Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022**

**Subject Code:2160602 Date:03/06/2022**

**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.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | |
|---|---|---|---|
| **Q.1** | **(a)** | What is open channel? Why bed slope is provided in open channel? | **03** |
| | **(b)** | Derive an expression for the loss of head due to sudden enlargement of a pipe. | **04** |
| | **(c)** | Explain the specific energy curve with neat sketch. | **07** |
| **Q.2** | **(a)** | Explain the term Hydraulic gradient line and Total energy line. | **03** |
| | **(b)** | Explain various types of open channels with sketch. | **04** |
| | **(c)** | Prove that the velocity distribution for viscous flow between two parallel plates when both plates are fixed across a section is parabolic in nature. | **07** |
| | | **OR** | |
| | **(c)** | What do you mean by most economical channel section? Show that for trapezoidal channel of most economical section (1) half of top width = length of one of the slopping side (2) hydraulic mean depth =1/2 depth of flow. | **07** |
| **Q.3** | **(a)** | Explain Hagen-Poiseuille theory. | **03** |
| | **(b)** | Derive an expression for the momentum thickness (ɵ) of boundary layer flow. | **04** |
| | **(c)** | What is couette flow? Derive an expression of velocity and shear stress for couette flow | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Differentiate hydro-dynamically smooth and rough pipes. | **03** |
| | **(b)** | What do you mean by pipes in series and pipes in parallel? How the loss of head is determined in both systems. | **04** |
| | **(c)** | A horizontal rectangular channel 4 m wide carries a discharge of 16 $m^3/s$. Determine that the hydraulic jump may occur at initial depth of 0.5 m or not. If hydraulic jump occurs, determine the sequent depth to this initial depth. Also determine the loss of energy in the jump. | **07** |
| **Q.4** | **(a)** | What is priming? Why it is necessary. | **03** |
| | **(b)** | Explain the hydroelectric plant with neat sketch. | **04** |

| | | | |
|---|---|---|---|
| | **(c)** | Find the head loss due to friction in a pipe of diameter 300 mm and length 50 m through which water is flowing at a velocity of 3 m/s using (1) Darcy-Weisbach formula (2) Chezy's formula for which C=60. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.4** | **(a)** | Write a note on prandtl mixing length theory | **03** |
| | **(b)** | Derive Chezy's formula to calculate the velocity in case of a channel. | **04** |
| | **(c)** | State and explain Buckingham's π theorem. Why it is considered over Rayleigh method over dimensional analysis. | **07** |
| **Q.5** | **(a)** | Differentiate between back water curve and drop down curve. | **03** |
| | **(b)** | The discharge of water through a rectangular channel with 6 m width and 2 m depth of flow is 18 cumecs. Calculate (1) Specific energy of flowing water (2) Critical depth (3) Critical velocity (4) minimum specific energy. | **04** |
| | **(c)** | Explain boundary layer separation. Also discuss the effect of pressure gradient on boundary layer separation. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Define specific speed, unit discharge and unit power of turbine. | **03** |
| | **(b)** | Differentiate between:<br>(1) Impulse and Reaction turbine<br>(2) Open channel flow and Pipe flow. | **04** |
| | **(c)** | Derive differential equation of gradually varied flow with assumptions made in it. | **07** |

*****************************