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SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR

(AUTONOMOUS)

B.Tech II Year I Semester Regular & Supplementary Examinations March-2023

FLUID MECHANICS & HYDRAULIC MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 60

(Answer all Five Units **5 x 12 = 60** Marks)

UNIT-I

1	a	Differentiate kinematic viscosity and dynamic viscosity. Give their dimensions.	CO1	L4	6M
	b	Calculate the capillary raise in a glass tube of 2.5 mm diameter when immersed vertically water & mercury. Take surface tension is 0.0725 N/m for water and 0.52 N/m for mercury. The specific gravity of mercury is given 13.6 and angle of contact is 130^0	CO1	L3	6M

OR

2	a	List out different types of manometers. Explain about piezometer in detail.	CO1	L1	6M
	b	An inverted U – tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30 cm. When an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective center lines of the pipes) are found to be same and equal to 35 cm. Determine the difference of pressure between the pipes.	CO1	L3	6M

UNIT-II

3	a	Define rate of flow and derive continuity equation for one dimensional flow.	CO2	L1	6M
	b	Water is flowing through a pipe has diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2 . Determine the difference in datum head if the rate of flow through pipe is 40 lit/s.	CO2	L3	6M

OR

4	a	Derive Bernoulli's equation and state assumptions.	CO2	L3	6M
	b	Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 N/cm^2 (gauge) and with mean velocity of 2.0 m/s. Find the total head or total energy per unit weight of the water at a cross section, which is 5 m above the datum line	CO2	L3	6M

UNIT-III

5	a	Explain about Venturimeter with neat sketches. Derive expression for rate of flow through Venturimeter	CO3	L2	6M
	b	A sub-marine move horizontally on a sea and has its axis 15m below the surface of water. A pitot tube properly placed just in front of a sub-marine and along its axis is connected to two limbs of a U – tube containing mercury. The difference of mercury level is found to be 170 mm. Find the speed of the sub marine knowing that the specific gravity of mercury is 13.6 and that of sea water is 1.026 with respect of fresh water.	CO3	L3	6M

OR

6	a	Derive the expression for head loss in pipes due to friction by using Darcy Weisbach equation	CO3	L3	6M
	b	Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 m/s using Darcy formula.	CO3	L3	6M

UNIT-IV

7	a	Obtain an expression for the hydraulic efficiency when a liquid jet strikes a single fixed curved vane	CO4	L3	6M
	b	A 7.5 cm diameter jet having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at 45° to the axis of the jet. Calculate the normal pressure on the plate when (i) the plate is stationary, and (ii) when the plate is moving with a velocity of 15 m/s and away from the jet.	CO4	L3	6M

OR

8	a	Describe the different types of hydroelectric power stations.	CO4	L1	6M
	b	A jet of water having a velocity of 15 m/s, strikes a curved vane which is moving with a velocity of 5 m/s in the same direction as that of the jet at inlet. The vane is so shaped that the jet is deflected through 135°. The diameter of jet is 100 mm. Assuming the vane to be smooth, find: (i) force exerted by the jet on the vane in the direction of the motion, (ii) Power exerted on the vane, and (iii) Efficiency of the vane.	CO4	L4	6M

UNIT-V

9	a	Explain the Classifications and efficiencies of turbines in detail.	CO5	L2	6M
	b	The following data is given for the Francis turbine. Net head H = 60 m, Speed N = 700 r.p.m., Shaft Power = 294.3 kW, ηo = 84 % ηh = 93 %, flow ratio = 0.2, breadth ratio n = 0.1, outer diameter of the runner = 2 X inner diameter of the runner. The thickness of vane occupies 5% of circumferential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radially at outlet. Determine: (i) Guide blade angle, (ii) Runner vane angles at inlet and outlet, (iii) Diameters of runner at inlet and outlet, and (iv) Width of wheel at inlet.	CO5	L3	6M

OR

10	a	Describe pumps in series and parallel.	CO5	L2	6M
	b	The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.	CO5	L3	6M

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