

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-III • EXAMINATION – WINTER 2013**

**Subject Code: 130502****Date: 07-12-2013****Subject Name: Fluid Flow Operation****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain cavitation and NPSH in centrifugal pump. **07**  
(b) Derive Hagen – Poiseuille's equation with its significance. **07**

- Q.2** (a) A single stage Centrifugal pump with an impeller diameter of 30 cm rotates at 2000 rpm and lifts  $3 \text{ m}^3$  of water/sec to a height of 25 m with an efficiency of 80 %. Find the number of stages and diameter of each impeller of a similar multistage pump to lift  $5 \text{ m}^3$  of water/sec to a height of 200 meters when rotating at 1500 rpm. **07**  
(b) Water with density  $1000 \text{ kg/m}^3$  enters at 50 mm pipe fitting horizontally at steady velocity of 1 m/s and a gauge pressure of  $100 \text{ kN/m}^2$ . It leaves the fitting horizontally at the same elevation, at an angle  $45^\circ$  with the entrance direction. The diameter at the water outlet is 20 mm. Assuming the water density constant throughout, the kinetic energy and momentum correction factors at both entrance and exit are unity and  $h_{fs} = 0$ .  
Calculate (a) Gauge pressure at the outlet  
(b) The forces in x and y directions exerted by the fitting on the fluid. **07**

**OR**

- (b) 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 the water in the main line, if the difference in the level of mercury in the limbs of U-tube is 10 cm and free surface of mercury is in level with the centre of the pipe – if the pressure of water in pipe is reduced to  $9310 \text{ N/m}^2$ . Calculate the new difference in mercury level. **07**
- Q.3** (a) Explain any one method of Dimensional Analysis with one suitable example. **07**  
(b) Starting with Bernoulli's and continuity equation, derive an expression for venturimeter, stating all assumptions. **07**

**OR**

- Q.3** (a) Explain in detail : Drag and drag coefficient. **07**  
(b) Discuss different types of manometers used for pressure measurement with neat sketches. **07**
- Q.4** (a) Define hydraulic radius, derive an expression for an equivalent diameter for the case of square duct. **07**  
(b) Write a short note on types of valves. **07**

**OR**

- Q.4** (a) Discuss the types of fluidization with its principles and application. **07**  
(b) Give the concept of hydrostatic equilibrium and derive the expression for pressure distribution in gas container. **07**

- Q.5 (a)** Water is flowing through a pipe having diameters 30 cm and 20 cm at the bottom and upper level respectively. The intensity of pressure at the bottom end is  $2.5 \text{ kgf/cm}^2$  and the pressure at the upper end is  $1 \text{ kgf/cm}^2$ . Determine the difference in datum head if the rate of flow through pipe is 40 lit/sec. **07**
- (b)** Define hydraulically smooth tube. Discuss the effect of friction factor for rough tube. **07**

**OR**

- Q.5 (a)** Derive an expression of head loss due to sudden expansion of flow area for steady flow of incompressible fluids. **07**
- (b)** Define the following **07**
- a) Manometer head
  - b) Delivery head
  - c) Reynolds number
  - d) BWG
  - e) Schedule number
  - f) Skin friction
  - g) Form friction

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