Code No: 134BC

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, February - 2024
FLUID MECHANICS AND HYDRAULIC MACHINES
(Mechanical 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) State Newton's law of viscosity and write the S.I unit for dynamic and kinematic viscosities. [2]
b) Find the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 2.5 N/m^2 above the atmospheric pressure. [3]
c) List the different types of fluid flows. [2]
d) Write Bernoulli's equation for flow through a streamline and discuss the terms involved. [3]
e) List the various devices for flow measurements. [2]
f) Define drag and lift force of an object immersed in a fluid. [3]
g) What is the purpose of needle valve used in Pelton turbines? [2]
h) Write a note on cavitation and its effect. [3]
i) What is slip in reciprocating pumps? [2]
j) What is priming in centrifugal pumps? Why is it necessary? [3]

PART – B

(50 Marks)

2.a) Describe the effect of pressure and temperature on viscosity of fluids.
b) The dynamic viscosity of oil used for lubrication between a shaft and sleeve is 6 Poise. The shaft is of 0.4 m diameter and rotates at 190 rpm. Calculate the power lost in the bearings for a sleeve length of 90 mm. The thickness of the oil film is 1.5 mm. [4+6]

OR

3.a) How manometers differ from mechanical devices in measuring fluid pressure?
b) A U-tube manometer is used to measure the pressure of oil of specific gravity 0.85 flowing in a pipeline. Its left end is connected to the pipe and the right limb is open to the atmosphere. The Centre of the pipe is 100 mm below the level of mercury (S=13.6) in the right limb. If the difference of mercury level in the two limbs is 160 mm, determine the absolute pressure of the oil in the pipe. [3+7]

4. Derive Euler's equation of motion stating clearly the assumptions made. [10]

OR

5.a) Distinguish between path lines, stream lines and streak lines.
b) Velocity for a 2D flow field is given by $V = (3+2xy+4t^2)i + (xy^2=3t)j$. Find the velocity and acceleration at a point (1,2) after 2 seconds. [3+7]

6.a) Define momentum thickness and energy thickness.

b) The velocity distribution in a boundary layer is given by $u / U = [y / \delta]^{(1/7)}$. Calculate the displacement thickness, momentum thickness, shape factor and energy thickness. [3+7]

OR

7.a) Discuss the working principle of pitot tube with a neat sketch.

b) In a pipe of 300 mm diameter and 800 m length an oil of specific gravity 0.8 is flowing at the rate of 0.45 m^3/s. Find head lost due to friction and power required to maintain the flow. Assume kinematic viscosity of oil as 0.3 Stoke. [3+7]

8.a) Define unit speed and unit discharge.

b) A Pelton wheel is to be designed for a head of 60 m when running at 200 rpm. The wheel develops 95.75 kW shaft power. The velocity of the buckets = 0.45 times the velocity of jet, overall efficiency = 0.85 and coefficient of velocity is equal to 0.98. [2+8]

OR

9.a) Write a critical note on selection of hydraulic turbines.

b) With a neat diagram explain the construction and working of a Pelton turbine. [3+7]

10. The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke is 300 mm. The pump runs at 50 rpm and lifts water through a height of 25 m. The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and theoretical power required to run the pump. If the actual discharge is 4.2 lits /s, find the percentage of slip. [10]

OR

11.a) Classify centrifugal pumps.

b) Explain the constructional details and function of main parts of a single acting reciprocating pump. [3+7]

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