

Total No. of Questions : 12]

SEAT No. :

P1688

[Total No. of Pages : 4

[5460]-505

T.E. (Civil)

**FLUID MECHANICS - II**  
**(2015 Pattern) (Semester - I)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Figures to the right, indicate full marks.
- 3) Use of non programmable electronic pocket calculator is allowed.
- 4) Assume suitable data if necessary.
- 5) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.

**Q1)** a) Distinguish between Bluff body and Streamlined body. [2]

- b) A standard cricket ball of diameter 7.13 cm is bowled at speed of 101 km/hr by fast bowler. Determine the drag force on the ball by taking the following values for  $C_D$  and fluid properties.

For a sphere:  $C_D = 0.5$  for  $10^4 < Re \leq 3 \times 10^5$  and  $C_D = 0.2$   $Re > 3 \times 10^5$

Density of air =  $1.21 \text{ Kg/m}^3$  and Dynamic viscosity of air =  $1.81 \times 10^{-5} \text{ N.s/m}^2$ . [6]

OR

**Q2)** a) Explain in brief unsteady flow with suitable practical examples of it. [2]

- b) In a pipe of 600 mm diameter and 3000 m length, provided with a valve at its end, water is flowing with a velocity of 2.1 m/s. Assuming velocity of pressure wave  $C = 1500 \text{ m/s}$ . Find:

- i) The rise in pressure if the valve is closed in 20 seconds, and
- ii) The rise in pressure if the valve is closed in 2.5 seconds.

Assume the pipe to be rigid one and take bulk modulus of water  $K = 2 \text{ GN/m}^2$ . [6]

**Q3)** Explain in brief the various types of flow in channels. [6]

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OR

**Q4)** Explain in brief with neat sketches the following terms: [6]

- a) Depth Discharge Diagram.
- b) Specific Energy Curve.

**Q5)** Derive the conditions for the most economical trapezoidal channel section. [6]

OR

**Q6)** A horizontal rectangular channel 4 wide carries a discharge of  $15.50 \text{ m}^3/\text{s}$ . [6]

- a) Determine whether a jump may occur at an initial depth of 0.5m or not.
- b) If a jump occurs, determine the sequent depth to this initial depth.
- c) Also determine the energy loss in the jump.

**Q7)** a) A jet of water having velocity of 45 m/s impinges without shock on series of vanes moving at 15 m/s, the direction of motion of vanes being inclined at  $20^\circ$  to that of jet. The relative velocity at outlet is 0.9 of that at inlet and absolute velocity of the water at exit is to be normal to the motion of the vanes.

Find :

[9]

- i) Vane angles at entrance and exit
  - ii) Work done on vanes per unit weight of water supplied by the jet and
  - iii) The hydraulic efficiency.
- b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5m/s. The vanes are set back at an angle of  $40^\circ$  outlet.

If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, Determine:

[9]

- i) Vane angle at inlet
- ii) Work done by the impeller on water per second, and
- iii) Manometric efficiency.

OR

- Q8)** a) Explain the principle and working of a centrifugal pump with neat sketch. [6]
- b) What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of centrifugal pump? [6]
- c) Derive expression for the “work done by the jet” in case of flat plate inclined and moving in the direction of jet. [6]

- Q9)** a) Obtain an expression with reference to hydraulic turbine for unit speed, unit power and unit discharge. [8]
- b) A Pelton wheel has mean bucket speed of 10 meters per second with jet of water flowing at the rate of 700 litres/s under a head of 30 meters. The bucket deflect the jet through an angle of  $160^\circ$ . Calculate the power given by the water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98. [8]

OR

- Q10)** a) What is Cavitation? How it can be avoided in case of a hydraulic turbine? [4]
- b) What is draft tube? What are the functions of draft tube? [4]
- c) A turbine is to operate under head of 26 m at 210 r.p.m. The discharge is  $9.5 \text{ m}^3/\text{s}$ . If the efficiency is 90%, determine [8]
- Specific speed of the machine
  - Power generated and
  - Type of turbine.

- Q11)** a) Derive the following form of GVF equation with usual notations. Also state the assumptions made for it. [8]

$$\frac{dy}{dx} = \frac{S_o - S_f}{1 - F_r^2}$$

- b) Describe with neat sketches “Classification of Channel Bed Slopes”. [8]

OR

- Q12)** a) What do you mean by Non-uniform flow? Explain its types with neat sketch along with suitable example. [4]
- b) A rectangular channel carries a discharge of  $3 \text{ m}^3/\text{s}/\text{m}$ . It is laid at a slope of 0.0001. If at section in this channel the depth is 1.6 m, how far (upstream or downstream) from the section will the depth be 1.9 m? Take Manning's  $n$  as 0.015 and width of rectangular channel as 10m. Use the Step method (Consider the depth of flow 'y' with interval of 0.1m). [12]

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