



**B.Tech IV Semester Regular Examinations, July 2024**

**HYDRAULICS & HYDRAULIC MACHINERY**  
*(Civil Engineering)*

**Maximum Marks: 60**

**Date: 25.07.2024 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)	Define the term most economical section of a channel.	1M	1
b)	What is the relation between Manning's and Chezy's constant?	1M	2
c)	Explain the term, 'dimensionally homogeneous equation'	1M	2
d)	Define Geometric similarity?	1M	1
e)	What is the effect of curvature on the force exerted by a jet on a curved vane?	1M	1
f)	Write the expression for the work done by a jet on a moving flat vane.	1M	2
g)	Distinguish between an impulse turbine and a reaction turbine	1M	2
h)	What is meant by hydraulic efficiency of turbine?	1M	1
i)	Why is priming necessary in centrifugal pump?	1M	2
j)	Define cavitation in centrifugal pump.	1M	1
Part-B			Bloom Tx level
Answer All the following questions. (5X10M=50Marks)			
2	Prove that for the trapezoidal channel of most economical section Half of Top width is equal to Length of one of the sloping sides. [10M]	1	3
OR			
3	A trapezoidal channel has side slope of 1 horizontal to 2 vertical and the slope of the bed is 1 in 1500. The area of the section is 40 m <sup>2</sup> . Find the dimensions of the section if it is most economical. Determine the discharge of the most economical section if C = 50. [10M]	1	4
4	The pressure difference ΔP in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's π- theorem, obtain an expression for ΔP. [10M]	2	4
OR			
5	A 1:15 model of a flying boat is towed through water. The prototype is moving in sea-water of density 1024 kg/m <sup>3</sup> at a velocity of 20 m/s. Find the corresponding speed of the model. Also determine the resistance due to waves on model if the resistance due to waves of prototype is 600 N. [10M]	2	4

6	Find an expression for the efficiency of a series of moving curved vanes by a jet of water striking at one of the tips of the vane. Prove that maximum efficiency is when $u = V$ and the value of maximum efficiency is 50%. [10M]	3	3
	OR		
7	Explain the Principle of Operation, Types, Working Mechanism Applications of Radial Flow Turbines. [10M]	3	4
8	A. What is specific speed? Derive an expression for specific speed of turbines. [5M]	4	3
	B. A turbine develops 9000 kW when running at a speed of 140 r.p.m and under a head of 30 m. Determine the specific speed of the turbine. [5M]		3
	OR		
9	A Kaplan turbine delivers 10 MW under a head of 25 m. The hub and tip diameters are 1.2 m and 3 m. Hydraulic and overall efficiencies are 0.90 and 0.85. If both velocity triangles are right angled triangles, determine the speed, guide blade outlet angle and blade outlet angle. [10M]	4	5
10	A. What is the difference between single-stage and multi stage pumps? [5M] B. Describe multistage pump with (a) impellers in parallel and (b) impellers in series. [5M]	5	3
	OR		
11	The dimensionless specific speed of a centrifugal pump is 0.06. Static head is 32 m. Flow rate is 50 l/s. The suction and delivery pipes are each of diameter 15 cm. The friction factor is 0.02. Total length is 60 m other losses equal 4 times the velocity head in the pipe. The vanes are forward curved at $120^\circ$ . The width is one tenth of the diameter. There is a 7% reduction in flow area due to the blade thickness. The Manometric efficiency is 80%. Determine the impeller diameter if inlet is radial. (ii) Explain about the performance characteristics of centrifugal pumps. [10M]	5	4