Time: 3 Hours **Marks: 80**

N. B.: (1) Question No. 1 is compulsory.
(2) Attempt any three questions from remaining five questions.
(3) Assume suitable data if necessary.

Q. 1 Answer any Four questions [20]

a) Derive Newton's law of viscosity and mention the various units of viscosity.
b) A plate of 0.05 mm at a distance from a fixed plate moves at 1.2 m/s and requires a force of 2.2 N/m^2 to maintain this speed. Find the viscosity of the fluid between the plates.
c) Derive equation of continuity for compressible and incompressible fluids.
d) What do you mean by compressible fluids and explain what are the objectives of learning compressible flow in short.
e) Write the classification of pressure measurement devices.

Q. 2

(a) Explain the different types of fluid flow. (any five types) [10]
(b) Oil of viscosity 0.098 kg/(m.s.)and sp.gr 0.9 flows through a horizontal pipe of 2.5 cm diameter. If the pressure drop per meter length of pipe is 0.12 kgf/cm^2.Determine (i) The rate of flow.(ii) Reynolds number. (iii) The power required per 50 m length pipe to maintain flow. [10]

Q. 3

(a) Water is flowing through a pipe having diameters 30 cm and 50 cm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 3 kgf/cm^2 and at the upper end is 1.5 kgf/cm^2. Determine the difference in datum head if the rate of flow through pipe is 50 lit/sec. [10]
(b) Draw and explain the propagation of pressure waves, when Ma = 1, Ma<1 and Ma>1 [10]

Q. 4

(a) Derive an expression for the velocity distribution, shear stress distribution and relation between average velocity and maximum velocity for the laminar flow of fluid through the circular pipe. [10]
(b) Explain any two types of valves with neat sketch. [10]

Q. 5

(a) Find the Mach number when an aeroplane is flying at 1100 km/hr through still air having a pressure of 7 N/cm^2 and temperature -5^0C, wind velocity may be taken as zero. Take R = 287.14 J/kg. ^0K. Calculate the pressure temperature and density of air at stagnation point on the nose of the plane. Take k = 1.4 [10]

(b) State the different types of pumps and explain the centrifugal pump with neat sketch. [10]

Q. 6

(a) Derive an expression for hydrostatic equilibrium [05]
(b) Define and explain drag force. [05]
(c) Define and give the significance of Mach Number. [05]
(d) Explain NPSHR and NPSHA [05]

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