Total No. of Questions : 8]   *[Total No. of Printed Pages : 3*

Roll No ....

MMTP-104
M.E./M.Tech., I Semester
Examination, December 2017

Advanced Fluid Mechanics

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any Five questions.
ii) All questions carry equal marks.
iii) Assume missing data suitably, if any.

1. a) Write short note on :   6
   i)   Specific weight
   ii) Concept of continuum
   iii) Newton's law of viscosity

   b) Calculate the dynamic viscosity of oil, which is used for lubrication between a square pate of size 0.8m × 0.8m and an inclined plane with angle of inclination 30°, the weight of the square plate is 300N and it slides down the inclined lane with a uniform velocity of 0.3m/s the thickness of oil film is 1.5mm.   8

2. a) Write short note on :   6
   i)   Local and convective acceleration
   ii) Stream and potential flow
   iii) Control volume

   b) The velocity component in a two-dimensional flow field for an incompressible fluid are as follows:
   $u = y^3/3 + 2x - x^2y$ and $v = xy^2 - 2y - x^3/3$, obtain an expression for the stream function Ψ.   8

3. a) What do you understand by term source flow and sink flow? Explain.   7

   b) Define boundary layer thickness, displacement thickness, momentum thickness.   7

4. a) Explain boundary layer separation phenomena.   7

   b) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by

   $$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$ 7

5. a) Establish an expression for stagnation pressure.   6

   b) Find the match number when an aeroplane is flying at 1100 km/hr through still air having a pressure of $7N/cm^2$ and temperature −5°C. Wind velocity may be taken as zero. Take R=287.14J/kgK. Calculate the pressure, temperature and density of air at stagnation point on the nose of the plane. Take k = 1.4   8

6. a) What is the basis of selection of a turbine at a particular place?   6

   b) A Pelton wheel is revolving at a speed of 190rpm and develops 5150.25 kW when working under a head of 220m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. The speed ratio of the turbine is given as 0.47. Find the speed, discharge and power when this turbine is working under a head of 140m.   8

7. a) Prove that the work done per second per unit weight of water in a reaction turbine is given as $= 1/g [(V_{w_1}u_1 + V_{w_2}u_2)]$, V_{w_1}, V_{w_2} = velocities of whirl at inlet and outlet.   7

   b) What is draft-tube? Why it is used, describe with neat sketch different types of draft-tubes?   7

8. a) Explain the characteristic curve for centrifugal pump.   6

   b) A centrifugal pump delivers water against a net head of 14.5 metres and a design speed of 1000rpm. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300mm and outer width is 50mm, determine the discharge of the pump if monomeric efficiency is 95%.   8

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