Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020

Subject Code:3140611 Date:19/02/2021

Subject Name:Fluid Mechanics & Hydraulics

Time:02:30 PM TO 04:30 PM Total Marks:56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Differentiate between liquid and gas.	**03**
	(b)	For a liquid having mass 2000 kg and volume 2.5 m^3, calculate mass density and weight density.	**04**
	(c)	Enlist fluid properties. Explain any three of them.	**07**
Q.2	**(a)**	Differentiate between simple manometer and differential manometer.	**03**
	(b)	Explain Simple U- tube manometer in brief with sketch.	**04**
	(c)	State & prove Pascal's law.	**07**
Q.3	**(a)**	Define Buoyancy, Metacentric height and Archimedes principle.	**03**
	(b)	Find the volume of water displaced and position of centre of buoyancy for a wooden block of width 2.5 m and depth 1.5 m, when it floats horizontally on water. The density of wooden block is 700 kg/m^3 and length is 5 m.	**04**
	(c)	Derive an expression for the total pressure and position of centre of pressure on a plane surface immersed vertically in a liquid.	**07**
Q.4	**(a)**	Define Laminar flow, Turbulent flow and Rotational flow.	**03**
	(b)	Differentiate between (i) Steady flow and Unsteady flow (ii) Uniform and Non uniform flow.	**04**
	(c)	Explain Bernoulli's equation. What are the practical applications of Bernoulli's equation?	**07**
Q.5	**(a)**	Define (i) Co efficient of contraction, (ii) Co efficient of velocity, (iii) Co efficient of discharge.	**03**
	(b)	Calculate the actual discharge and actual velocity of a jet at venacontracta considering the C_d = 0.6 and C_v = 0.98 for an orifice of 40 mm diameter, if the head over the orifice is 9 m.	**04**
	(c)	Classify different types of orifices according to its shapes, size, discharge condition and shape of upstream edge. Explain all in brief.	**07**
Q.6	**(a)**	Define (i) Hydraulic grade line, (ii) Total energy line, (iii) Equivalent pipe.	**03**
	(b)	Two reservoirs are connected by three pipes laid in parallel. The pipe diameters are 10 cm, 20 cm and 30 cm respectively and they are of same lengths. If the discharge through 10 cm pipe is 0.1 m^3/s, calculate discharge through the other two pipes. Assume f is same for both pipes.	**04**
	(c)	Derive Darcy–weisbach equation for friction loss in the pipe.	**07**
Q.7	**(a)**	Define (i) Hydraulic mean depth, (ii) Wetted perimeter, (iii) Critical velocity.	**03**
	(b)	Find the width and depth of a rectangular channel to convey a discharge of 1.5 m^3/s at a velocity of 0.5 m/s. Take Chezy's constant equal to 60 and bed slope equal to 0.00012.	**04**

	(c)	Derive the geometrical conditions for the most economical section of a trapezoidal channel.	**07**
Q.8	**(a)**	Define (i) Reynolds's number, (ii) Froude's number (iii) Euler's number.	**03**
	(b)	What is Dimensional Homogeneity? What are the applications of Dimensional Homogeneity?	**04**
	(c)	The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of aircraft l, velocity V, air viscosity μ, air density p and bulk modulus of air K. Express the functional relationship between these variables using Buckingham's π- theorem.	**07**

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