Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-III Examination May 2012

Subject code: 130602

Subject Name: Fluid Mechanics

Date: 10/05/2012 **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) Explain following terms: **07**

(i) Newtonian fluid and non-Newtonian fluid
(ii) Surface tension and capillarity
(iii) Kinematic viscosity and dynamic viscosity

(b) Differentiate between the following and state application of following pressure measuring devices. **07**

(i) Manometers and mechanical gauges
(ii) U-tube differential manometer and inverted U-tube manometer.

Q.2

(a) A circular plate 3.0 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4m and 1.5m resply. Determine the total pressure on one face of the plate and position of the center of pressure. **07**

(b) Explain how you will determine the meta-centre height of a floating body experimentally? Explain with neat sketch. **07**

OR

(b) A glass tube of uniform bore is bent into the form of a square of sides a and filled with equal amounts of three immiscible liquids of densities ρ_1, ρ_2, ρ_3. It is known that $\rho_1 < \rho_2 < \rho_3$. If the tube arrangement is in a vertical plane (i.e. two sides vertical) and if one of the vertical side is completely filled with the liquid of density ρ_2. Show that $1/3(2\rho_3 + \rho_1) > \rho_2 > 1/3(\rho_3 + 2\rho_1)$ **07**

Q.3

(a) The stream function for a two -dimensional flow is given by $\Psi = 2xy$, calculate the velocity at the point P (2, 3). Find the velocity potential function ϕ. **07**

(b) Derive Bernoulli's equation for the flow of an incompressible friction less fluid from consideration of momentum. **07**

OR

Q.3 (a) Explain following terms:Rotational flow,uniform flow, path line, stream tube, streak line **07**

(b) Define the equation of continuity. Obtain an expression for continuity. **07**

Q.4

(a) Derive formulae for calculating loss of head due to sudden enlargement. **07**

(b) The head lost in flow through a 50mm diameter orifice under a certain head is 160mm of water and the velocity of water in the jet is 7.0 m/s if coefficient of discharge be 0.61, determine **07**

(i) Head on the orifice causing flow
(ii) Coefficient of velocity
(iii) Diameter of the jet

OR

Q. 4 (a) A 2500 m long pipe line is used for transmission of power 120 k W power is to be transmitted through the pipe in which water having a pressure of 4000 k N/m^2 at inlet is flowing . If the pressure drop over the length of pipe is 800 k N/m^2 ,f=0.006 find diameter of pipe and efficiency of transmission. **07**

(b) Derive an expression for time of emptying a tank through an orifice at its bottom. **07**

Q.5

(a) (i) How are notches and weirs classified? **03**

(ii) Find the time required to lower the water level from 3m to 2m in a reservoir of dimensions 70 m x 70 m by **04**

(i) A rectangular notch of length 1.2 m
(ii) Right angled V notch assume C_d=0.62

(b) What do you understand by stagnation pressure? Obtain an expression for stagnation pressure of a compressible fluid in terms of approaching Mach number and pressure. **07**

OR

Q.5 (a) Write brief notes on following: **07**

(i) Narrow crested weir
(ii) Ogee weir
(iii) Submerged weir

(b) An aero plane is flying at 1000Km/hr through still air having a pressure of 78.5 k N/m^2(abs.) and temperature of -8°C. Calculate on the stagnation point on the nose of the plane **07**

(i) Stagnation pressure
(ii) Stagnation temperature
(iii) Stagnation density for air R=287J/Kg K , γ=1.4

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