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B.TECH.
(SEM III) THEORY EXAMINATION 2018-19
FLUID MECHANICS

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. Draw the figure of shear stress VS Rate of Deformation.
b. Define perfect gas.
c. What do you understand by Stable equilibrium?
d. The velocity distribution between two parallel plate is given by $u=(a^2-y^2)$ where u is the velocity at a distance y from the middle of the two plates. Find the expression for stream function.
e. Define surface loss.
f. What do you understand by Dimensional Homogeneity?
g. Find the frequency of oscillation when a 72 Km/hr wind blows across a telephone wire of 3 mm diameter. take $\nu=1.5x10^{-5}$ m^2/s

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. Explain the procedure of finding hydrostatic forces on curved surfaces.
b. What are the different laws on which models are designed for dynamic Similarity?
c. What are the different laws on which models are designed for dynamic Similarity?
d. Draw the pressure distribution, theoretical as well as experimental, on an airfoil in the fluid flow.
e. What is the difference between Eulerian and Lagrangian approach?

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) What is the importance of Model Testing?
(b) Determine the Bulk Modulus of elasticity and compressibility of a liquid. If the pressure of liquid is increased from $70N/cm^2$ to $130N/cm^2$. The volume of liquid decreases by 0.15%.

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) A model boat, 1/50 of its prototype experienced 0.2 N when simulating a speed of 5 m/s. Find the corresponding resistance of the prototype considering resistance at free surface only. Water is used for model as well as prototype also
(b) Mention the important dimensionless numbers used in fluid mechanics and their significance.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) A 30 cm diameter horizontal pipe terminates in a nozzle with the exit diameter of 7.5cm.if the water flows through the pipe at a rate of $0.15m^3$/sec .What force will be exerted by the fluid on the nozzle?

(b) Find the discharge from an 80mm diameter external mouth piece fitted to a side of a large vessel if the head over the mouthpiece is 6mtr.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) A kite 60cm x 60cm is size weighing 3 N makes an angle of 10° with the horizontal. The thread attached to makes an angle of 45° to the horizontal and pull on the string 25 N. the wind is flowing over the kite 15 m/s. Find C_L and C_D for the kite.

(b) Explain the displacement thickness, momentum thickness to related to boundary layer.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) A pipe tapers from 250 mm to 125mm the rate of flow of the liquid in the pipe is 24000 lit/min. Calculate average velocity of flow at the two sections.

(b) Find the displacement thickness for velocity distribution in the boundary layer given by

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$