

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI • EXAMINATION – SUMMER • 2014****Subject Code: 160602****Date: 21-05-2014****Subject Name: Applied Fluid Mechanics****Time: 10:30 am - 01:00 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 types of flow in open channel. **07**
 (b) An oil of viscosity 0.12 N-s/m^2 and density 900 kg/m^3 flows between two large parallel plates which are kept at a distance of 20 mm apart. The maximum velocity of flow is 1.5 m/s. Determine (a) The average velocity (b) The velocity at 5 mm from the plates (c) The discharge per m width (d) The velocity gradient at the plates (e) The shear stresses at the plates and (f) The difference in pressure between two points 10 m apart. **07**
- Q.2** (a) Describe Reynold's experiment. **07**
 (b) Water is flowing nonuniformly through a rectangular channel of 3 m width at a rate of $9.72 \text{ m}^3/\text{s}$. At a particular section of the channel, the depth of flow is 0.8 m. Determine whether a hydraulic jump will occur and if so find its height. Also find the loss of energy and power lost in the hydraulic jump. **07**
- OR**
- (b) Obtain an expression for hydraulic radius for a hydraulically efficient triangular channel in terms of depth of flow. **07**
- Q.3** (a) State Buckingham's π theorem. Why it is considered superior over Rayleigh method for dimension analysis. **07**
 (b) The pressure drop in an aero plane model of size $1/20$ of its prototype is 8 KN/m^2 . The model is tested in water. Find the corresponding pressure drop in prototype. The density and viscosity of air are 1.22 kg/m^3 and $1 \times 10^{-5} \text{ N-S/m}^2$ respectively and the corresponding value for water are 1000 kg/m^3 and 0.001 N-S/m^2 respectively. **07**
- OR**
- Q.3** (a) What is undistorted and distorted model. What are the advantages of using distorted model. **07**
 (b) The power P required to run a centrifugal pump depends on the impeller diameter D , the rotational speed N , the rate of discharge Q , density ρ and viscosity μ . Using Buckingham's π theorem, obtain an expression for power $P = \rho N^3 D^5 \phi \left[\frac{Q}{ND^5}, \frac{\mu}{\rho ND^2} \right]$ **07**
- Q.4** (a) Discuss the phenomenon of boundary layer separation. **07**
 (b) The velocity distribution in the turbulent boundary layer over a flat plate is given as $\frac{u}{U_\infty} = \left(\frac{y}{\delta} \right)^{1/7}$ obtain the expression for the displacement thickness and momentum thickness. **07**
- OR**
- Q.4** (a) Define the terms (i) Coefficient of drag (ii) Coefficient of lift (iii) Total drag on body **07**

- (b) In a fluid mechanics laboratory it was asked to conduct an experiment on a flat plate of 2 m long and 1.2 m wide in a wind tunnel with a wind velocity of 40 km/h when the plate is kept at 6° angle of attack, the coefficients of lift and drag are computed as 0.7 and 0.18 respectively. Find the (a) Lift force (b) Drag force (c) Magnitude and direction of resultant force and (d) Power exerted by air on the plate. Density of air is 1.2 kg/m^3 . **07**
- Q.5** (a) Draw a layout of typical hydroelectric plant and explain different components of hydroelectric plant. **07**
- (b) Explain various forces acting on moving fluid. **07**
- OR**
- Q.5** (a) Define unit speed, unit discharge and unit power. **07**
- (b) A centrifugal pump has an impeller of 80 cm in diameter and it delivers 40 liters/s of water against a head of 30 m. The pump is running at 800 rpm. The geometrically similar pump of 40 cm diameter is running at 1600 rpm, find the head and discharge. Also find the ratio of the power of the two pumps. **07**

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