(36)

Exam.Code:0940
Sub. Code: 7051

1059
B.E. (Mechanical Engineering)
Fourth Semester
MEC-406: Fluid Mechanics

17 **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 Part.*

x-x-x

Q.1 i) Define the terms: Buoyancy and Metacentric height.

ii) Show the streamlines and equipotential lines are mutually perpendicular lines.

iii) Why co-efficients of discharge of an orifice-meter is much smaller than that of venturimeter?

iv) What is laminar sublayer? How is the concept of laminar sublayer useful?

v) What is silence zone during the disturbance which propagates when an object moves in still air? **(02x05=10)**

Part-A

Q.2 a) Given that the barometer reading=740 mm of mercury; specific gravity of mercury=13.6; and intensity of pressure=40 kPa. Express the intensity of pressure in SI units, both gauge and absolute. **(05)**

b) An annular plate 2m external diameter and 1m internal diameter with its greatest and least depths below the surface being 1.5m and 0.75m respectively. Calculate the magnitude, direction and location of the force acting upon one side of the plate due to water pressure. **(05)**

Q.3 Derive the 3-dimensional Continuity equation in polar coordinates. **(10)**

Q.4 a) A venturimeter is installed in a pipeline carrying water and is 30 cm in diameter. The throat diameter is 12.5 cm. The pressure in pipeline is 140 kN/m^2, and the vacuum in the throat is 37.5 cm of mercury. Four percent of the differential head is lost between the gauges. Find the flow rate in the pipeline in litre/sec. assuming the venturimeter to be horizontal. **(07)**

b) What are the merits and demerits of distorted models? **(03)**

Part-B

Q.5 A horizontal pipe line 40m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25m of its length from the tank, the pipe is

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150mm diameter and its diameter is suddenly enlarged to 300mm. The height of water level in the tank is 8m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow and draw hydraulic gradient and energy gradient lines. Take f=0.01 for both sections of the pipe. **(10)**

Q.6 For the below given velocity distribution in the laminar boundary layer, find the parameters: Boundary layer thickness, Shear stress, Drag force and Drag co-efficient.

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - 2\left(\frac{y}{\delta}\right)^3 + \left(\frac{y}{\delta}\right)^4$$

(10)

Q.7 a) Air has a velocity of 1000km/h at a pressure of 9.81kN/m^2 vacuum and a temperature of 47^{0}C. Determine its stagnation properties and the local Mach number. Take atmospheric pressure=98.1kN/m^2, R=287J/kgK. Also find the compressibility factor to measure the velocity at a Mach number of 0.8.

b) Describe compressible flow through a convergent-divergent nozzle. How and where does the shock wave occur in the nozzle? **(05+05)**

x-x-x