Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – SUMMER 2013

Subject Code: 143403 Date: 14-06-2013

Subject Name: Fluid Mechanics and Machinery

Time: 10:30am – 01:00pm 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 Newton law of viscosity. Classify the Five types of fluids with a neat sketch	**07**
	(b)	If the velocity profile of a fluid over a plate is parabolic with the vertex 20cm from the plate, where the velocity is 120cm/sec. Calculate the gradients and shear stresses at a distance of 0, 10 and 20cm from the plate, if the viscosity of the fluid is 8.5poise.	**07**
Q.2	**(a)**	Briefly discuss the classification of different types of fluid flow with necessary equations.	**07**
	(b)	The diameters of a pipe at the sections 1 and 2 are 10cm and 15cm respectively. Find the discharge through the pipe if the velocity of water flowing through the pipe at section 1 is 5m/s. Determine also the velocity at section 2.	**07**
		OR	
	(b)	Find the head loss due to friction in a pipe of diameter 300mm and length 50m, through which water is flowing at a velocity of 3 m/s using (i) Darcy formula, (ii) Chezy's formula for which C = 60.	**07**
Q.3	**(a)**	Determine the dimensions of the quantities given below: (i) Angular velocity, (ii) Angular acceleration, (iii) Discharge, (iv) Kinematic viscosity, (v) Force, (vi) Specific weight and (vii) Dynamic Viscosity.	**07**
	(b)	Briefly explain about the Rayleigh's method and Buckingham's p- theorem.	**07**
		OR	
Q.3	**(a)**	Explain the methods of selecting repeating variables. the procedure for solving problems by Buckingham's p- theorem.	**07**
	(b)	Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by a propeller. Assume that the thrust P depends upon the angular velocity ? , speed of advance V, diameter D, dynamic viscosity µ, mass density ?, elasticity of the fluid medium which can be denoted by the speed of sound in the medium C.	**07**
Q.4	**(a)**	Explain the classification of Hydraulic turbines.	**07**
	(b)	A Pelton wheel is to be designed for the following specifications: Shaft power = 11772KW; Head = 380 meters; Speed = 750 r.p.m; Overall efficiency = 86%; Jet diameter is not to exceed one-sixth of the wheel diameter. Determine (i) The wheel diameter, (ii) the number of jets required, and (iii) diameter of the jet.	**07**
		OR	
Q.4	**(a)**	Explain the main parts of a Radial flow reaction turbine with neat sketch.	**07**
	(b)	A pelton wheel has a mean bucket speed of 10 meters per second with a jet of water flowing at the rate of 700 liters under a head of 30 meters. The buckets deflect the jet through on angle of 160º. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98.	**07**
Q.5	**(a)**	Explain the Discharge, work done and power required to drive a Double – acting pump	**07**

(b) A double – acting reciprocating pump, running at 40 r.p.m, is discharging 1.0m^3 of water per minute. The pump has a stroke of 400 mm. The diameter of the piston is 200 mm. The delivery and suction head are 20m and 5m respectively. Find the slip of the pump and power required to drive the pump. **0 7**

OR

Q.5	**(a)**	Explain the classification of reciprocating pumps. Discuss the Ideal indicator diagram with a neat sketch.	**07**
	(b)	The cylinder bore diameter of a single – acting reciprocating pump is 150mm and its stroke is 300mm. The pump runs at 50 r.p.m and lifts water through a height of 25m. The delivery is 22m long and 100mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 liters/s, find the percentage slip. Also determine the acceleration head the beginning and middle of the delivery stroke.	**07**

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