CBCS SCHEME

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BMR403

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Fluid Mechanics and Machinery

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Show the relationship between absolute, gauge, vacuum pressure. Explain with a neat sketch.	6	L2	CO1
	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 of U-tube is 10 cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m^2, calculate the new difference in the level of mercury. Sketch the arrangements in both cases.	14	L3	CO3
		OR			
Q.2	a.	Explain: i) Buoyancy ii) Meta centre iii) Centre of pressure.	6	L2	CO2
	b.	Analyze a vertical plane submerged in a liquid to derive the total pressure force and the centre of pressure.	14	L3	CO2
		Module – 2			
Q.3	a.	Derive Euler's equation of motion along a streamline and hence obtain Bernoulli's equation. Also mention the assumptions made.	12	L2	CO2
	b.	The water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 litres/s. The section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm^2, find the intensity of pressure at section 2.	8	L3	CO3
		OR			
Q.4	a.	What is a venturimeter? Derive an expression for the discharge through a venturimeter.	12	L2	CO2
	b.	A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of sp. gr. 0.8. The discharge of oil through venturimeter is 60 litres/s. Find the reading of the oil-mercury differential manometer. Take $C_d = 0.98$.	8	L3	CO3

		Module – 3			
Q.5	**a.**	Explain the following dimensionless numbers: i) Reynold's number ii) Froude's number	**6**	**L2**	**CO2**
	b.	Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow.	**14**	**L3**	**CO2**
		OR			
Q.6	**a.**	Explain the following dimensionless numbers: i) Eulers number ii) Weber's number	**6**	**L2**	**CO2**
	b.	Derive Darcy-Weisbach equation for friction loss through a pipe.	**14**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	Define turbo machine. Explain the basic parts of turbo machine.	**8**	**L2**	**CO4**
	b.	Derive Euler's equation for a turbomachine.	**12**	**L3**	**CO4**
		OR			
Q.8	**a.**	Define degree of reaction and utilization factor. Obtain the relationship between the two.	**8**	**L2**	**CO4**
	b.	Air enters in an axial flow turbine with a tangential component of the absolute velocity equal to 600 m/s in the direction of rotation. At the rotor exit, the tangential component of the absolute velocity is 100 m/s in a direction opposite to that of rotational speed. The tangential blade speed is 250 m/s. Evaluate: i) The change in total enthalpy of air between the inlet and outlet of the rotor. ii) The power in KW if the mass flow rate is 10 kg/s. iii) The change in total temperature across the rotor.	**12**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Explain the following terms with respect to centrifugal pump: i) Section head ii) Manometric efficiency iii) Volumetric efficiency iv) Manometric head.	**8**	**L2**	**CO4**
	b.	A centrifugal pump delivers 1800 lpm against a total head of 20 m. Its speed is 1450 RPM, inner and outer diameters of the impeller are 120 mm and 240 mm respectively and diameter of suction and delivery pipe are both 120 mm. Determine the blade angles β_1 and β_2 if the water enters radially. Also find the power required to drive the pump.	**12**	**L3**	**CO4**
		OR			
Q.10	**a.**	Explain cavitation and net positive suction head.	**8**	**L2**	**CO4**
	b.	A centrifugal pump has an impeller diameter of 25 cm and width of 7.5 cm at exit. It delivers 120 lit/s of water against a head of 24 m at 1440 rpm. Assuming the vane blocks the area of flow by 5% and a hydraulic efficiency of 0.85, estimate the vane angle at exit. Also calculate the torque exerted on the driving shaft if the mechanical efficiency is 95%.	**12**	**L3**	**CO4**

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