Code No: 114DF

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, April - 2018
MECHANICS OF FLUIDS AND HYDRAULIC MACHINES
(Common to ME, MIE, MSNT)

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 the difference between dynamic viscosity and kinematic viscosity? [2]
b) One litre of crude oil weighs 9.6 N. Calculate its specific weight and specific gravity. [3]
c) Define terms path line and streak line. [2]
d) List the conditions for flow to be irrotational. [3]
e) Define the terms hydraulic gradient line and total line energy. [2]
f) Write Darcy Weishbach equation. [3]
g) What is draft tube theory? [2]
h) Define governing of turbine. [3]
i) What is meant by pump? [2]
j) Mention the main components of centrifugal pump. [3]

PART – B

(50 Marks)

2.a) Explain with sketches the working principle of inverted differential manometer.
b) Define metacentre and metacentric height of a floating body. Derive the expression for the metacentric height. [5+5]

OR

3.a) What are mechanical pressure gauge? Explain anyone in detail with the help of a neat sketch.
b) Derive an expression for the pressure at the height Z from the sea-level for a static air when the compression of air is assumed isothermal. The pressure and temperature at sea levels are P_0 and T_0 respectively. [5+5]

4.a) Two velocity components are given in the following cases. Find the third components such that they satisfy the continuity equation.
i) $u=\left(2x^3+2y^2+2z^2\right); v=-x^2y-yz-2xy$
ii) $u=\log\left(2y^3+2z^2\right); v=\log\left(x^2+2z^2\right)$
b) Explain one and two dimensional flow for equation of continuity. [5+5]

OR

5.a) Derive Euler's equation of motion along a stream line for an ideal fluid stating clearly the assumptions.
b) Distinguish between surface and body forces. [5+5]

6.a) Two water tanks are connected by a horizontal compound pipe comprising two series pipes, one of 300 m length, dimeter 20 cm and another 200 m length, diameter 10 cm, starting from the high level reservoir. Assume f =0.008 for both the pipes and consider minor losses treating all junctions to be abrupt in section change. If the discharge through the system is 0.03 cumec, determine the water level difference between the two tanks.

b) Explain the phenomenon of boundary layer separation and its influence on drag in a turbulent boundary layer. [5+5]

OR

7.a) What do you understand by total energy line, hydraulic gradient line, pipes in series and pipes in parallel?

b) Explain why the coefficient of discharge for orifice meter is less than that of venturimeter. [5+5]

8.a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.

b) Show that for curved radial vane, the work done per second is given by, $\rho a V_1 \left[V_{w_1} u_1 \pm V_{w_2} u_2\right]$ [5+5]

OR

9.a) A pelton turbine is to produce 15 MW under a head of 480 m when running at 500 rpm. If D/d = 10, determine the number of jets required.

b) With a neat sketch explain the design and working of Kaplan turbine. [5+5]

10.a) Draw the velocity diagrams of centrifugal pumps. What is the effective venae shape on velocity triangles.

b) Explain in detail the concept of biometric head. [5+5]

OR

11.a) With the help of suitable diagram, explain the performance of a reciprocating pumps.

b) What is negative slip in reciprocating pump? Explain with neat sketch the function of air vessel in a reciprocating pump. [5+5]

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