CBCS SCHEME - Make-Up Exam

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BCV402

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Fluid Mechanics and Hydraulics

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.	Define the following : i) Specific Gravity ii) Specific Volume iii) Dynamic Viscosity iv) Kinematic Viscosity	4	L1	CO1
	b.	State and prove Pascal's law.	8	L1	CO1
	c.	The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 metre per sec requires a force of 9.81 N to maintain the speed. Determine : i) The dynamic viscosity of the oil in poise ii) The kinematic viscosity of the oil in stokes, if the specific gravity of the oil is 0.95.	8	L2	CO1
		OR			
Q.2	a.	Define the following : i) Ideal fluid ii) Real fluid iii) Newtonian fluid iv) Non-Newtonian fluid.	4	L1	CO1
	b.	Explain the terms capillarity and surface tension properties of a fluid.	8	L1	CO1
	c.	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 the 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 10cm and the free surface of mercury is in level with centre of the pipe. If the pressure of water in pipeline is reduced to 9810 N/m^2, Calculate the new difference in the level of mercury. Sketch the arrangements in both the cases.	8	L1	CO1
		Module – 2			
Q.3	a.	Define velocity potential and stream function.	4	L1	CO2
	b.	Derive an expression for Bernoulli's theorem with suitable sketches.	8	L2	CO2
	c.	A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and vacuum pressure at the throat is 30 cm of mercury. Determine the discharge through venturi meter. Take $C_d = 0.98$.	8	L2	CO2

		OR			
Q.4	a.	Mention the applications and limitations of having venturi meter.	4	L1	CO2
	b.	Derive an expression for the discharge through an orifice meter..	8	L2	CO2
	c.	An orifice-meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauge fitted upstream and downstream of the orifice-meter gives readings of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. The coefficient of discharge of the meter is 0.60. Determine the discharge of water through the pipe.	8	L2	CO2
		Module – 3			
Q.5	a.	What are hydraulic co-efficients? Explain briefly.	4	L2	CO3
	b.	Derive an expression for the loss of head due to sudden contraction of the pipe.	8	L2	CO3
	c.	Three pipes of lengths 800 m, 600 m and 300 m having diameters 400 mm, 300 mm and 200 mm respectively are connected in series. The ends of the compound pipes are connected to two tanks, whose water surface levels are maintained at a difference of 15 m. Determine the rate of flow of water through the pipe, if f = 0.005. What will be the diameter of a single pipe of length 1700 m and f = 0.005, which replaces three pipes.	8	L2	CO3
		OR			
Q.6	a.	Mention the classifications of orifice and mouth piece.	4	L1	CO3
	b.	Derive an expression for the discharge over a rectangular notch/weir in terms of head of water over the crest of the weir.	8	L2	CO3
	c.	Water flows over a rectangular weir 1 m wide at a depth of 150 mm and afterwards passes through a triangular right angled weir. Taking C_d for the rectangular and triangular weir as 0.62 and 0.59 respectively. Determine the depth of flow over the triangular weir.	8	L2	CO3
		Module – 4			
Q.7	a.	Mention the different classification of open channel flow.	4	L1	CO4
	b.	Derive an expression for a trapezoidal channel section in an open channel flow having most economical condition.	8	L2	CO4
	c.	A trapezoidal channel with side slopes of 3 horizontal to 2 vertical has to be designed to convey $10 m^3/s$ at a velocity of 1.5 m/s, so that the amount of the concrete lining for the bed and sides is minimum. Determine : i) The wetted perimeter ii) Slope of the bed, if Manning's constant N = 0.014 in Manning's formula.	8	L2	CO4

		OR			
Q.8	**a.**	Mention the assumption made during the gradually varied flow.	**4**	**L1**	**CO4**
	b.	Derive an expression for loss of energy due to hydraulic jump.	**8**	**L2**	**CO4**
	c.	The depth of flow of water, at a certain section of a rectangular channel of 2 m wide, is 0.3 m. The discharge through the channel is 1.5m^3/s. Determine whether a hydraulic jump will occur and if so, find its height and loss of energy per kg of water.	**8**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Differentiate between impulse and reaction turbine.	**4**	**L1**	**CO5**
	b.	Derive an expression for the force exerted on a curved plate or vane, when the plate is moving in the direction of the jet.	**8**	**L1**	**CO5**
	c.	A Jet of water 60 mm in diameter, strikes a curved vane at its centre with a velocity of 18 m/s. The curved vane is moving with a velocity of 6 m/s in the direction of jet. The jet deflected through an angle of 165°. Assuming the plate to be smooth, find : i) Thrust on the plate in the direction of jet ii) Power of the jet and iii) Efficiency of the jet	**8**	**L2**	**CO5**
		OR			
Q.10	**a.**	Mention the advantages and disadvantages of a Francis turbine over a Pelton wheel turbine.	**4**	**L1**	**CO5**
	b.	Explain briefly the classification of heads and efficiencies of a centrifugal pump.	**8**	**L1**	**CO5**
	c.	A Pelton wheel is to be designed for the following specifications. Power (Brake or Shaft) = 9560 kW Head = 350 meters Speed = 750 rpm Overall efficiency = 85% Jet diameter not to exceed 1/6 the wheel diameter Determine the following : i) The wheel diameter ii) Diameter of the jet iii) The number of jets required Take C_v = 0.985 and Speed ratio = 0.45.	**8**	**L2**	**CO5**

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