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Total No. of Questions : 18

B.Tech. (CE) (2018 Batch) (Sem.–3)

FLUID MECHANICS

Subject Code : BTCE-303-18

M.Code : 76372

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

Write briefly :

1. Distinguish between compressible and incompressible fluids.
2. Distinguish between dynamic viscosity and kinematic viscosity.
3. Define static pressure and vacuum pressure.
4. Explain rotational and irrotational flow.
5. Define Euler number and Mach number.
6. State Buckingham's Pi theorm.
7. How does turbulence affects the flow properties?
8. What are the situations in which hydraulic jump occurs?
9. What do you mean by most economic channel cross section?
10. What are the limitations of Bernouli's equation?

SECTION-B

11. In a 50mm long journal-bearing arrangement, the clearance between the two at concentric condition is 0.1 mm. The shaft is 20mm in diameter and rotates at 3000 rpm. The dynamic viscosity of the lubricant used is 0.01 Pa s and the velocity variation in the lubricant is linear. Considering the lubricant to be Newtonian, calculate the frictional torque the journal has to overcome, and the corresponding power loss.

12. A gas follows the law p = (constant)ρT and flows steadily in a horizontal pipe of constant diameter. If the flow is isothermal and ratio of pressure at the two sections under consideration is p1/p2 = 8/7. Find the ratio V1/V2.

13. An oil having viscosity of 7 poise and specific gravity 0.85 flows through a horizontal 50mm diameter pipe with a pressure drop of 18 kN/m^2 per meter length of pipe. Determine :

    a) The flow rate of oil and the centre line velocity

    b) The total friction drag over 100 m length of pipe and the power required to maintain the flow

    c) The velocity and shear stress at 8mm from the wall.

14. A plate 0.5m × 0.2m has been placed longitudinally in a stream of crude oil which flows with undisturbed velocity of 6m/s. Given that oil has a specific gravity 0.9 and kinematic viscosity 1 stoke, calculate the boundary layer thickness and shear stress at the middle of the plate. Also calculate friction drag on one side of the plate.

15. A hydraulic jump occurs in a 0.5m wide rectangular channel at the point where depth of water flow is 0.15m and the Froude number is 2.5. Make calculations for the specific energy, critical and sequent depths, loss of head and the energy dissipated.

SECTION-C

16. A hollow wooden cylinder of specific gravity 0.56 has an outer diameter of 60 cm and an outer diameter of 30 cm. It is required to float in oil of specific gravity 0.85. Calculate the maximum height of the cylinder so that it shall be stable when floating with its axis vertical. Also calculate the depth to which it will sink.

17. The angle of a reducing bend is 60° (that is deviation from initial direction to final direction). Its initial diameter is 30 cm and final diameter is 15 cm and is fitted in a pipeline, carrying a discharge of 360 lit/sec. The pressure at the commencement of the bend is 2943 bar. The friction loss in the pipe bend may be assumed as 10% of the kinetic energy at exit of the bend. Determine force exerted by the reducing bend.

18. Water from a main canal is siphoned to a branch canal over an embankment by means of wrought iron pipe of 9 cm diameter. The length of the pipe upto the summit is 25 m and the total length is 65 m. Water surface elevation in the branch canal is 10m below that the main canal.

a) How many pipes are needed if the total quantity of water required to be conveyed is 60 lit/sec?

b) What is the maximum permissible height of the summit above the water level in the main canal so that the water pressure of the summit may not fall below 0.2 bar absolute, the barometer reading being 10m of water?

Entry loss may be assumed as one-half of the velocity head in the pipe and take friction factor $f = 0.0075$ in the Darcy equation, $h_f = 4flV^2/2gd$.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.