

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 $C_d = 0.18$, $C_L = 0.70$ 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 °C. Compute the velocity and discharge in the model. Viscosity of water at 20°C = 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 specification : 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 $K_v1=0.985$ and $K_u1=0.45$. 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
