

R18

Code No: 154BA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, September/October - 2023

HYDRAULICS AND HYDRAULIC MACHINERY

(Civil Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) What is specific energy curve? [2]
- b) Distinguish between sub critical and super critical flow. [3]
- c) What is hydraulic jump? [2]
- d) Define the terms Afflux and back water curve. [3]
- e) What are the uses of dimensional analysis? [2]
- f) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of jet. [3]
- g) Distinguish between Inward and outward flow reaction turbine. [2]
- h) Define specific speed of a turbine and write its formula. [3]
- i) What do you mean by Net positive suction Head? [2]
- j) Distinguish between single stage and Multi stage centrifugal pumps. [3]

PART – B

(50 Marks)

- 2.a) Determine the expression for the most economical trapezoidal section in terms of side slope?
- b) Find the most economical cross section of a rectangular channel which is to be dug in the rocky portion of a soil. The channel is to convey $8 \text{ m}^3/\text{s}$ of water with an average velocity of 2 m/s . Take Chezy's constant $C = 65$. [5+5]

OR

- 3.a) Derive an expression for critical depth and critical velocity.
- b) A concrete lined circular channel of diameter 3 m has a bed slope of 1 in 500 . Find out velocity and flow rate for conditions of Max. Velocity and Max. Discharge. Assume Chezy's constant $C = 50$. [5+5]

- 4.a) Derive an expression for loss of energy head for a hydraulic jump.
- b) What are assumptions of gradually varied flow? Derive the Dynamic equation of gradually varied flow. [5+5]

OR

- 5.a) Distinguish between gradually varied flow and rapidly varied flow? Illustrate with neatly drawn sketches.
- b) A hydraulic jump forms at the downstream end of spillway carrying $18.62 \text{ m}^3/\text{s}$ discharge. If depth before jump is 0.82 m , determine the depth after the jump and energy loss. [5+5]

- 6.a) What are distorted models? What are the reasons of constructing such models for rivers?
b) A jet of water of diameter 8.5 cm strikes a curved plate at its center with a velocity of 30 m/sec. The curved plate is moving with a velocity of 8.5 m/sec in the direction of the jet. The jet is deflected through an angle of 165 degree. Assuming the plate smooth find. [5+5]

OR

- 7.a) Derive the expression for force exerted by a jet on stationary curved plate if jet strikes the curved plate at the Centre and at one end.
b) For laminar flow in a pipe the drop in pressure ΔP is a function of the pipe length L, its diameter D, mean velocity of flow V and the dynamic viscosity. Using Rayleigh's method, develop an expression for ΔP . [5+5]

- 8.a) Explain in detail the various characteristic curves present in the case of turbines.
b) A reaction turbine work at 550 rpm under a head of 100m. the diameter of turbine at inlet is 100cm. and the flow area is 0.35m^2 . the angle made by absolute and relative velocity at inlet are 15° and 60° with the tangential velocity. Determine the volume flow rate, the power developed and efficiency, assume whirl at outlet to be zero. [5+5]

OR

- 9.a) Distinguish between impulse turbine and reaction turbine on the basis of principle of working, pressure head, discharge and application.
b) A jet strikes the buckets of Pelton wheel, which is having shaft power as 16450kW. The diameter of each jet is given as 210mm. If the net head on the turbine is 420m. Find the overall efficiency of the turbine, take $C_v = 1.0$. [5+5]

- 10.a) Draw a neat sketch of a hydropower plant and show clearly various elements.
b) The diameters of an impeller of a centrifugal pump at inlet and outlet are 32 cm and 62 cm respectively. Determine the minimum starting speed of the pump if it works against a head of 30 m. [5+5]

OR

- 11.a) Explain the importance of load factor, utilization factor in calculation of hydro power.
b) A three-stage centrifugal pump has impeller 42 cm in diameter and 2 cm wide at outlet. The vanes are curved back at the outlet at 45° and reduce the circumferential area by 10%. The manometric efficiency is 90% and overall efficiency is 80%. Determine the head generated by the pump when running at 1100 r.p.m. delivering 55 liters per second. What should be the shaft horse power? [5+5]

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