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Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, NOVEMBER 2014

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

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*
Each question carries 2 *marks.*

1. State the Newton's law of viscosity.
2. Define temporal acceleration.
3. State Bernoulli's theorem and mention the assumptions involved in it.
4. State the basic principle behind the theory of venturimeter.
5. Enlist the minor losses in flow through pipes.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*
Each question carries 5 *marks.*

6. Define (i) Pitot tube ; (ii) Mouthpiece ; (iii) Venturimeter.
7. Calculate the capillary effect in millimeter in glass tube of 4 mm. diameter, when immersed in water and mercury. The temperature of the liquid is 20 degree Celsius and the value of the surface tension of water and mercury at 20° C. in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angles of contact for water is zero that mercury 1.30°. Take density of water at 20 °C as equal to 998 kg./m.^{3}
8. A pipe of diameter 25 cm. and length 2600 m. is used for the transmission of power by water. The total head at the inlet of the pipe is 500 m. Find the maximum power available at the outlet of the pipe, if the value of $f = 0.008$.
9. A 50 cm. diameter pipe conveys water for power generation. The pipe is 1000 m. long and a head of 100 m. at the inlet. What maximum power can be generated from the system ?
10. The maximum velocity of flow in a pipe of diameter 0.3 m. is 2 m/s. If the flow is laminar, determine (i) the average velocity and the radius at which it occurs ; (ii) the velocity at 5 cm. from the wall of the pipe.
11. Explain laminar and turbulent boundary layers with neat sketch.

(4 × 5 = 20 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 10 *marks.*

12. Water is flowing in a pipe line at a rate of 0.6 m^3/sec. The energy loss due to friction in the pipe line is 9 m./km., 36.75 kW pumps with an efficiency of 80 % are available for pumping stations. At what intervals should the pumping stations be located ?

Or

13. A uniform body of size 3 m. long × 2 m. wide × 1 m. deep floats in water. What is the weight of the body if depth of immersion is 0.8 m. ? Determine also the meta-centric height.

14. A wooden cylinder of specific gravity = 0.6 and circular in cross-section is required to float in oil (specific gravity = 0.9). Find the L/D ratio for the cylinder to float with its longitudinal axis vertical in oil, where L is the height of cylinder and D is its diameter.

Or

15. Find the discharge through the rectangular orifice 2 m. wide and 1.5 m. deep fitted to a water tank. The water level in the tank is 3 m. above the top edge of the orifice. Take $C_d = 0.62$.

16. An internal mouthpiece of 80 mm. diameter is discharging water under a constant head of 8 meters. Find the discharge thorough the mouthpiece, when (i) the mouthpiece is running free ; (ii) the mouthpiece is running full.

Or

17. A mercury filled vertical U-tube manometer connected across a venturimeter records a difference of 30 mm. diameters at inlet and throat of venturimeter are respectively 100 mm. and 50 mm. If oil of specific gravity 0.85 flows through a horizontal pipe. Calculate the discharge. C_d for venturimeter is 0.9.

18. Derive Hagen-Poiseuille equation and state the assumption made.

Or

19. Derive an expressions for shear stress on the basis of "Prandtl Mixing Length Theory".

(4 × 10 = 40 marks)