Roll No .....

MMTP - 104

M.E./M.Tech. I Semester

Examination, June 2014

Advanced Fluid Mechanics

Time : Three Hours

Maximum Marks : 70

Note : 1. Attempt any five questions. All questions carry equal marks.
2. Assume suitably misprint/missing data, if necessary, clearly mentioned it.

1. a) State and prove the Pascal's law.
   b) Enunciate Newton's law of viscosity. Explain the importance of viscosity in fluid motion. What is the effect of temperature on viscosity of water and that of air?

2. a) Derive the Reynolds Transport theorem and write its applications.
   b) Distinguish between:
      i) Steady and unsteady flow
      ii) Uniform and non uniform flow
      iii) Compressible and incompressible flow
      iv) Rotational and irrotational flow

3. a) What is a 'flow-net'? Enumerate the methods of drawing flow nets.
   b) Clearly bring out the difference between one, two and three dimensional flows. Classify the following flow into these categories.
      i) Flow in a River.
      ii) Flow of water over a spillway.
      iii) Flow through the test section of a water tunnel.
      iv) Flow in a Turbo machine.

4. a) What do you understand by the term boundary layer, and boundary layer theory?
   b) What do you mean by boundary layer separation? What is the effect of pressure gradient on boundary layer separation?

5. a) Prove that the velocity of sound wave in a compressible fluid is given by $C = \sqrt{k/\rho}$, where,
   k = Bulk modulus of fluid, ρ = Density of fluid
   b) What is the relation between pressure and density of a compressible fluid for
      i) Isothermal process ii) Adiabatic process

6. a) What do you understand by the characteristic curves of a turbine? Name the important types of characteristic curves.
   b) Obtain an expression for the work done by the impeller of a centrifugal pump on water per second per unit weight of water.

7. Water is flowing over a thin smooth plate of length 4m and width 2m at a velocity of 1m/s. if the boundary layer flow changes from laminar to turbulent at a Reynolds number 5×10^5, find
   i) The distance from leading edge upto which boundary layer is laminar.
   ii) The thickness of the boundary layer at the transition point, and
   iii) The drag force on one side of the plate. Take viscosity of water $\mu = 9.81\times10^{-4}$ Ns/m^2

8. Calculate the stagnation pressure, temperature and density at the stagnation point on the nose of a plane, which flying at 800 km/hour through still air having a pressure 80N/cm^2(abs), and temperature $-10°$C. Take R=287J/kgK, and K=1.4.

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