Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Regular Examination January / February 2011

Subject code: 711201N
Subject Name: Advanced Fluid Mechanics

Date: 31 /01 /2011 **Time: 02.30 pm – 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)** Explain significant of each term in N.S equation. **07**

(b) A rectangular channel carries a flow with a velocity of 0.65m/s and depth of 1.40m. If the discharge is abruptly increased three fold by a sudden lifting of gate on the up stream, estimate the velocity and the height of the resulting surges. **07**

Q.2 **(a)** Explain flownet with it's limitation and utility. **07**

(b) Explain briefly classification of flow profiles with sketch. **07**

OR

(b) Write the algorithm for the location of the jump by graphical or numerical computation procedure. **07**

Q.3 **(a)** Explain the direct integration procedure for computing the GVF profiles and obtain the Bress's function. **07**

(b) The velocity vector in a fluid flow is given by $v = 3x^2i - 4x^2yj + 2tk$. Find velocity and acceleration of a fluid particle at (1,2,3) at time t = 1. **07**

OR

Q.3 **(a)** Show that the discharge per unit width between two parallel plates distance 'b' apart, when one plat is moving at velocity 'V' while the other one is held stationary for the condition of zero shear stress at the fixed plate is $q = bv / 3$ **07**

(b) A river is 75m wide and 2.5m deep has an average bed slope of 0.0005. Estimate the length of GVF profile using direct step method produced by a low weir which raises the water surface just upstream of it by 1.4m. Take manning coefficient $n = 0.03$ **07**

Q.4 **(a)** What are the different methods of preventing the separation of boundary layer? **07**

(b) A wide rectangular channel in a alluvium of median size 2.5mm(Relative density 2.85) has a longitudinal slop of 0.0002. Estimate the depth of flow in this channel which will cause incipient motion. **07**

OR

Q.4 **(a)** Derive the differential equation of SVF for decreasing discharge. **07**

(b) Water flows between parallel plates which are 2.0mm apart. Determine (i) maximum velocity (ii) the pressure drop per unit length and (iii) shear stress on the **07**

walls of plate if average velocity is 0.3m/s. Take viscosity of water as 0.01 poise.

Q.5 **(a)** Explain uniformly progressive wave. **07**

(b) A smooth rectangular plate 1.25m wide x 25m long moves through water in the direction of its length. The drag force on the two sides of the plate is estimated to be 8500N (900kgf). Workout (i) Velocity with which the plates moves. (ii) Boundary layer at the trailing edge of the plate and (iii) Distance X_0 at which the laminar boundary layer existing at the leading edge transforms in to turbulent boundary layer. **07**

OR

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

(b) A sluice gate discharges 10.0m^3/s per meter width in to a wide rectangular channel of n = 0.025 and bottom slope S_0 = 0.0002. The depth of flow at the vena contracta is 0.40 m. If the channel ends in a sudden drop at a distance of 1300m downstream of the gate, locate the position of the jump. **07**

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