

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 1 kgf/cm^2 and 1.8 kgf/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 $\Psi = 2xy$. 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

