Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2022

Subject Code:3140611 Date:04-07-2022

Subject Name:Fluid Mechanics & Hydraulics

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define density, specific weight and specific volume.	**03**
	(b)	Calculate the specific weight, density and specific gravity of one litre of liquid which weighs 7 N.	**04**
	(c)	Write about different types of fluid in detail with example.	**07**
Q.2	**(a)**	Differentiate between Piezometer and U-tube manometer	**03**
	(b)	Prove that the rate of increase of pressure in a vertically downward direction must be equal to the specific weight of the fluid at that point.	**04**
	(c)	A differential manometer is connected at the two points A and B of two pipes as shown in Fig.1. The pipe A contains a liquid of sp.gr. = 1.5 while pipe B contains a liquid of sp.gr.= 0.9. The pressures at A and B are 1kgf/cm^2 and 1.8 kfg/cm^2 respectively. Find the difference in mercury level in the differential manometer.	**07**
		OR	
	(c)	State and Prove Pascal's Law.	**07**
Q.3	**(a)**	Define Buoyancy, Center of Pressure, and Metacentric height.	**03**
	(b)	Derive an expression for Centre of Pressure by using " Principle of Moments"	**04**
	(c)	A pipe line which is 4 m in diameter contains a gate valve. The pressure at the centre of the pipe is 19.6 N/cm^2. If the pipe is filled with oil of sp.gr. 0.87, find the force exerted by the oil upon the gate and position of centre of pressure.	**07**
		OR	
Q.3	**(a)**	Define Laminar flow, stream line and path line.	**03**
	(b)	A stream function in a two-dimensional flow is Ψ =2xy. Calculate the velocity at the point (3, 2). Find the corresponding velocity potential Φ.	**04**
	(c)	Define flow net and write in detail characteristics, applications and limitations of flow net.	**07**
Q.4	**(a)**	Explain Venturimeter and parts of Venturimeter with diagram.	**03**
	(b)	An orifice meter with orifice diameter of 150 mm is used to measure the rate of flow of oil in a pipe of 300 mm diameter. The manometer shows a pressure difference of 40 cm of mercury. Find the rate of flow of oil through pipe if sp.gr of oil is 0.8. Take coefficient of discharge for meter = 0.60	**04**
	(c)	Derive equation of velocity measurement using pitot tube. Also explain different arrangement to know the static pressure head h.	**07**
		OR	
Q.4	**(a)**	Enlist minor losses in flow through pipes.	**03**

(b) Calculate the discharge through a pipe of diameter 250 mm when the difference of pressure head between the two ends of a pipe 500 m apart is 3.5 m of water. Take value of friction factor = 0.04 **04**

(c) Derive Darcy–Weisbach equation for friction loss in the pipe. **07**

Q.5 **(a)** Define (i) Prismatic channel (ii) Gradually varied flow (iii) Wetted perimeter **03**

(b) An irrigation lined canal of trapezoidal section has to carry a discharge of 12 cumec at a longitudinal slope of 0.00048. Find the dimensions of most economical section if channel has side slope of 3 horizontal to 2 vertical. Take Manning's constant n = 0.013. **04**

(c) Derive the geometrical conditions for the most economical section of a triangular channel. **07**

OR

Q.5 **(a)** Define (i) Reynold's number (ii) Mach number (iii) Weber number **03**

(b) Write in detail about (i) Geometric similarity (ii) Kinematic similarity **04**

(c) The efficiency η of a fan depends on the density ρ, dynamic viscosity μ, the angular velocity ω, Diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. **07**