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Code No: 114AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2016
HYDRAULICS AND HYRAULIC MACHINERY
(Common to CE, CEE)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A **(25 Marks)**

1.a) What is meant by most economical section in open channel flow? [2]
b) Explain chezy's and manning's formula for uniform flow. [3]
c) State Buckingham's pi theorem. [2]
d) Define Reynolds number, Weber number and Mach number. [3]
e) State the principle of Angular momentum. [2]
f) Explain Hydraulic efficiency, Mechanical efficiency and Overall efficiency. [3]
g) Explain about Draft tube theory in turbines. [2]
h) What is cavitation? Write the formula for cavitation in turbines. [3]
i) Write about classification of pumps. [2]
j) Define load factor and capacity factor. [3]

PART-B **(50 Marks)**

2.a) What is critical depth? With usual notations prove that in case of a rectangular Channel $y_c=(q^2/g)^{1/3}$.
b) A 10 m wide rectangular channel carries a discharge of 20 m^3/s with a depth of 2 m. Find the width to which the channel should be contracted to get critical flow at the contracted section. [5+5]

OR

3.a) What is a control section? Describe with sketches any two control sections.
b) Give sketches with examples for the following types of GVF profiles in an open channel H_3, M_2, S_2, S_3, C_1.
c) A wide rectangular channel carries a discharge intensity of 4 m^3/s per meter width. The longitudinal slope of the channel is 0.00005. Calculate the GVF profile produced by a sudden drop in the bed of the channel. Assume manning's n =0.03. [3+3+4]

4.a) Write short notes on model and prototype.
b) In a 1 in 20 model of stilling basin, the height of the hydraulic jump in the model is observed to be 0.20 meter. What is the height of the hydraulic jump in the prototype? If the energy dissipated in the model is 1/10 kW, what is the corresponding value in prototype? [5+5]

OR

5.a) State the Buckingham's π-theorem. What do you mean by repeating variables? How are the repeating variables selected in dimensional analysis?

b) A pipe of diameter 1.5 m is required to transport an oil of specific gravity 0.90 and viscosity 3×10^{-2} poise at the rate of 3000 liter/s. Tests were conducted on a 15 cm diameter pipe using water at 20^0 C. Find the velocity and rate of flow in the model. Viscosity of water at 20^0 C=0.01 poise. [5+5]

6.a) Prove that the force exerted by a jet of water on a fixed semi-circular plate in the direction of the jet when the jet strikes at the centre of the semi-circular plate is two times the force exerted by the jet on an fixed vertical plane.

b) A jet of water of 10 cm diameter is discharging under a constant head of 80 m. Find the force exerted by the jet on a fixed plate. Take coefficient of velocity as 0.9. [5+5]

OR

7.a) Show that the efficiency of a free jet striking normally on a series of flat plates mounted on the periphery of a wheel can never exceed 50%.

b) A jet of water of diameter 100 mm strikes a curved plate at its centre with a velocity of 15 m/s. The curved plate is moving with a velocity of 7 m/s in the direction of the jet. The jet is deflected through an angle of 150^0. Assuming the plate smooth find:

i) forced exerted on the plate in the direction of the jet

ii) power of the jet

iii) efficiency. [5+5]

8.a) A Francis turbine runner having a diameter of 2.92 m. operates at 163.5 rpm, under 54 m head, and develops 19900 kW at an efficiency of 87%. Find the other characteristics if this turbine is operated under 60 m head.

b) What are the characteristics curves of a hydraulic turbine? How are they useful to a practical engineer? [5+5]

OR

9.a) 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.

b) Explain the principle on which Kaplan turbine works with a neat sketch. [5+5]

10.a) With a neat sketch, explain the principle and working of a centrifugal pump.

b) A centrifugal pump rotating at 1000 rpm delivers 160 liters/s of water against a head of 30 m. The pump is installed at a place where atmospheric pressure is 1×10^5 P_a(abs.) and vapour pressure of water is 2 kP_a (abs.). The head loss in suction pipe is equivalent to 0.2 m of water. Calculate minimum NPSH. [5+5]

OR

11.a) Discuss detail estimation of hydropower plant.

b) What are the various applications of Hydroelectric power plant? [5+5]

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