Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 160602 **Date: 12/05/2017**

Subject Name: Applied Fluid Mechanics

Time: 10:30 AM to 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)** Differentiate between an impulse turbine and a reaction turbine. What are the different component parts of a reaction turbine? Also, explain the functions of draft tube in it. **07**

(b) Sketch the specific energy curve and explain different types of open channel flows based on Froude No. What are the characteristics of the flow at critical depth? **07**

Q.2 **(a)** Define: Uniform flow, Normal depth. **07**
Compute the discharge through a rectangular channel of width 3m and depth of flow 1.1m, laid at a bed slope of 0.0002. Take Chezy's constant C = 45 $m^{0.5}s^{-1}$.

(b) Discuss the characteristics of laminar flow and turbulent flow. Also, explain how the stresses due to turbulences (Reynolds stresses) generates in a turbulent flow. **07**

OR

(b) Two parallel plates are placed horizontally 12 mm apart. The bottom plate is fixed and the top plate is moved at a uniform speed of 28 cm/s. The fluid has a dynamic viscosity μ = 1.47 N-s/m^2. Determine the pressure gradient which corresponds to the condition of zero discharge between the plates and the shearing stress at the moving plate. **07**

Q.3 **(a)** Show that the velocity distribution for viscous flow through a circular pipe is given by $u = \frac{-1}{4\mu}\frac{\partial p}{\partial x}\left[R^2 - r^2\right]$ where u is the point velocity at a radial distance r from the pipe axis, R is the radius of pipe, $\frac{\partial p}{\partial x}$ is the pressure gradient and μ is dynamic viscosity. **07**

(b) Explain 'boundary layer phenomenon' and draw the neat sketch showing the growth of the boundary layer over a flat plate kept in a uniform flow at zero angle of incidence. **07**

OR

Q.3 **(a)** Discuss, using a neat sketch, boundary layer separation with suitable examples. Also, explain the Karman vortex street. **07**

(b) Explain: Boundary layer thickness, Displacement thickness **07**
Given the velocity distribution for a boundary layer flow as,

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2 \quad \text{with usual notations,}$$

determine the displacement thickness.

Q.4 **(a)** An oil is flowing in laminar regime through a 6 cm diameter circular pipe. A pitot tube at a radial distance of 2 cm from the pipe axis indicated a velocity of 0.6 m/s. Calculate (i) the maximum velocity (ii) mean velocity and (iii) the discharge through the pipe. Assume dynamic viscosity of oil as 1.1 Pa-s. **07**

(b) Discuss the water hammer phenomenon, with suitable sketches. Suggest the suitable measure to safeguard the pipes carrying liquids against water hammer effect. **07**

OR

Q.4 **(a)** Explain "Dimension" and write dimensions (in M-L-T system) of velocity, force and density. Differentiate between dimensionally homogeneous and non-homogeneous equations. **07**

(b) Differentiate between the following: **07**

(i) Drawdown curve and backwater curve

(ii) Alternate depths and conjugate depths

(iii) Rapidly varied flow and gradually varied flow

Q.5 **(a)** What are the different types of pump? Discuss, in brief, working of these pumps. Also explain 'priming' of the pump. **07**

(b) Using Buckingham's π-theorem, show that the resistance (F) to the motion of a sphere of diameter (D) moving with a uniform velocity (V) through a real fluid of density (ρ) and viscosity (μ) is given by: **07**

$$F = \rho D^2 V^2 . \Phi\left(\frac{\mu}{\rho V D}\right)$$

OR

Q.5 **(a)** What are advantages of model testing? Explain different types of similarities to be obtained between the model and its prototype for model testing. **07**

(b) A pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at the rate of 0.75 m^3/s under the head of 35 m. If the buckets deflect the jet through an angle of 160°, find the power and efficiency of the turbine. Take coefficient of velocity $C_v = 0.98$. **07**

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