D 30896 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION OCTOBER 2012

Mechanical Engineering

AN/ME/AM 09 303/PTME 09 302—FLUID MECHANICS

(2009 Admissions)

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Define surface tension.
2. State Bernoullie's theorem.
3. What are the factors influencing the frictional loss in pipe flow ?
4. What is total acceleration of three dimensional fluid flows ?
5. Give the equation for capillarity fall in a glass tube.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. Find the height through which water rises by capillary action in a glass tube of 2 mm bore if the surface tension at the prevailing temperature is 0.075 g/cm.
7. A plate, 0.025 mm distant from a fixed plate, moves at 60 cm/s and requires a force of 2 N per unit area i.e., 2 N/m^2 to maintain this speed. Determine the fluid viscosity between the plates.
8. Calculate the pressure due to column of 0.3 m of :
   (a) Water.
   (b) An oil of specific gravity 0.8.

   Take density of water, ρ = 1000 kg/m^3.
9. Find the discharge of water flowing over a rectangular notch of 2 m length when the constant head over the notch is 300 mm. Take C_d = 0.6.
10. Define kinetic energy correction factor and momentum correction factor.
11. Explain about mechanics of boundary layer transition..

(4 × 5 = 20 marks)

Turn over

Part C

Answer **all** *questions.*

12. If the velocity distribution over a plate is given by $u = \frac{2}{3}y - y^2$ in which u is the velocity in metre per second at a distance y metre above the plate, determine the shear stress at $y = 0$ and $y = 0.15$ m. Take dynamic viscosity of fluid as 8.63 poise.

Or

13. The pressure intensity at a point in a fluid is given 3.924 N/cm^2. Find the corresponding height of fluid when the fluid is :
    (a) Water ; and
    (b) Oil of specific gravity 0.9.

14. The head of water over the centre of an orifice of diameter 20 mm is 1 m. The actual discharge through the orifice is 0.85 litre/s. Find the coefficient of discharge.

Or

15. If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y-1)$. Determine the velocity at the point P (4, 5). Determine also the value of stream function ψ at the point P.

16. Derive the expression for coefficient of discharge of orifice meter.

Or

17. An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 10 cm. The oil mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take $C_d = 0.98$.

18. A fluid of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m^2, find :
    (a) The pressure gradient.
    (b) The average velocity ; and
    (c) Reynolds number of the flow.

Or

19. Water at 15°C flows over a flat plate at a speed of 1.2 m/s. The plate is 0.3 m long and 2 m wide. The boundary layer on each surface of the plane is laminar. Assume the velocity profile is approximated by a linear expression for which $\frac{\delta}{x} = \frac{3.46}{\sqrt{R_{ex}}}$. Determine the drag force on the plate.

For water $\upsilon = 1.1 \times 10^{-6}$ m^2/s, $\rho = 1000$ kg/m^3.

(4 × 10 = 40 marks)