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

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC SEM-III Examination-December-2011

Subject code: X30604 **Date: 20/12/2011**

Subject Name: Advanced Fluid Mechanics **Time: 2.30 pm -5.00 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)**	Define (i) steady flow (ii) uniform flow (iii) laminar flow (iv) sub critical flow (v) two dimensional flow (vi) rotational flow (vii) comprisable flow	**07**
	(b)	Explain Hydrodynamically smooth and rough pipe.	**07**
Q.2	**(a)**	Explain 'flow net'. Write its uses and limitations.	**07**
	(b)	Shear stress at a point 40mm from axis of a pipe is 28 pa. Find wall shear stress and rate of flow if pipe diameter is 36cm and viscosity of flowing liquid is 40poise. Assume laminar flow through pipe.	**07**
		OR	
	(b)	Obtain an equation of continuity for three dimensional flow.	**07**
Q.3	**(a)**	Expiain formation of boundary layer with sketch.	**07**
	(b)	A thin plate is moving in still atmospheric air at a velocity of 5m/s. The length of the plate is 0.6 m and width 0.5 m. Calculate (i) the thickness of the boundary layer at the end of the plate, and (ii) drag force on one side of the plate. Take density of air as 1.24 kg/m3 and kinematic viscosity 0.15 stokes.	**07**
		OR	
Q.3	**(a)**	Explain Hardy cross method.	**07**
	(b)	A pipe line carrying oil s = 0.8 has average height of irregularities projecting from the surface of the boundary of the pipe as 0.3 mm. What type of boundary is it? The shear stress developed is 3N/m2. Take kinematic viscosity $\nu = 0.012$ stoke.	**07**
Q.4	**(a)**	Explain Buckingham π theorem method.	**07**
	(b)	Water is flowing through a pipe of diameter 30cm at a velocity of 4m/s. Find the velocity of oil flowing in another pipe of diameter 10 cm. if the condition of dynamic similarity is satisfied between the two pipes. The viscosity of water and oil is given as 0.01 poise and 0.025 poise. The sp. gr. of oil = 0.8.	**07**
		OR	
Q.4	**(a)**	Describe Reynolds's experiments.	**07**
	(b)	Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe.	**07**
Q.5	**(a)**	Derive an Equation of Gradually varied flow, and write assumption made in it.	**07**
	(b)	A triangular channel having a vertex angle 1200 , calculate critical depth if flow through the channel is 15 m^3 /s.	**07**
		OR	
Q.5	**(a)**	Discus the specific energy curve with a neat sketch	**07**
	(b)	Find the slope of the free water surface in a rectangular channel of width 20m, having depth of flow 5m. The discharge through the channel is 50 m^3 /s . The bed of the channel is having a slope of 1 in 4000. Take the value of Chezy's constant C = 60.	**07**

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