

Enrollment No./ Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

MASTER OF ENGINEERING - SEMESTER - 1 EXAMINATION – SUMMER 2026

Subject Code: 3713303

Date: 10-06-2026

Subject Name: Advanced fluid mechanics

Time: 02:30 PM TO 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)** Describe the following with example **07**
(1) Gradually varied steady flow (2) Gradually varied unsteady flow
(2) Rapidly varied unsteady flow (4) Spatially varied flow
- (b)** Draw the water surface profile for following change in the grade **07**
(1) Mild to steep (2) Steeper to steep (3) Milder to mild (4) Steep to steeper
- Q.2 (a)** Derive Navier-Stokes Equation for approximate solutions. **07**
(b) Describe the procedure of location of hydraulic jump in case of mild slope channel. **07**
- OR**
- (b)** Derive the equation of motion in the case of unsteady flow. **07**
- Q.3 (a)** A rectangular channel of 4.0 m width has a Manning's coefficient of 0.025. For a discharge of 6.0 m³/s in this channel, identify the possible GVF profiles produced in the following break in grades. **07**
(a) $S_{01} = 0.0004$ to $S_{02} = 0.015$
(b) $S_{01} = 0.005$ to $S_{02} = 0.0004$
- (b)** Explain the steps of computing the length of back water curve in a mild sloped channel. **07**
- OR**
- Q.3 (a)** In a very long, wide rectangular channel the discharge intensity is 3.0m³/s/metre width. The bed slope of the channel is 0.004 and Manning's $n = 0.015$. At a certain section in this channel, the depth of flow is observed to be 0.90 m. What type of GVF profile occurs in the neighborhood of this section? **07**
(b) Derive expression of conjugate depths in the case of a triangular channel. **07**
- Q.4 (a)** Explain boundary layer separation and its preventive measures. **07**
(b) Write a short note on (1) Prandtl mixing length theory (2) Hydrodynamically rough and smooth boundaries **07**
- OR**
- Q.4 (a)** Write a detailed note on application of finite difference in open channel flow. **07**
(b) A 3.0 m wide rectangular channel has a flow of 3.60 m³/s with a velocity of 0.8 m/s. If a sudden release of additional flow at the upstream end of the channel causes the depth to rise by 50 per cent, determine the absolute velocity of the resulting surge and the new flow rate. **07**
- Q.5 (a)** Lubrication oil of specific gravity 0.82 and dynamic viscosity 12.066×10^{-2} N-s/m² is pumped at a rate of 0.02 m³/s through a 0.15m diameter 300 m long pipe. Calculate the pressure drop, average shear stress at the wall of pipe and the power required to maintain the flow. **07**
(b) How would you carry out water hammer analysis in pipes? Explain it. **07**
- OR**
- Q.5 (a)** In a hydraulic jump taking place in a horizontal, rectangular channel a sequent- **07**

depth ratio of 10 is desired. What initial Froude number would produce this ratio? What would be the Froude number after the jump?

- (b) Write a detailed note on surges in open channel.

07
