F 2972 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, DECEMBER 2012

Third Semester

Branch : Aeronautical Engineering/Mechanical Engineering/Production Engineering

AN 010 303/ME 010 303/PE 010 303—FLUID MECHANICS (AN, ME, PE)

(New Scheme—Regular/Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Explain why petrol evaporates more readily than water at ordinary temperature.
2. Write down the Euler's equation along a stream line. What assumptions are involved in its derivation ?
3. Explain minor losses in pipes.
4. Distinguish between stream line, streak line and path lines.
5. Differentiate between stream lined body and bluff body.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Discuss the conditions of equilibrium of floating bodies.
7. Show that the stream lines and equi-potential lines form a net of mutually perpendicular lines.
8. What is Moody's chart ? What is its significance ?
9. What is magnus effect ? Give examples of practical occurrence which illustrate the use of principle embodied in the magnus effect.
10. What is a boundary layer ? How the boundary layer thickness is defined ?

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (a) What is the difference between U-tube differential manometer and inverted U-tube differential manometer ? Where are they used ?

(6 marks)

(b) A sleeve 10 mm long encases a vertical metal rod 3 cm in diameter with a radial clearance of 0.02 mm. If when immersed in an oil of viscosity 6 Poise, the effective weight of the sleeve is 7.5 N, will the sleeve slide down the rod and if so at what velocity ?

(6 marks)

Or

12. A cube of side a and relative density s floats in water. Determine the conditions for its stability if it is given an angular tilt.

(12 marks)

13. (a) Write Euler's equation of motion along a stream line. Integrate it to obtain Bernoullis equation for incompressible fluids. State all the assumptions and limitations.

(6 marks)

(b) State the momentum equation. How will you apply momentum equation for determining the force exerted by a flowing liquid on a pipe bend ?

(6 marks)

Or

14. 200 litres per second of water is flowing in a pipe having a diameter of 30 cm. If the pipe is bent by 135°, find the magnitude and direction of resultant force on the bend. The pressure of water flowing in the pipe is 400 KPa.

(12 marks)

15. Oil of mass density 850 kg/m^3 and dynamic viscosity 0.025 poise flows through a 5 cm diameter pipe of length 400 m at the rate of 0.2 litre/sec. Determine the Reynolds Number of the flow, centre line velocity, pressure gradient, loss of pressure, wall shear stress and the power required to maintain the flow.

(12 marks)

Or

16. (a) Derive the geometrical conditions for the most economical section of a rectangular channel.

(6 marks)

(b) Derive Chezy equation for steady uniform flow in an open channel. (6 marks)

17. Derive the continuity equation in 3 dimensional Cartesian Co-ordinates for an incompressible fluid.

(12 marks)

Or

18. In a two dimensional incompressible flow the fluid velocity components are given by $u = x - 4y$, $v = -y - 4x$. Show that the flow satisfies the continuity equation and obtain the expression for the stream function. If the flow is potential, obtain also the expression for the velocity potential.

(12 marks)

19. Air flows over a flat plate 1 m long at a velocity of 6 m/sec. Determine :
    (a) The boundary layer thickness at the end of the plate.
    (b) Shear stress at the middle of the plate.
    (c) Total drag per unit length on the sides of the plate. Take $\rho = 1.23$ kg/m^3 $\gamma = 0.15 \times 10^{-4}$ m^2 /sec.

(12 marks)

Or

20. (a) Distinguish between the friction drag, the pressure drag and the profile drag.
    (b) A thin plate 90 cm wide and 2.1 m long is dragged lengthwise through water at a velocity of 1.5 m/s. If the kinematic viscosity of water is 0.315 stokes, calculate the total drag on the plate.

(12 marks)

[5 × 12 = 60 marks]