Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) - EXAMINATION – SUMMER 2018

Subject Code:2141906 **Date:22/05/2018**

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.**

			MARKS
Q.1	**(a)**	Define: Surface Tension, Cavitation, Capillarity	**03**
	(b)	Define and derive hydrostatic law.	**04**
	(c)	Derive an equation of continuity for three dimensional Cartesian coordinate system.	**07**
Q.2	**(a)**	Discuss stability of submerged and floating bodies.	**03**
	(b)	A U-tube manometer is used to measure the pressure of water in a pipe line, This is in excess of atmospheric pressure. The right limb of the manometer Contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U-tube is 15 cm and the free surface of mercury is in level with the center of the pipe.	**04**
	(c)	Derive equation of total pressure and center of pressure for inclined submerged body.	**07**
		OR	
	(c)	A rectangular pontoon 9 m long, 8 m wide and 3 m deep, floats in sea water (sp. weight = 10000 N/m^3). It carries an empty boiler on its upper dock of 5 m diameter. The weight of pontoon and boiler are 600 kN and 300 kN respectively. The center of gravity of each unit coincides with geometric center of the arrangement and lie on same vertical line. Find the metacentric height of arrangement and check the stability	**07**
Q.3	**(a)**	Define: Stream line, Path line, Steady flow.	**03**
	(b)	The velocity potential function is given by $Ø = 4(x^2-y^2)$. Calculate the velocity components at the point (2,3).	**04**
	(c)	Derive Euler's equation of motion for flow along a stream line. Obtain Bernoulli's from it. State assumptions clearly.	**07**
		OR	
Q.3	**(a)**	Explain terms Rotation and Vorticity.	**03**
	(b)	A horizontal Venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of oil of sp.gr 0.8. The discharge of oil through Venturimeter is 60 Liters/Second. Find the reading of the oil mercury differential manometer take Cd = 0.98.	**04**
	(c)	Derive an equation for discharge through a Venturimeter. Compare it with equation of discharge through an orifice meter.	**07**
Q.4	**(a)**	Compare rectangular and triangular notches.	**03**
	(b)	State and derive Pascal's law with usual notations.	**04**
	(c)	Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by propeller. Assume that thrust P depends upon the angular velocity ω, speed of advance V, diameter D, dynamic viscosity μ, mass density ρ, elasticity of the fluid medium which can be denoted by speed of the sound in the medium C.	**07**
		OR	

Q.4 **(a)** List different methods of viscosity measurement. Explain any one of them. **03**

(b) Find the loss of head when a pipe of diameter 250 mm is suddenly enlarged to a diameter of 500 mm. the rate of flow through the pipe is 300 liters/ s. **04**

(c) Derive an expression for Hagen-Poiseuille's formula for viscous flow. **07**

Q.5 **(a)** Define Mach number. Classify compressible flow based on Mach number. **03**

(b) A projectile is travelling in air having pressure 0.1 N/mm^2 and temperature -1^oC. If the Mach angle is 39^o, find the velocity of projectile and Mach number. Take k = 1.4 and R = 287 J/kgK **04**

(c) State minor and major losses for flow through pipe and Obtain Darcy-Weisbach formula for head loss due to friction. **07**

OR

Q.5 **(a)** Define velocity potential function and stream function. Derive relation between them. **03**

(b) A flat plate 40 cm x 30 cm slides on oil ($\mu = 0.7$ $N\text{-}s/m^2$) over a large plane surface. What is the force required to drag the plate at 3 m/s if separating oil film is 0.5 mm thick ? **04**

(c) Prove the friction head losse is equal to one third of total head at inlet for maximum power transmission through pipe. **07**

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