



B.Tech IV Semester Regular/Supplementary Examinations, July 2021

**Hydraulics and Hydraulic Machinery
Civil Engineering**

Maximum Marks: 70

Date:31.07.2021 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.
 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)

- 1 Differentiate the sub critical and super critical flow.
- 2 Define 'conveyance' of an open channel.
- 3 Distinguish between a model and prototype.
- 4 Compare a distorted and undistorted model.
- 5 What are radial flow turbines?
- 6 State the angular momentum principle.
- 7 Define Volumetric efficiency and overall efficiency of a turbine.
- 8 What is the function of a draft tube?
- 9 Define NPSH.
- 10 List the use of air vessels fitted in a pump.

Part-B

Answer All the following questions. (10M X 5=50Marks)

- 11 Explain the computation of uniform flow using Manning's and Chezy's method. (10M)
OR
- 12 A. Derived rapid varied flow? (5M)
B. Explain Energy Dissipation? (5M)
- 13 Give an account of Kinematic, Geometric and Dynamic similarities. (10M)
OR
- 14 You are interviewed by a panel of experts. As you had highlighted that fluid mechanics is your area of interest, the panel wants you to find the efficiency of the rotating fan in the interview hall. The efficiency depends on density, dynamic viscosity, angular velocity, diameter of the rotor. Use Buckingham's pi theorem to analyse the same. (10M)
- 15 Derive the equation for power and work done for the impact of hydrodynamic jet at an angle on moving curved vanes. (10M)
OR
- 16 Give a detailed account of the construction of inlet and exit velocity triangles in case of impact of jets on inclined moving vanes. (10M)

- 17 Design a Francis Turbine runner with the following data: Net head $H = 68$ m, Speed $N = 750$ rpm, Output power $P = 330$ kW, Overall efficiency = 85%, Hydraulic efficiency = 94%, Flow ratio = 0.15, Breadth ratio $n = 0.1$, Outer diameter = 2 x inner diameter. Also assume 6% of circumferential area of the runner to be occupied by the thickness of the vanes. Velocity of flow remains constant throughout and flow is radial at exit. (10M)

OR

- 18 A Pelton wheel turbine runs under a head of 400 m at a speed of 700 rpm. It develops a power of 3500 kW. Find the minimum diameter of the jet and the wheel diameter, Assume overall efficiency of the turbine as 80%, $C_v = 0.98$, Speed ratio = 0.4. Find the number of buckets. (10M)

- 19 The cross-sectional area of a plunger of reciprocating pump equals 1.5 times that of a delivery pipe. The delivery pipe is 60 m long and it rises upward at a slope of 1 in 6. If the plunger has an acceleration of 2.4 m/s^2 at the end of the stroke and separation pressure is 2.5 m of water, find whether separation will take place. (10M)

OR

- 20 A centrifugal pump discharges of $0.118 \text{ m}^3/\text{s}$ at a speed of 1450 rpm against a head of 25 m. The diameter of the impeller is 250 mm and width at outlet is 50 mm, Manometric efficiency is 75%. Determine the vane angle at outlet of the impeller. (10M)