following pump is suitable for small discharge and high heads
    a) Centrifugal pump
    b) Axial flow pump
    c) Mixed flow pump
    d) Reciprocating pump

10. Main characteristics curve of a centrifugal pump means ------------------.

PART B (10 x 2 = 20 Marks)
(Not more than 40 words)

11. State and explain hydrostatic law?

12. Define flow net.

13. State the equation of continuity in three dimensional unsteady and in compressible flow.

14. Write Euler's equation of motion and explain the terms involved.

15. Explain the term dimensionally homogeneous equation.

16. Write the applications of venture meter, orifice meter and pitot tube.

17. List out the various classification of water turbines.

18. A pelton wheel turbine is having a net head of 700 m. If the discharge through nozzle is 0.1 m^3/sec. Determine the power available at the Nozzle.

19. Draw the inlet and outlet velocity triangle of the centrifugal pump and indicate all notations.

20. Define "slip" of reciprocating pump. When does the negative slip occur?

PART C (5 x 14 = 70 Marks)
(Not more than 400 words)

Q.No. 21 is Compulsory

21. A Kaplan turbine runner is to be designed to develop 9000 kW. The net available head is 10 m. If the speed ratio = 2.1, flow ratio = 0.70, overall efficiency 90 % and the diameter of the boss is 1/3 of the diameter of the runner. Estimate the diameter of the runner, its speed and the specific speed of the turbine.

22. a) A U- tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line,
    (i) If the difference in level of mercury in the limbs of U- tube is 10cm and the free surface of mercury is in level with the centre of the pipe.
    (ii) If the pressure of water in the pipe line is reduced to 9810 N/m^2, calculate the new difference in the level of mercury. Sketch the arrangements in both cases.

(OR)

   b) (i) Derive an expression for the depth of centre of pressure from free surface of (7) liquid of an inclined plane surface submerged in the liquid.

(ii) A circular plate of diameter 3 m is immersed in water in such a way that its greatest and least depth below free surface are 4 m and 1.5 m respectively. Evaluate the total pressure on one face of the plate and position of the centre of pressure. (7)

23. a) State the Bernoulli's theorem for steady flow of an incompressible fluid. And derive Bernoulli's equation from Euler's equation along a stream line.

(OR)

b) Water is flowing through a pipe having diameters 40 cm and 20 cm at section 1 and 2 respectively. The rate of flow through the pipe is 50 l/s. Section 1 is 9 m above the datum and 2 is 6 m above datum. If the pressure at section 1 is 39.24 N/cm^2. Find the intensity of pressure at section 2.

24. a) Three pipes of 500mm, 350mm, and 250mm diameters have lengths of 400m, 200m and 300m respectively. They are connected in series to make a compound pipe. The ends of this compound pipes are connected in two tanks whose difference of water level is 25m. If the co-efficient of friction for this pipe is same and equal to 0.005, determine the discharge through the compound pipe (i) neglecting the minor losses and (ii) including the minor losses.

(OR)

b) The pressure difference Δp in a pipe of diameter D and length L due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's π – theorem, obtain an expression for Δp.

25. a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 50 m.The velocity of flow through the impeller is constant and equal to 2.5 m / sec. The vanes are set back at an angle of 45° at outlet. If the outer diameter of the impeller is 600 mm and width at outlet is 60 mm. Evaluate (i).Vane angle at inlet (ii). Work done by impeller on water per second and (iii) Manometric efficiency.

(OR)

b) (i) Explain the working principle of Double Acting Reciprocating Pump with neat Sketch. (9)

(ii) Explain Cavitations in Centrifugal Pump. (5)

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