Seat No.: ________ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2130101 **Date: 07/06/2019**

Subject Name:Fundamentals of Fluid Mechanics

Time: 02:30 PM TO 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.**

			MARKS
Q.1	**(a)**	Explain following terms: (i) Specific weight (ii) Viscosity (iii) Newtonian fluid	**03**
	(b)	State the Pascal's Law and prove it.	**04**
	(c)	Enlist stability criteria of submerged and floating bodies.	**07**
Q.2	**(a)**	Explain following terms: (i) Stream line (ii) Compressible flow (iii) Mach number	**03**
	(b)	The space between two flat parallel plates is filled with oil. Each side of the plate is 720 mm. the thickness of the oil film is 15 mm. The upper plate, which moves at 3 m/s requires a force of 120 N to maintain the speed. Determine: (i) Dynamic viscosity of oil (ii) Kinematic viscosity when specific gravity of oil is 0.95	**04**
	(c)	Give detailed classification of Fluid flow.	**07**
		OR	
	(c)	A pipe (1), 450 mm in diameter branches into two pipes (2 and 3) of diameter 300 mm and 200 mm respectively as shown in Fig. (1). If the average velocity in 450 mm diameter pipe is 3 m/s. Find: (i) Discharge through 450 mm diameter pipe (ii) Velocity in 200 mm diameter pipe if average velocity in 300 mm pipe is 2.5 m/s	**07**
Q.3	**(a)**	Define Buoyancy and Centre of Buoyancy.	**03**
	(b)	Calculate the absolute pressure at a depth of 4 m below the surface of a liquid of specific gravity 0.8. The barometer reading on the surface is 760 mm of mercury. (Specific gravity of mercury is 13.6)	**04**
	(c)	Derive Euler's equation of motion along a streamline and hence obtain Bernoulli's equation.	**07**
		OR	
Q.3	**(a)**	Given velocity field $= 5x^3\,\hat{\imath} - 15x^2y\,\hat{\jmath}$; obtain the equation of stream line.	**03**
	(b)	Explain Reynold's Experiment with neat sketch.	**04**
	(c)	Explain two methods of dimensional analysis.	**07**
Q.4	**(a)**	Compare laminar and turbulent flow	**03**
	(b)	What is Pitot tube? How is it used to measure velocity of flow at any point in a pipe or channel.	**04**
	(c)	Using Buckingham Pi theorem, show that the lift F_L on airfoil can be expressed as:	**07**

$$F_L = \rho V^2 d^2 \phi\left(\frac{\rho V d}{\mu}, \alpha\right)$$

Where ρ =mass density
V= velocity of flow
d= characteristic depth
μ= coefficient of viscosity
α= Angle of incidence

OR

Q.4	**(a)**	Fig. (2) shows a circular plate of diameter 1.2 m placed vertically in water in such a way that the center of the plate is 2.5 m below the free surface of water. Determine position of center of pressure.	**03**
	(b)	What is meant by Geometric, Kinematic and Dynamic similarities?	**04**
	(c)	A nozzle of 30 mm diameter discharges 0.95 m^3 of water per minute under the head of 65 m. The diameter of the jet is 28 mm. Calculate: (i) The values of coefficients C_c, C_v, C_d (ii) The loss of the head due to fluid resistance	**07**
Q.5	**(a)**	Define coefficient of velocity (C_v), coefficient of contraction (C_c), and coefficient of discharge (C_d).	**03**
	(b)	Enlist advantage and limitations of manometer.	**04**
	(c)	A pipe of diameter 1.5 m is required to transport oil of specific gravity 0.90 and viscosity 3×10^{-2} poise at the rate of 3000 liter/s. Tests were conducted on a 15 cm diameter pipe using water at 20° C. Find out the velocity and flow rate in the model. (Viscosity of water at 20° C = 0.01 poise.)	**07**

OR

Q.5	**(a)**	Define discharge and mean velocity.	**03**
	(b)	Explain principle of Venturimeter.	**04**
	(c)	Two parallel plates kept 100 mm apart, have laminar flow of oil between them with a maximum velocity of 1.5 m/s. (Viscosity of oil= 24.5 poise) Calculate: (i) The discharge per meter length (ii) The shear stress at the plates (iii) The difference in pressure between two points 20 m apart (iv) The velocity gradient at the plates (v) The velocity at 20 mm from plate	**07**

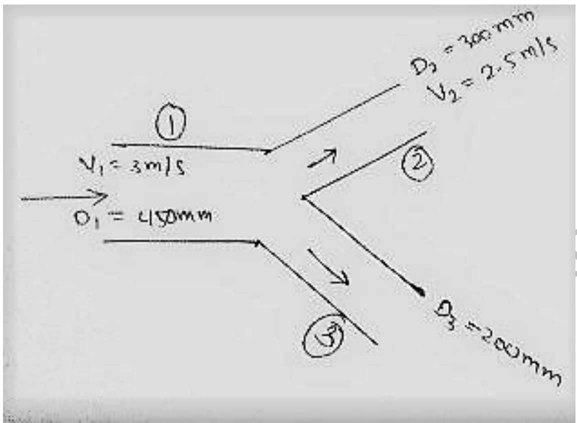

Fig. (1)

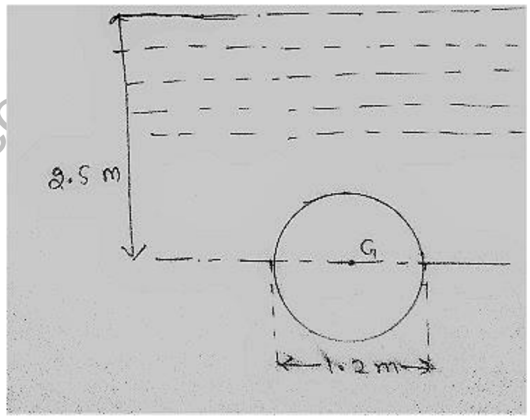

Fig. (2)

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