R22 Regulation *Subject code: 4E4AD*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech IV Semester Supplementary Examinations, December 2024

HYDRAULICS & HYDRAULIC MACHINERY

(Civil Engineering)

Maximum Marks: 60 Date:10.12.2024 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

	Part-A	CO	Bloom Tx
All the following questions carry equal marks (10X1M=10 Marks)			
1.a)	Explain the terms specific energy, critical depth, critical velocity	1	1
b)	Explain the terms:(i) hydraulic mean depth and (ii) wetted perimeter.	1	1
c)	State Froude's model law.	2	1
d)	Give the dimensions of the following physical quantities: surface tension and dynamic viscosity.	2	2
e)	Define angular momentum.	3	2
f)	What is the efficiency of a jet striking a moving vane?	3	2
g)	A hydraulic reaction turbine working under a head of 16 m develops 640 kW of power. What is unit of power of the turbine?	4	2
h)	Define gross head and net or effective head.	4	1
i)	Classify pumps on the basis of transfer of mechanical energy.	5	2
j)	List the losses in centrifugal pump.	5	1
	Part-B		
Answer All the following questions. (5X10M=50Marks)			Bloom Tx level
2	Show that in a rectangular channel [5M][5M] (i) Critical depth is two-third of specific energy and (ii) Froude number at critical depth is unity	1	3
	OR		
3	A power canal of trapezoidal section has to be excavated through hard clay at the least cost. Determine the dimensions of the channel given, discharge equal to 14 m^3/sec, bed slope 1 : 2500 and Manning's N = 0.020. [10M]	1	4
4	Distinguish between Rayleigh's method and Buckingham's π-theorem. [10M]	2	3
	OR		
5	The resisting force F of a plane during flight can be considered as dependent	2	4

	upon the length of aircraft (l), velocity (v), air viscosity (μ), air density (ρ) and bulk modulus of air (K). Express the functional relationship between these variables using dimensional analysis. Explain the physical significance of the dimensionless groups arrived. [10M]		
6	Find the work done per second on a series of moving curved vanes by a jet of water striking at one of the tips of the vane. [10M]	3	3
	OR		
7	A jet of water of diameter 7.5 cm strikes a curved plate at its centre with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction jet. The jet is deflected through an angle of 165^0. Assuming the plate smooth find: Force exerted on the plate in the direction of jet, Power of the jet and Efficiency of the jet. [10M]	3	3
8	Draw inlet and outlet velocity triangles for a Pelton turbine and indicate the direction of various velocity components. Also obtain an expression for the work done per second by water on the runner of the Pelton wheel. [10M]	4	3
	OR		
9	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 = 0.261 and the radial velocity of flow at inlet is 0.964 The wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22 % of the available energy. Assuming radial discharge, determine: (i) The guide blade angle (ii) The wheel vane angle at inlet (iii) Diameter of the wheel at inlet, and (iv) Width of the wheel at inlet. [10M]	4	4
10	A. With a neat sketch, explain the principle and working of a centrifugal pump. [5M]	5	3
	B. Define cavitation and discuss its causes, effects and prevention. [5M]		3
	OR		
11	A centrifugal pump has an impeller 500 mm in diameter running at 400 rpm. The discharge at the inlet is entirely radial. The velocity of the flow at outlet is 1 m/s. The vanes are curved backwards at outlet at 30° to the wheel tangent. If the discharge of the pump is 0.14 m3/s, calculate the impeller power and the torque on the shaft. [10M]	5	4