Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M.E. SEMESTER I (old course)–EXAMINATION (Remedial) – WINTER 2015**

**Subject code: 711201N** **Date: 08/12/2015**

**Subject Name: ADVANCED FLUID MECHANICS**

**Time: 10:30 AM to 1:00 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)** What is the importance of studying a open channel flow **07**

**(b)** Explain the application of Navier-stokes equation. **07**

**Q.2** **(a)** Classify the following open-channel flow situation **07**

1. Flow from a sluice gate
2. Flow in a main irrigation channel
3. A river during flood
4. Breaking of a dam
5. Flow over a spillway
6. Sudden opening of a sluice gate
7. Flow in sewer.

**(b)** A discharge of 16.0 cubic meter per second with a depth of 2.0 meter in a rectangular channel 4.0 meter wide. At a downstream section the width is reduced to 3.5 meter and the channel bed is raised by 0.20 meter. Analyze the water surface elevations in the transitions. **07**

**OR**

**(b)** A concrete-lined trapezoidal channel (n= 0.015) is to have a side slope of 1.0 horizontal: 1.0 vertical. The bottom slope is to be 0.0004. Find the bottom width of the channel necessary to carry 100 cubic meter per second of discharge at a normal depth of 2.50 meter. **07**

**Q.3** **(a)** Develop the gradually varied flow equation $dy/dx = (S_o - S_f)/ (1-Q^2T/gA^3)$ where the terms have their usual meaning. **07**

**(b)** Discuss with sketches the various types of hydraulic jump. **07**

**OR**

**Q.3** **(a)** What is the direct-step method for computing GVF profiles explain briefly? **07**

**(b)** A small stream has a cross-section which can be approximated by a trapezoid. The cross-sectional properties at three sections are as follows: **07**

| Section | Distance up the river (km) | Bed elevation (m) | Bed width | Side slope |
|---|---|---|---|---|
| A | 100.00 | 100.00 | 14.0 | 1.5:1 |
| B | 102.00 | 100.80 | 12.5 | 1.5:1 |
| C | 103.50 | 101.40 | 10.0 | 1.5:1 |

Section A is the downstream-most section. For a discharge of 100.0 cubic meters per second in the stream, water-surface elevation at A was 104.500 meter. Estimate the water-surface elevation at the upstream sections B and C. Assume n = 0.02 and Ŭ= 1.0 at all sections.

**Q.4** **(a)** Derive the sequent depth ratio for hydraulic jump on sloping floor. **07**

**(b)** Derive the differential equation of SVF with decreasing discharge. **07**

**OR**

**Q.4** **(a)** Explain prandtlôs mixing length theory? **07**

**(b)** Explain the method of characteristics. **07**

**Q.5** **(a)** Briefly explain a positive surge. **07**

**(b)** What is meant by separation of boundary layer? How is the separation point determined? State the reasons for separation. **07**

**OR**

**Q.5** **(a)** Write a short note on hydraulically smooth and rough pipes. **07**

**(b)** Explain flow net with its limitation and utility. **07**

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