D 51020 (Pages 2)

Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, NOVEMBER 2013

ME/AN/AM 09 303—FLUID MECHANICS

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Define specific volume.
2. Give some examples of surface tension.
3. What are the assumptions made in deriving Bernouillie's equation ?
4. What is the expression for head loss due to friction in Darcy formula ?
5. Define local acceleration.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. A flat plate of area 1.5×10^6 mm^2 is pulled with a speed of 0.4 m/s relative to another plate located at a distance of 0.15 mm from it. Find the force and power required to maintain this speed, if the fluid separating them is having the viscosity of 1 poise.
7. A right limb of simple U tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm.
8. A rectangular plane surface is 2 m wide and 3 m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and coincides with water surface.
9. A block of wood of specific gravity 0.7 floats in water. Determine the meta centric height of the block if its size is 2 m × 1 m × 0.8 m.
10. Sketch the development of velocity profile for laminar flow through a pipe and explain.
11. The distribution of velocity, u, in metres/sec with radius r in metres in a smooth bore tube of 0.025 m bore follows the law, $u = 2.5 - kr^2$. Where k is a constant. The flow is laminar and the velocity at the pipe surface is zero. The fluid has a coefficient of viscosity of 0.00027 kg/m s. Determine (a) the rate of flow in m^3/s ; (b) the shearing force between the fluid and the pipe wall per metre length of pipe.

(4 × 5 = 20 marks)

Turn over

Part C

Answer **all** *questions.*

12. If the surface tension of water in contact with air is 0.075 N/m , what correction need to be applied towards capillary rise in the manometric reading in tube of 3 mm diameter ?

Or

13. A solid cylinder of diameter 4 m has a height of 3 m. Find the meta centric height of the cylinder when it is flowing in water with its axis vertical. The specific gravity of the cylinder = 0.6.

14. Derive the expression for coefficient of discharge of venturimeter.

Or

15. A pipe of diameter 400 mm carries water at a velocity of 25 m/s. The pressures at the points A and B are given as 29.43 N/cm^2 and 22.563 N/cm^2 respectively while the datum head at A and B are 28 m and 30 m. Find the loss of head between A and B.

16. Show that the average velocity of the fluid flowing through a circular pipe under laminar conditions is half that of the maximum velocity.

Or

17. Explain the Lagrangian method for flow field and fluid motion.

18. The velocity potential function is given by $\phi = 5 (X^2 - Y^2)$. Calculate the velocity components at the points (4, 5).

Or

19. Calculate power required to move a flat plate, 8 m long and 3 m wide in water (ρ = 1000 kg/m^3, $\mu = 1.02 \times 10^{-3}$ kg/ms) at 8 m/s for the following cases.

    (a) the boundary layer is turbulent over entire surface of the plate.

    (b) the transition takes place at $Re = 5 \times 10^5$.

($4 \times 10 = 40$ marks)