Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (OLD) EXAMINATION – WINTER 2018

Subject Code:160602 **Date: 15/12/2018**

Subject Name: Applied 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)	Derive the continuity equation for one dimensional flow and discuss its application.	07
	(b)	Derive an expression for the velocity distribution of viscous flow through a circular pipe and prove that the ratio of maximum velocity to average velocity is 2.	07
Q.2	(a)	Explain the Navier –Stokes equation of motion for one dimensional flow. What do you understand by initial conditions and boundary conditions?	07
	(b)	Derive the Hagen- Poiseuille equation for viscous flow through a circular pipe.	07
	(b)	Oil of specific gravity 0.82 is pumped through a horizontal pipe line 15 cm in diameter & 3 km long at the rate of 900 liters per minute. The pump has an efficiency of 68% & requires 7.35 kw to pump the oil. Determine the dynamic viscosity of oil & verify whether the flow is laminar?	07
Q.3	(a)	A plate 1 m × 1 m moves through air of density 1.15 kg/cum at 36 km/hour. Determine (i) The drag force, (ii) The lift force, (iii) The resultant force, and (iv) The power required to maintain the plate in motion. Take Cd = 0.18, CL =0.70	07
	(b)	Find the width and depth of a rectangular channel to convey a discharge of 1.5 m3/s at a velocity of 0.5 m/s. Take Chezy's constant equal to 60 and the channel bed slope equal to 0.00012 .	07
Q.3	(a)	Explain the terms (i) sub-critical flow, (ii) critical depth and (iii) specific energy.	07
	(b)	Explain the displacement and momentum thickness.	07
Q.4	(a)	What are the different methods of prevention of separation of boundary layer?	07
	(b)	A pipe of diameter 2 m is transporting oil of specific gravity 0.85 and dynamic viscosity 0.04 poise at a rate of 4 cumecs. Model tests were conducted on a 10 cm diameter pipe using water at 20 ^{o}C. Compute the velocity and discharge in the model. Viscosity of water at 200C = 0.01 poise.	07
Q.4	(a)	State the procedure for locating hydraulic jump below a sluice in a mild sloped channel.	07
	(b)	Differentiate between : (a) Impulse and Reaction turbines (b) Radial flow and Axial flow turbines (c) Kaplan and Propeller turbines.	07
Q.5	(a)	(i) Develop the expression for average shear stress for a steady uniform flow in open channel in terms of hydraulic radius and channel bottom slope (ii) Give the significance of hydraulic radius and hydraulic mean depth.	07

(b) A Pelton turbine is to be designed for the following specifications:- Shaft power = 11000 kw, Head = 365metres, Speed = 750 r.p.m. , Overall efficiency = 86% Jet diameter = 1/6 of the wheel diameter. Determine (i) The wheel diameter (ii) The no of jets required and (iii) Diameter of the jet. Take Kv1=0.985 and Ku1=0.45 . 07

Q.5 (a) Explain the components of a centrifugal pump. What do you understand by manometric head? 07

(b) Explain the Buckingham π theorem for dimensional analysis. 07

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