Hall Ticket No | | | | | | | | | | |

Question Paper Code:AAEC03

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022

Regulation:UG-20

FLUID DYNAMICS

Time: 3 Hours **(AE)** **Max Marks: 70**

Answer ALL questions in Module I and II

Answer ONE out of two questions in Modules III, IV and V

NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

MODULE – I

1. (a) State and explain the Newton's law of viscosity. Deduce the expression for the dynamic viscosity. **[7M]**

   (b) A cylindrical body 2m diameter and 3.5 m height weight is 80kN. Find the tension necessary in a vertical chain attached to the centre of the base that will keep the cylinder float vertically. **[7M]**

MODULE – II

2. (a) Find the expression of drag over a cylinder using dimensional analysis method. **[7M]**

   (b) In 1:20 model of stilling basin, the height of hydraulic jump in the model is observed to be 20cm. What would be the corresponding height of jump in the prototype, if energy dissipation in the model were 0.1KW. What would be the corresponding value in the prototype? **[7M]**

MODULE – III

3. (a) What is law of conservation of mass? Derive the expression for continuity in 3D flow and steady flow. **[7M]**

   (b) Given that u = xy, v = 2yz, examine whether these velocity components represent two or three dimensional incompressible flow. If three dimensional, determine the third component. **[7M]**

4. (a) What is a pitot tube? How is it used to measure velocity of flow at any point in a pipe or channel? **[7M]**

   (b) Water at the rate of 30 litres/sec. is flowing through a 0.2 m. I.D. pipe. A venturimeter of throat diameter 0.1 m is fitted in the pipeline. A differential manometer in the pipeline has an indicator liquid M and the manometer reading is 1.16 m. What is the relative density of the manometer liquid M? Venturi co-efficient = 0.96; Density of water = 998 kg/m^3 . **[7M]**

MODULE – IV

5. (a) How will you determine whether a boundary layer flow is attached flow, detached flow or on the verge of separation? **[7M]**

   (b) The boundary layer thickness at a distance of 1 m from the leading edge of a flat plate kept over zero angle of incidence to the flow direction is 1 mm. The velocity outside the boundary layer is 25 m/s. determine the boundary layer thickness at a distance of 4 m. Assume that the boundary layer is entirely laminar. **[7M]**.

6. (a) Explain the phenomenon of boundary layer separation using an example of flow over a cylinder. **[7M]**

   (b) A submarine can be treated as an ellipsoid with a diameter of 5 m and a length of 25 m. Determine the power required for this submarine to cruise horizontally and steadily at 40 km/h in seawater whose density is 1025 kg/m^3. Also determine the power required to tow this submarine in air whose density is 1.30 kg/m^3. Assume the flow is turbulent in both cases. **[7M]**

MODULE – V

7. (a) Determine an expression for maximum hydraulic and overall efficiency of a Pelton wheel. **[7M]**

   (b) The propeller reaction turbine of runner diameter 4.5 m is running at 48 r.p.m. The guide blade angle at inlet is 145° and the runner blade angle at outlet is 25° to the direction of vane. The axial flow area of water through the runner is 30 m^2. If the runner blade angle at inlet is radial, determine

   i) Hydraulic efficiency of the turbine

   ii) Discharge through the turbine

   iii) Power developed by the runner. **[7M]**

8. (a) Make a detailed comparison between reciprocating pumps and centrifugal pumps. **[7M]**

   (b) A centrifugal pump delivers water against a net head of 14.5m and design speed of 1000 rpm. The vanes are curved back to an angle of 30^0 with periphery. The impeller diameter is 300 mm and outlet width 50 mm. Determine the discharge of the pump if the manometric efficiency is 95%. **[7M]**

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