R20 Regulation *Subject code: 3P4AD*

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: 70 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 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X2M=20) Marks)		CO	Bloom Tx
1	What is hydraulic jump?	1	L1
2	Write about the rapid varied flow and gradually varied flow.	1	L1
3	State Reyleigh's method of dimensional analysis.	2	L1
4	Define Reynolds number, Weber number and Mach number.	2	L1
5	Show that the forces exerted by a jet of water on a inclined fixed plate in the direction of the jet is given by $F_x = \rho a V^2 \sin^2\theta$. Where a = area of the jet, V= velocity of the jet and θ= inclination of the plate with the jet.	3	L1
6	State the principle of Angular momentum.	3	L1
7	What is a draft tube? What are its functions?	4	L1
8	Write about surge tank in turbines.	4	L1
9	What is priming? Why is it necessary?	5	L1
10	Differentiate between single stage and multi stage centrifugal pump.	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		CO	Bloom Tx
11	A) Prove that for a channel of circular section, the depth of flow d = 0.81D for maximum velocity and d = 0.95D for maximum discharge where D = diameter of circular channel, d=depth of flow. [5M] B) Find the discharge through a trapezoidal channel of width 6m and side slope of 1 horizontal to 3 verticals. The depth of flow of water is 3m and chez's constant, C=60.The slope of the bed of the channel is given 1 in 5000. [5M]	1	L2
	OR		
12	A sluice gate discharges water into a horizontal rectangular channel with a velocity of 8m/s and depth of flow is 0.5m. The width of the channel is 6m. Determine whether a hydraulic jump will occur, and if so, find its height and loss of energy per kg of water. Also determine the horse power lost in the hydraulic jump. [10M]	1	L2

13	A) Explain about similarities? [5M] B) Explain about different types of forces acting in moving liquid. [5M]	2	L2
	OR		
14	The pressure difference Δp in a pipe of diameter D and length due to turbulent flow depends on the velocity V, viscosity μ, density ρ and roughness K. Using Buckingham's π-theorem, obtain expression for Δp. [10M]	2	L2
15	A) Prove that the force exerted by the jet of water on a fixed semi-circular plate in the direction of the jet when the jet strikes the centre of the semi-circular plate is two times the force exerted by the jet on a fixed vertical plane . [5M] B) A jet of water of 10 cm diameter is discharging under a constant head of 80m. Find the force exerted by the jet on a fixed plate. Take coefficient of velocity as 0.9. [5M]	3	L2
	OR		
16	A) Find an expression for the efficiency of a series of moving curved vanes when a jet of water strikes the vanes at one of its tips. Prove that maximum efficiency is when u=v and value of maximum efficiency is 50% [5M] B) Show that for a curved radial vane, the work done per second is given by $\rho aV1[V_{w1}u_1 \pm V_{w2}u_2$ [5M]	3	L2
17	A) Define the term unit power , unit speed and unit discharge with reference to a hydraulic turbine. And also derive the expression for these terms. [5M] B) A turbine develops 9000KW when running at a speed of 140rpm and under a head of 30m. Determine the specific speed of the turbine. [5M]	4	L2
	OR		
18	A. Define the term unit power, unit speed and unit discharge with reference to a hydraulic turbine. And also derive the expression for these terms. [5M] B. Design a pelton wheel which is required to develop 1500 kW, when working under a head of 160 m at a speed of 420 rpm. The overall efficiency may be taken as 85% and assume other data required. [5M]	4	L2
19	A centrifugal pump rotating at 1000rpm delivers 160 lit/sec of water against a head of 30m. The pump is installed at a place where atmospheric pressure is $1x10^5$ KPa. and vapour pressure of water is 3 KPa. The head loss in suction pipe is equivalent to 0.2m of water. Calculate: i) Maximum NPSH and ii) Maximum allowable height of the pump from free surface of water in the sump. [10M]	5	L2
	OR		
20	A centrifugal pump with 1.2m diameter runs at 200 r.p.m. and pumps 1880 liters/s, the average lift being 6m. The angle which the vanes make at exit with the tangent to the impeller is 26^0 and the radial velocity of flow is 2.5m/s. Determine the manometric efficiency and the least speed at start pumping against a head of 6m, the inner diameter of the impeller being 0.6m [10M]	5	L2