

B.Tech II Year I Semester (R13) Regular Examinations December 2014

**FLUID MECHANICS & HYDRAULIC MACHINERY**

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

**PART – A**  
(Compulsory Question)

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- 1 Answer the following: (10 X 02 = 20 Marks)
- Define viscosity. How it varies with temperature?
  - What is continuity equation? Explain continuity equation in two dimensional flow.
  - What are different types of losses in pipes? Explain.
  - What are different methods of describing fluid motion?
  - Explain the momentum principles.
  - Write short notes on water hammer.
  - Define coefficient of discharge.
  - What is meant by centrifugal pump? Define specific speed of the pump.
  - Explain about priming of a centrifugal pump.
  - Explain about net positive suction head (NPSH).

**PART – B**  
(Answer all five units, 5 X 10 = 50 Marks)**UNIT - I**

- 2 (a) What are different types of fluid flow? Explain them.  
(b) A 25 cm diameter pipe carries oil of specific gravity 0.9 at a velocity of 3 m/s. At another section the diameter is 20 cm. Find the velocity at this section and also mass rate of flow of oil.

OR

- 3 (a) Define the equation of continuity. Obtain an expression for continuity equation for a three-dimensional flow.  
(b) A fluid flow field is given by  $V = x^2yi + y^2zj - (2xyz + yz^2) k$ , Prove that it is a case of possible steady incompressible fluid flow. Calculate velocity and acceleration at the point (2, 1, 3).

**UNIT - II**

- 4 (a) Obtain the expression for discharge through venturimeter.  
(b) Derive an expression for force in a pipe bend.
- OR
- 5 (a) State the momentum equation. How will you apply momentum equation for determining the force exerted by a flowing liquid on a pipe bend?  
(b) A pipe of 300 mm diameter conveying  $0.30 \text{ m}^3/\text{s}$  of water has a right angled bend in a horizontal plane. Find the resultant force exerted on the bend if the pressure at inlet and outlet of the bend are  $24.525 \text{ N/cm}^2$  and  $23.544 \text{ N/cm}^2$ .

**UNIT - III**

- 6 (a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.  
(b) Find the force exerted by a jet of water of diameter 100 mm on a stationary flat plate, when the jet strikes the plate normally with velocity of 30 m/s.
- OR
- 7 (a) Show that the efficiency of a free jet striking normally on a series of flat plates mounted on the periphery of a wheel can never exceed 50%.  
(b) A jet of water of diameter 100 mm strikes a curved plate at its centre with a velocity of 15 m/s. The curved plate is moving with a velocity of 7 m/s in the direction of the jet. The jet is deflected through an angle of  $150^\circ$ . Assume the plate is smooth, find (i) force exerted on the plate in the direction of the jet (ii) power of the jet (iii) efficiency.

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## UNIT – IV

- 8 (a) With a neat sketch, explain the principle and working of a centrifugal pump.  
(b) A centrifugal pump rotating at 1000 rpm delivers 160 liters/s of water against a head of 30 m. The pump is installed at a place where atmospheric pressure is  $1 \times 10^5 \text{ Pa (abs.)}$  and vapour pressure of water is 2 kPa (abs.). The head loss in suction pipe is equivalent to 0.2 m of water. Calculate minimum NPSH

OR

- 9 (a) With neat sketch, explain the principle of working of reciprocating pumps.  
(b) A centrifugal pump is to discharge  $0.118 \text{ m}^3/\text{s}$  at a speed of 1450 rpm against head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometer efficiency is 75%. Determine the vane angle at the outer periphery of the impeller.

## UNIT – V

- 10 (a) What are surge tanks? What is the purpose of providing surge tanks? Explain the different types present in it.  
(b) A turbine develops 7460 kW under a head of 24.7 m at 135 rpm. What is the specific speed? What would be the normal speed and output under a head of 19.5 m?

OR

- 11 (a) Discuss detail estimation of hydropower potential.  
(b) What are the various applications of Hydroelectric power plant?

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