Exam.Code:0940
Sub. Code: 7051

2010

B.E. (Mechanical Engineering) Fourth Semester

MEC-406: Fluid Machines

Time allowed: 3 Hours **Max. Marks: 50**

***NOTE**: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit.*

x-x-x

I. Answers the following:-

a) Distinguish between (i) Uniform flow & Non- Uniform flow and (ii) Laminar & Turbulent Flow

b) State any two assumptions in deriving Bernoulli's equation and write Bernoulli's equation with friction?

c) What do you understand by Boundary layer and what are the methods used to arrest or delay the flow separation

d) What do you understand by Minor and Major Head losses?

e) What do you mean by Flow-net? What are its applications?

UNIT – I

II. a) A circular plate of 1.5 m diameter is submerged in water, with its greatest and least depth below the water surface being 2 m and 0.75 m respectively. Determine: (a) The total pressure on the face of the plate (b) The position of centre of pressure.

b) Explain the terms Floating Bodies, Metacentre and Metacentric height in detail with the help of diagrams. (2x5)

III. Derive the Euler's equation in Cartesian coordinates and then proceed to derive the Bernoulli's equation. (10)

IV. a) A jet of water 20 mm diameter nozzle leaves the nozzle tip with 15 m/s and is directed vertically upwards. If the jet remains circular, work out its diameter at a point 5 m above the nozzle tip. Neglect any loss of energy.

b) A "block of wood of specific gravity 0.7 floats in water. Determine the metacentric height of the block if its size is 2 m x 1 m x 0.8 m. (2x5)

P.T.O.

UNIT – II

V. a) Show that the discharge per unit width between two parallel plates distance "b" apart, when one plate is moving at velocity "V" while the other one is held stationery, for the condition of zero shear stress at the fixed plate is: q=bV/3.

b) Calculate: (i) the pressure gradient along flow (ii) the average velocity and (iii) the discharge for an oil of viscosity 0.02 Ns/m^2 flowing between two stationary parallel plates 1 m wide maintained 10 mm apart. The velocity midway between the plates is 2 m/s. (2x5)

VI. a) Work out the Displacement Thickness, Momentum Thickness and Energy thickness in terms of nominal boundary layer thickness δ for the velocity distribution prescribed by the relation:

$$\frac{u}{U_0} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

Where "u" is the velocity at a distance "y" from the plate and "$u = U_o$" at "$y = \delta$".

b) What is Rankine Half- Body and explain the flow past a Rankine Half- Body with the help of suitable diagrams and equations. (2x5)

VII. a) Discuss with the help of diagrams the nature of propagation of disturbance in compressible flow when the flow is (i) Sub- sonic (ii) Sonic (iii) Super-Sonic

b) Air Flows with a velocity of 360 m/s through a duct. At a particular section of the duct, the static pressure and temperature are 85 kPa and 290 K. Assuming the flow to be reversible adiabatic, estimate the (i) Mach number at the given section (ii) Mach number, temperature and velocity at another section where the static pressure is 125 kPa. (2x5)

x-x-x