Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- Vth SEMESTER–EXAMINATION – MAY/JUNE - 2012

Subject code: 152003   **Date: 04/06/2012**
Subject Name: Fluid Mechanics & Machines
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) Define following properties of fluids and give their units   07
Specific weight, Specific volume, Viscosity, Kinematic viscosity,
Surface tension, Compressibility, Bulk modulus of Elasticity

(b) A solid of 200mm diameter and 800mm length has its base   07
20mm thick and of specific gravity 6.The remaining part of
cylinder is of   specific gravity 0.6, State whether it can flow
vertically in water and also define Metacentre

Q.2 (a) Define stream function and potential function and if stream   07
function for 2D flow is given by ψ=2xy, calculate velocity at point
P (2, 3).

(b) State Bernoulli's Theorem, write down its equation and state its   07
application and assumptions for steady flow

OR

(b) Derive an expression for the continuity equation for a three   07
dimensional flow using the control volume approach

Q.3 (a) A pipe of diameter 20cm and length 10^4 m is laid at a slope of 1   07
in 200.An oil of specific gravity 0.9and viscosity 1.5 poise is
pumped up at the rate of 20 liters per second. Find the head lost
due to friction. Also calculate the power required to pump the oil.

(b) Explain the term Boundary layer separation and also give   07
methods of preventing separation.

OR

Q.3 (a) Give classification of fluid flow.   07

(b) A lubricating oil of viscosity 1 poise and specific gravity 0.9 is   07
pumped through a 30mm diameter pipe. If the pressure drop per

metre length of pipe is 20 KN/m^2.Determine i) Mass flow rate in kg/min   ii) The shear stress at the pipe wall. iii) The Reynolds number of flow   iv) The power required per 50m length of the pipe to maintain the flow.

Q.4 (a) A Pelton wheel is working under a gross head of 400m.The water is supplied through penstock of diameter 1m and length 4km from reservoir to the Pelton wheel. The coefficient of friction for the penstock is given as 0.008.The jet of water of diameter 150mm strikes the buckets of the wheel and gets deflected through an angle of 165°.The relative velocity of water at outlet is reduced by 15% due to friction between the inside surface of the bucket and water. If the velocity of buckets is 0.45times the jet velocity at inlet and mechanical efficiency as 85%, determine power given to runner, shaft power, Hydraulic efficiency & overall efficiency.   07

(b) What is cavitation? What are its causes? How will you prevent cavitation in centrifugal pump?   07

OR

Q.4 (a) What is draft tube? Why it is used in reaction turbine? State its various types   07

(b) A pipe 200m long slopes down at 1 in 100 and tapers from 600mm diameter at the higher end to 300m at lower end and carries 100 liters per second of oil(specific gravity 0.8).If the pressure gauge at the higher end reads 60 KN/m^2, determine velocities at two ends and pressure at the lower end. Neglect all the losses   07

Q.5 (a) The diameter of centrifugal pump which is discharging 0.03 m^3/s of water against a total head of 20m is 0.40m.The pump is running at 1500rpm.Find the head, discharge and ratio of powers of a geometrically similar pump of diameter 0.25m when it is running at 3000 rpm.   07

(b) Write short note on steam turbine and gas turbine   07

OR

Q.5 (a) Define indicator diagram for reciprocating pump and explain ideal indicator diagram with neat sketch. **07**

(b) A cylindrical gate of 4m diameter 2m long has water on its both sides as shown in figure. Determine the magnitude, location and direction of resultant force exerted by the water on gate. Find also the least weight of cylinder so that it may not be lifted away from floor. **07**

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4m

2m