Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III EXAMINATION – SUMMER 2016

Subject Code:130101 **Date:02/06/2016**

Subject Name:Fluid Mechanics

Time:10:30 AM to 01:00 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 the following: (1) Laminar flow (2) Turbulent flow (3) Compressible flow (4) Incompressible flow (5) One, two and three dimensional flow	**07**
	(b)	Derive an expression for the continuity equation for unsteady, three dimensional and compressible flow in cartesian co ordinate.	**07**
Q.2	**(a)**	State and explain Pascal's law .	**07**
	(b)	A wooden block of size 2.0 meter x 1 meter x 0.8 meter floats in water. Determine meta centric height of the block. Specific gravity = 0.73 for wooden block.	**07**
		OR	
	(b)	Define total hydrostatic force and centre of pressure. Derive an expression for the force exerted on a sub-merged vertical plane surface by the static liquid and locate the position of centre of pressure.	**07**
Q.3	**(a)**	Prove that in case of forced vortex , the rise of liquid level at the ends is equal to the full of liquid level at the axis of rotation	**07**
	(b)	A 30 cm diameter pipe, conveying water branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm pipe is 3 m/sec find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/sec.	**07**
		OR	
Q.3	**(a)**	The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 10 poise. The shaft is of 50 cm diameter and rotates at 300 r.p.m. The length of sleeve is 150 mm. The thickness of the oil film is 2.0 mm. Calculate : (1) Shear force on the shaft (2) Torque developed (3) Power lost	**07**

(b) Define the following terms. **07**
(1) Bulk modulus
(2) Compressibility
(3) Surface tension
(4) Mass density
(5) Weight density
(6) Specific volume
(7) Specific gravity

Q.4 **(a)** Derive Darcy Weisbach equation with usual notation **07**

(b) Determine the wall shearing stress in a pipe of diameter 100 mm which carries water. The velocities at the pipe center and 30 mm from the pipe center are 2 m/s and 1 m/s respectively. The flow in pipe is given as turbulent. **07**

OR

Q.4 **(a)** Define the following terms. **07**
(1) Model
(2) Prototype
(3) Model Analysis
(4) Geometric Similarities
(5) Kinematic Similarities
(6) Reynold's number
(7) Froude's number

(b) State Buckingham's π theorem.What do you mean by repeating variables ? How are the repeating variables selected in dimensional analysis **07**

Q.5 **(a)** Show by means of diagram the nature of propagation of disturbance in compressible flow when mach number is less than one, is equal to one and is more than one. **07**

(b) Derive an expression for velocity of sound wave for a compressible fluid when the process is assumed as : **07**
(1) Isothermal
(2) Adiabatic

OR

Q.5 **(a)** A crude oil of viscosity 0.95 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and a length of 50 meter long. Calculate the difference of pressure at the two ends of the pipe, if flow rate is 0.005 m^3/s **07**

(b) Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe. **07**

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