BT MRE-IV(R/S)-06-23-2332 Reg. No. | | | | | | | | |

C

B.Tech. Degree IV Semester Regular/Supplementary Examination in Marine Engineering June 2023

19-208-0405 HYDRAULIC MACHINERY

(2019 *Scheme*)

Time: 3 Hours Maximum Marks: 60

Course Outcome

On successful completion of the course, the students will be able to:

CO1: Understand dimensional analysis and principles of similitude.
CO2: Apply the momentum principles to impinging jets and analyse the performance of hydraulic turbine.
CO3: Learn the performance characteristics of various hydraulic turbines, their specific speed and speed control.
CO4: Understand the working of roto-dynamic pumps and positive displacement pumps.
CO5: Study the principle of working of hydraulic devices.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 –Analyze, L5 – Evaluate, L6 – Create

PI – Programme Indicators

(Answer *ALL* questions) (5 × 15 = 75)

			Marks	BL	CO	PI
I.	(a)	Using Rayleigh method, derive the time period of simple pendulum which may depend upon the length of the pendulum, mass of the bob and acceleration due to gravity.	5	L3	1	1.2.1
	(b)	A model of rectangular pier 1.5 m wide and 4.5 m long in the river is built to a scale of 1: 25. The average depth of water in the river is 3 m. The model was tested in a laboratory where the velocity of flow was maintained constant at 0.6 m/s. It was observed that the force acting on the model was 3.6 N and the height of the standing wave was 30 mm. Determine the following for the prototype: (i) The corresponding speed. (ii) The force acting. (iii) The height of the standing wave at nose.	10	L4	1	2.1.2
		OR				
II.	(a)	In 1 in 40 model of a spillway, the velocity and discharge are 2 m/s and 2.5 m^3/s. Find the corresponding velocity and discharge in the prototype.	5	L3	1	1.2.1
	(b)	Using Buckingham's π theorem, derive an equation for lift of an aerofoil (F_L) which may depend upon mass density 'ρ', velocity of flow 'V' , characteristic depth 'd', angle of incidence 'α' and viscosity 'μ'	10	L4	1	2.1.2
III.	(a)	Explain the working of Pelton wheel with the help of a neat sketch.	5	L2	2	1.2.1
	(b)	A jet of water having a velocity of 20 m/s strikes a curved vane, which is moving with a velocity of 10 m/s. The jet makes an angle of 20° with the direction of motion of vane at inter and leaves at an angle of 130° to the direction of motion of vane an outlet. Calculate: (i) Vane angles, so that the water enters and leaves the vane without shock. (ii) Work done per second per unit weight of water striking the vane.	10	L4	2	2.1.2
		OR				

(P.T.O.)

			Marks	BL	CO	PI
IV.	(a)	Explain the working of Kaplan turbine with the help of a neat sketch.	5	L2	2	1.2.1
	(b)	The external and internal diameters of an inward flow reaction turbines are 1.20 m and 0.6 m respectively. The head on the turbine is 22 m and velocity of flow through the runner is constant and equal to 2.5 m/s. The guide blade angle is given as 10° and the runner vanes are radial at inlet. If the discharge at outlet is radial, determine: (i) The vane angle at outlet of the runner. (ii) The speed of the turbine. (iii) Hydraulic efficiency.	10	L4	2	2.1.2
V.	(a)	Explain unit quantities in turbine.	5	L2	3	2.1.2
	(b)	A conical draft-tube having inlet and outlet diameters 1 m and 1.5 m discharges water at outlet with a velocity of 2.5 m/s. The total length of the draft-tube is 6 m and 1.20 m of the length of draft-tube is immersed in water. If the atmospheric pressure head is 10.3 m of water and loss of head due to friction in the draft-tube is equal to 0.2 times the velocity head at outlet of the tube, find: (i) Pressure head at inlet. (ii) Efficiency of the draft tube.	10	L4	3	2.1.2
		OR				
VI.	(a)	Explain characteristics curves of hydraulic turbines.	5	L2	3	2.1.2
	(b)	A Pelton wheel develops 8 MW under a net head of 130 m at a speed of 200 r.p.m. Assuming the co-efficient of velocity for the nozzle 0.98, hydraulic efficiency 87%, speed ratio 0.46 and jet diameter to wheel diameter ratio determine: (i) The discharge required. (ii) The diameter of the wheel. (iii) The diameter and number of jets required. (iv) The specific speed. Take Mechanical efficiency as 75%.	10	L4	3	2.1.2
VII.	(a)	Explain the working of centrifugal pump with the help of a neat sketch.	7	L2	4	2.1.2
	(b)	Derive an expression for minimum speed for starting centrifugal pump.	8	L3	4	2.1.2
		OR				
VIII.	(a)	Explain the working of single acting reciprocating pump with the help of a neat sketch.	7	L2	4	2.1.2
	(b)	Derive the amount of work saved by fitting air vessels in a single acting reciprocating pump.	8	L3	4	2.1.2
IX.	(a)	Explain the working of hydraulic intensifier with the help of a neat sketch.	7	L2	5	1.2.1
	(b)	Explain the working of fluid coupling with the help of a neat sketch.	8	L2	5	1.2.1
		OR				
X.	(a)	Explain the working of hydraulic torque converter with the help of a neat sketch.	7	L2	5	1.2.1
	(b)	Explain the working of hydraulic ram with the help of a neat sketch.	8	L2	5	1.2.1

Bloom's Taxonomy Levels
L1 - 6.6%, L2 – 42.6%, L3 – 17.3%, L4 – 40%,

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