CBCS SCHEME

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BMR403

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2024

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.	Explain: i) Absolute pressure ii) Gauge pressure iii) Vacuum pressure.	6	L1	CO1
	b.	Derive an expression for the depth of centre of pressure from face surface of liquid of an inclined plane surface submerged in the liquid.	10	L2	CO1
	c.	Explain Stability of submerged bodies.	4	L2	CO1
		OR			
Q.2	a.	Derive the three dimensional continuity equations in Cartesian coordinates.	10	L2	CO1
	b.	A stream function represent 2-D fluid flow, $\psi = 2xy$. Find the velocity at a point P(3, 4). Check whether the flow is rotational. Find the velocity potential function ϕ.	10	L3	CO1
		Module – 2			
Q.3	a.	State the assumptions made in deriving the Euler's equation of motion. Hence obtain Bernoulli's equation from Euler's equation with a neat sketch.	12	L2	CO2
	b.	A pipe line is used for supplying water. It has diameter 400mm at the bottom end and 300mm at the upper end. The intensity of pressure is 20KPA and 10KPa at the bottom and upper end respectively. Find datum difference for flow of 60 ℓ/s.	8	L3	CO2
		OR			
Q.4	a.	What is orifice meter? Derive an expression for the discharge through orifice meter.	6	L2	CO2
	b.	A venturimeter has an area ratio of 5:1 and the diameter of large section (inlet) is 25cm. During the flow, the recorded pressure head in the large section is 7.5m and that of at the small section (throat) is 5.5m. If $C_d = 0.97$ find the discharge through the venturimeter.	10	L3	CO2
	c.	Explain Navier – Stokes equation.	4	L2	CO2
		Module – 3			
Q.5	a.	Derive Hagen-Poisenille equation for Viscous flow through a circular pipe.	10	L2	CO3
	b.	Oil is to be transported to the shore at a rate of $0.006m^3/s$ using a pipe of 32cm diameter for a distance of 20Kms. If oil has viscosity $\mu = 0.1Ns/m^2$ and density $\rho = 900Kg/m^3$. Calculate the power necessary to maintain flow.	6	L3	CO3
	c.	Define Reynolds number. What is the significance of critical Reynolds number?	4	L4	CO3
		OR			
Q.6	a.	Derive an expression for major loss through pipe.	8	L2	CO3
	b.	Define the following terms i) boundary layer ii) Boundary layer thickness.	4	L1	CO3

	c.	A kite of mass 0.5Kg and surface area $0.5m^2$ is flying in air of density $1.2Kg/m^3$. The tension in the string is 12N. Which makes an angle of 35° with the horizontal. If the wind speed is 30Kmph, determine the coefficient of drag and lift.	8	L3	CO3
		Module – 4			
Q.7	**a.**	Define a turbo-machine, with a neat sketch explain the parts of a turbo-machine. Also classify turbo-machine.	10	L2	CO4
	b.	Define utilization factor for a turbine. Derive an expression relating utilization factor with degree of reaction.	10	L2	CO4
		OR			
Q.8	**a.**	With a neat sketch, explain the principle and working of Pelton wheel along with velocity triangle.	10	L2	CO4
	b.	An inward flow Francis turbine operates at 486rpm and uses $100m^3$/min of water. The draft tube diameter at inlet and outlet are 0.8m and 1.5m respectively. The length of the draft tube is 30m. The available head is 81m. Assuming $\eta_v = 0.98$, $\eta_m = 0.97$ and $\eta_H = 0.92$, find the runner tip diameter, power output and speed ratio if the flow ratio $\psi = 0.2$. The blade at the inlet in inclined 120° to the wheel tip velocity.	10	L3	CO4
		Module – 5			
Q.9	**a.**	With a neat sketch, explain the working of centrifugal pump.	10	L2	CO4
	b.	A centrifugal pump impeller has straight (radial) vanes from inner radius of 8cm to outer radius 24cm. The width of the impeller is constant and is 6cm between the shrouds. If the speed is 1500rpm and the discharge is 250ℓ/s. Find the outlet pressure if inlet pressure = 0.8KPa and water flow is outward.	10	L3	CO4
		OR			
Q.10	**a.**	What is minimum starting speed of a centrifugal pump? Derive on expression for minimum and starting speed.	10	L2	CO4
	b.	Write a note on the following with respect to centrifugal pump. i) Cavitations ii) Need for priming iii) NPSH iv) Pumps in series and parallel.	10	L2	CO4

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