F 3129 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Naval Architecture and Ship Building Engineering/Aeronautical Engineering/ Mechanical Engineering/Production Engineering

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

(New Scheme—2010 admission onwards)

[Regular/Improvement/Supplementary—ST Regular]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Define Bulk modulus.
2. Write an expression for flow rate through a v-notch. Briefly explain.
3. Define : Hydraulic gradient line.
4. Distinguish between steady flow and unsteady flow.
5. What do you mean by laminar sublayer ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Find the kinematic viscosity of an oil having density 980 kg/m^3 when at a certain point in the oil, the shear stress is 0.25 N/m^2 and velocity gradient 0.3/s.
7. Explain the principle of a pitot tube with a neat sketch.
8. Obtain an expression for head loss in a sudden expansion in the pipe.
9. What do you mean by the equipotential line and a line of constant stream function ?
10. Differentiate between stream-lines body and bluff body. Give examples.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **either** *(a)* **or** *(b) of each question.*
Each question carries 12 *marks.*

11. (a) The velocity distribution for flow over a flat plate is given $u = \frac{3}{4}y - y^2$ in which u is the velocity in metre per second at a distance y metre above the plate. Determine the shear stress at $y = 0.15$ m. Take the dynamic viscosity of fluid as 8.6 poise.

(12 marks)

Or

(b) A rectangular tank of length 6 m, width 2.5 m height 2 m is completely filled with water when at rest. The tank is open at the top. The tank is subjected to a horizontal constant linear acceleration of 2.4 m/s^2 in the direction of its length. Find the volume of water spilled from the tank.

(12 marks)

12. (a) An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure ganges fitted upstream and downstream of the orifice meter give readings of 14.715 N/cm^2 and 9.81 N/cm^2 respectively. Find the rate of flow of water through the pipe in litres/s.

(12 marks)

Or

(b) Prove that for viscous flow through a circular pipe the kinetic energy correction factor is equal to 2 while momentum.

(12 marks)

13. (a) A pipeline AB of diameter 300 mm and of length 400 m carries water at the rate of 50 litres/s. The flow takes place from A to B where point B is 30 metres above A. Find the pressure at A if the pressure at B is 19.62 N/cm^2. Take $f = 0.008$.

(12 marks)

Or

(b) What do you mean by hydraulic jump ? Derive an expression for depth of hydraulic jump.

(12 marks)

14. (a) Sketch the stream lines represented by $\psi = xy$. Also find out the velocity and its direction at point (2, 3).

Or

(b) Define circulation. Sketch the flow pattern of an ideal fluid flow past a cylinder with circulation.

(12 marks)

15. (a) Oil with a free-stream velocity of 1.5 m/s flow over a thin plate 1.4 m wide and 2.2 m long. Calculate the boundary layer thickness and the shear stress at the trailing end point and determine the total surface resistance of the plate. Take specific gravity of oil as 0.80 and kinematic viscosity as 0.1 stoke.

(12 marks)

Or

(b) What do you mean by boundary layer separation ? How will you determine whether a boundary layer flow is attached flow, detached flow or on the verge of separation ?

(12 marks)

[5 × 12 = 60 marks]