Hall Ticket No | | | | | | | | | | | Question Paper Code: AMEB08

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular/Supplementary) - July, 2021

Regulation: R18

FLUID MECHANICS AND MACHINES

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

Answer FIVE Questions choosing ONE question from each module
(NOTE: Provision is given to answer TWO questions from any ONE module)
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) List out and explain the significant properties of fluid along with their mathematical expressions. **[7M]**

   (b) The space between two horizontal square flat plates of sides $0.7m$ each is filled with a lubricant film of thickness 1 cm. The upper plate requires a force of 100 N to maintain its speed of $2m/s$ while the lower plate is fixed. Evaluate the dynamic viscosity in poise and the kinematic viscosity in stokes of the lubricant if its specific gravity is 0.96. **[7M]**

2. (a) State and derive impulse-momentum equation for steady flow. **[7M]**

   (b) The smaller diameter 0.1 m of a 4 m long pipe at lower level is inclined at an angle of 30^0 with the horizontal and its large diameter is 0.3 m. If the velocity of water at the smaller diameter section is 2m/s, then calculate the difference of pressure between the smaller and larger diameter sections of the pipe. **[7M]**

UNIT – II

3. (a) Derive acceleration of fluid flow by Lagrangian method. **[7M]**

   (b) Explain the working of Venturi meter with a neat sketch and determine the coefficient of discharge. **[7M]**

4. (a) Discuss various hydraulic coefficients. Distinguish between laminar and turbulent flow. **[7M]**

   (b) Find the velocity and acceleration components at point $A(1, 2, 3)$ m and at $t = 2s$ for the fluid flow described by the velocity vector $V = (2x^3)i – (5x^2y)j + (3t)k$ **[7M]**

UNIT – III

5. (a) Discuss the various minor losses in a pipe flow with simple sketch. **[7M]**

   (b) If the velocity distribution in the boundary layer is given by $\frac{u}{U} = 2(\frac{y}{\delta}) - (\frac{y}{\delta})^2$, where δ is the boundary layer thickness. determine the displacement thickness. **[7M]**

6. (a) Enlist the effects of boundary layer separation. Discuss the methods to control. **[7M]**

(b) The petrol of specific gravity 0.74 flows at a rate of $0.06 m^3/s$ through a pipe of length $1250m$ and diameter 0.25 m. If the coefficient of friction is $f = 0.002$ in the Darcy-Weisbach equation, then determine (i) The loss of head due to friction, (ii) Shear stress on the pipe wall, (iii) Shear velocity and (iv) Power required to maintain the flow **[7M]**

UNIT – IV

7. (a) Enumerate the functions of draft tube used in turbine. Explain its different types with neat sketch. **[7M]**

   (b) A turbine is to operate under a head of 30 m at 190 rpm and the discharge is $8 m^3/s$. If the efficiency is 85%, then determine (i) The power generated, (ii) Specific speed of the turbine, (iii) Type of turbine and (iv) The performance of turbine under a head of 20 m. **[7M]**

8. (a) Explain the construction and working of a Pelton turbine with a neat diagram. **[7M]**

   (b) A Kaplan turbine working under a head of 5.5 m develops 2950 kW. It is fitted with a draft tube having inlet diameter 3 m and it is placed 1.6 m above the tail race level. The vacuum gauge connected to the inlet of draft tube reads 5 m of water. If the efficiency of draft tube is 75%, then determine the efficiency of the turbine. Take atmospheric pressure head as 10.3 m of water. **[7M]**

UNIT – V

9. (a) With neat sketch explain the construction and working principle of reciprocating pump. **[7M]**

   (b) The internal and external diameters of a centrifugal pump are $10\,cm$ and $20\,cm$ respectively. It runs at $2800 rpm$ and delivers $0.105\,m^3/s$ of water. The widths of impeller at the inlet and outlet are 2 cm and 1cm, respectively. The water enters the impeller radially at the inlet and impeller blade angle at the exit is 45^0. Determine the pressure rise in the impeller by assuming that flow velocity as constant and neglecting losses through it. **[7M]**

10. (a) Discuss the importance and applications of model study. **[7M]**

    (b) The velocity through a circular orifice depends on the head H causing the flow, diameter of the orifice D, coefficient of viscosity μ, mass density ρ and the acceleration due to gravity g. Using Buckingham pi theorem, obtain an expression for V. **[7M]**

– ○ ○ ◯ ○ ○ –