Q. Code:205944

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth -Semester

ME18405 –FLUID MECHANICS AND MACHINERY

(Mechanical Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Students will understand the basic knowledge of properties and characteristics of fluids.	**3**
CO 2	Students will apply the physical laws in solving the problems in hydraulics.	**3**
CO 3	Students will perform dimensional and model analysis.	**3**
CO 4	Students will evaluate the performance of roto dynamic pumps and reciprocating pumps.	**3**
CO 5	Students will determine the performance of turbines and select the type of turbine for an application.	**3**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Calculate the specific weight and specific gravity of 1 litre of a liquid which weighs 7 N.	**1**	**3**
2.	Find the height of a mountain where the atmospheric pressure is 730mm of Hg at Normal conditions.	**1**	**3**
3.	Write down Hagen-Poiseuille equation for laminar flow.	**2**	**2**
4.	Does the friction ‘f ’ remain constant during all flows.? If not, how does it change?	**2**	**3**
5.	Develop the dimensions of the following Physical Quantities:(i)surface tension and (ii)Kinematic viscosity	**3**	**2**
6.	List the types of similarities or similitude used in model analysis.	**3**	**2**
7.	14. Compare sensors and actuators Write shortly about curved forward vanes.	**4**	**3**
8.	16. Draw the block diagram of knock sensor. 16. Draw the block diagram of knock sensor. When will you select a reciprocating pump?	**4**	**3**
9.	Why the pelton wheel does not possess a draft tube?	**5**	**3**

10. Mention the Significance of elbow tube. **5** **3**

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	A Vertical gap of 2.2 cm wide of infinite extent contains a fluid of viscosity 2.0 Ns/m^2 and specific gravity 0.9. A metallic plate 1.2 m x 1.2 m x 0.2 cm is to be lifted up with a constant velocity of 0.15 m/sec through the gap. if the plate is in the middle of the gap, find the force required. The weight of the plate is 40 N.	**(14)**	**1**	**3**
	(OR)			
(b)	A U-Tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs U tube is 20 cm and the free surface of mercury is in level with over the Centre of the pipe. If the pressure of water in pipe line is increased to 50%. Calculate the new difference in the level of mercury. Sketch the arrangement in both cases.	**(14)**	**1**	**3**
12. (a)	A horizontal pipe carries water at the rate of 0.04 m^3/s. Its diameter, which is 30 mm reduces abruptly to 150 mm. Calculate the pressure loss across the contraction. Take the coefficient of contraction C_C= 0.62.	**(14)**	**2**	**3**
	(OR)			
(b)	A 30 m long pipe line connects two reservoir, both of which are open to the atmosphere. The difference in their water level is 12 m. The pipe has three equal sections of 10 m each. The first and last sections are 60 mm in diameter and the intermediate section is 40 mm in diameter. The value of f for the pipes is 0. 0054.Calculate the flow rate and draw the total energy and hydraulic gradient lines.	**(14)**	**2**	**3**
13. (a)	The variables controlling the motion of a floating vessel through water are the drag force F, the speed V, the length L, the density ρ and dynamic viscosity μ of water and acceleration due to gravity g. Derive an expression	**(14)**	**3**	**3**

for F by dimensional analysis.

(OR)

(b)	**(i)**	A model of spillway is made to test the flow. The discharge and the velocity of flow over the model were measured as 3 m^3/s and 1.5 m/s respectively. Determine the discharge and the velocity over the prototype which is 40 times larger than its model.	**(7)**	**3**	**3**
	(ii)	What do you mean by distorted model? Why models of rivers and harbours are made as distorted models.	**(7)**	**3**	**3**
14. (a)		A Centrifugal pump has an impeller 500 mm in diameter at 400 rpm. The discharge at the inlet is entirely radial. The velocity of the flow at outlet is 1 m/s. The vanes are curved backwards at outlet at 30˚ to the wheel tangent. If the discharge of the pump is 0.14 m^3/s. Calculate the impeller power and the torque on the shaft.	**(14)**	**4**	**3**

(OR)

(b)		Explain with a neat sketch the working principle of a single acting reciprocating pump. Also obtain the expression for weight of water delivered by the pump per second.	**(14)**	**4**	**3**
15. (a)		Design a Pelton Wheel for a head of 400 m when running at 750 rpm. The Pelton wheel develops 12110 kW shaft power. The ratio of jet diameter to the wheel diameter is 1/6. The overall efficiency η_o=0.86, Coefficient of velocity C_v = 0.985 and speed ratio ϕ = 0.45.	**(14)**	**4**	**3**

(OR)

(b)		The following data is given for Francis turbine. Net head = 60 m, speed = 700 rpm,shaft power = 294.3 kW, η_o=84%, η_h=93%,flow ratio =0.2, breadth ratio = 0.1, outer diameter of the runner =2 inner diameter of runner. The thickness of vanes occupies 5% of the circumferential area of the runner. Velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine (i) guide blade angle (ii) Runner vane angle at the inlet and outlet (iii) Diameter of the runner at inlet and outlet (iv) Width of the wheel at inlet.	**(14)**	**4**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

	Marks	**CO**	**RBT LEVEL**

16.	Air is introduced through a nozzle into a tank of water to form a stream of bubbles. If the bubbles are intended to have a diameter of 2 mm, calculate how much the pressure of the air at the nozzle must exceed that of the surrounding water. Assume that surface tension of water is 0.073 N/m. What would be the absolute pressure inside the bubble if the surrounding water is at 100 kPa.	**(10)**	**1**	**4**

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