U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 19CV4PCHYM **Max Marks: 100**
Course: Hydraulics and Hydraulic Machines

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

				CO	*PO*	Marks
			UNIT – I			
1	a)		Water flows at a uniform depth of 2 m in a trapezoidal channel having a bottom width 6 m, side slopes 2H: 1V. If it has to carry a discharge of 65 m^3/s, compute the bottom slope required to be provided. Take Manning's n = 0.025.	*CO* 1	*PO1*	**6**
	b)		Differentiate between (i) steady and unsteady flow (iii) uniform and non-uniform flow (iii) supercritical and subcritical flow	*CO* 1	*PO1*	**6**
	c)		An irrigation canal is required to convey 10 m^3/s of water at a mean velocity of 1.25 m/s. For the canal to be most efficient, compare the rectangular and trapezoidal shape and identify the most economical one.	*CO* 1	*PO2*	**8**
			OR			
2	a)		With a neat sketch explain the terms bed slope, total energy line, hydraulic grade line as applicable to open channel flows.	*CO* 1	*PO1*	**6**
	b)		For a constant specific energy of 1.8 N.m/N, calculate the maximum discharge that may occur in a rectangular channel 5.0 m wide.	*CO* 1	*PO1*	**6**
	c)		An irrigation channel of trapezoidal section, having side slopes 3H : 2V, is to carry a flow of 10 m^3/s on a longitudinal slope of 1 in 5000. The channel is to be lined for which the value of friction coefficient in Manning's formula is n = 0.012. Determine the dimensions of the most economical section of the channel.	*CO* 1	*PO2*	**8**
			UNIT – II			
3	a)		With a neat sketch discuss the formation of M1 profile in a real word scenario and explain the characteristics of the M1 profile.	*CO* 1	*PO1*	**6**
	b)		Water flows at a rate 15 m^3/s through an 8 m wide rectangular channel, depth of flow being 500 mm. Analyse whether a hydraulic jump occurs in the channel and if yes, calculate the depth after the jump.	*CO* 1	*PO2*	**6**

		c)	State the assumptions made in the analysis of hydraulic jump. Also derive the relationship between the alternate depths in a hydraulic jump formed in a horizontal rectangular channel.	***CO*** 1	***PO1***	**8**
			UNIT - III			
	4	a)	A 50 mm diameter jet having a velocity of 25 m/s, strikes a flat plate, the normal of which is inclined at 30^o to the axis of the jet. Calculate (i) the normal force exerted on the plate when the plate is stationary (ii) the normal force when the plate is moving with a velocity of 10 m/s in the direction of the jet (iii) the work done and efficiency of the jet when the plate is moving.	***CO*** 2	***PO1***	**10**
		b)	A jet of water with a velocity of 20 m/s impinges on a moving vane of velocity 10 m/s. The jet makes an angle 20^o to the direction of motion of the vane at the inlet and leaves at an angle 130^o to the direction of motion of vane at outlet. Compute (i) the vane angles so that the water enters and leaves without shock (ii) the work done per second on the vane per unit weight of water striking the vane per second.	***CO*** 2	***PO1***	**10**
			UNIT – IV			
	5	a)	A Pelton wheel generates 8000 kW under a net head of 130 m at a speed of 200 r.p.m. Assume the coefficient of velocity for the nozzle = 0.98, speed ratio = 0.46, and jet diameter to wheel diameter = 1/9, hydraulic efficiency = 87 %, and mechanical efficiency = 75 %. Determine (i) the discharge required (ii) diameter of the wheel (iii) diameter of the jet and (iv) number of jets required.	***CO*** 3	***PO1***	**10**
		b)	Define the following terms with respect to hydraulic turbines (i) Draft tube (ii) Specific speed (iii) Unit discharge (iv) Hydraulic efficiency and (v) Mechanical efficiency.	***CO*** 3	***PO1***	**10**
			OR			
	6	a)	Explain the importance of the characteristic curves of a turbine. Also explain the three important characteristic curves for a hydraulic turbine.	***CO*** 3	***PO1***	**10**
		b)	A Francis turbine with an overall efficiency of 75 % is required to produce 148.25 kW power. It is working under a head of 7.62 m. The peripheral velocity = $0.26\sqrt{2gH}$ and the radial velocity of flow at inlet is = $0.96\sqrt{2gH}$. The wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22 % of the available energy. Assuming radial discharge, estimate (i) the guide blade angle (ii) the wheel vane angle at inlet and (iii) the diameter of the wheel at inlet.	***CO*** 3	***PO1***	**10**
			UNIT – V			
	7	a)	Explain the following terms as applied to a centrifugal pump (i) Priming (ii) Manometric head (iii) Cavitation (iv) Minimum starting speed and (v) Multi-stage pumps.	***CO*** 3	***PO1***	**10**

		b)	A centrifugal pump has an impeller 0.5 m outer diameter and 0.25 m inner diameter. The pump when running at 600 r.p.m discharges water at the rate of 8000 litres per minute against a head of 8.5 m. The water enters the impeller without whirl and shock and the vanes are set back at outlet an angle of 45^o. The area of flow which is constant from inlet to outlet of the impeller is 0.06 m^2. Determine (i) manometric efficiency of the pump (ii) and the vane angle at inlet.	***CO*** 3	***PO2***	**10**

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