

**R09**

Code No: 54063

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B.Tech II Year II Semester Examinations, July/August - 2021**

**MECHANICS OF FLUIDS AND HYDRAULIC MACHINES**

(Common to ME, MIE)

Time: 3 hours

Max. Marks: 75

Answer any five questions  
All questions carry equal marks

- 1.a) Differentiate between: i) Liquid and gases ii) real fluid and ideal fluid iii) Specific weight and specific volume of a fluid.
- b) Calculate the capillary effect in millimeters in a glass tube of 4 mm diameter, when immersed in: i) water and ii) Mercury. The temperature of the liquid is  $20^{\circ}\text{C}$  and the value of the surface tension of water and mercury at  $20^{\circ}\text{C}$  in contact with air are  $0.073575\text{ N/m}$  and  $0.51\text{ N/m}$  respectively. The angle of contact for water is zero that for mercury  $1.30^{\circ}$ . Take density of water at  $20^{\circ}\text{C}$  as equal to  $998\text{ kg/m}^3$ . [7+8]
- 2.a) Define two dimensional stream function and velocity potential.
- b) Show that the stream function  $\psi = 6x - 4y + 7xy + 9$  represents an irrotational flow. Find its velocity potential. [7+8]
- 3.a) Derive the equation for actual discharge in an orifice meter.
- b) A  $30\text{ cm} \times 15\text{ cm}$  venturimeter inserted in vertical pipe carrying water, flowing in the upward direction. A differential mercury manometer connected to inlet and throat gives a reading of  $30\text{ cm}$ . Find the discharge  $C_d = 0.98$ . [7+8]
- 4.a) Explain the phenomenon of boundary layer separation and its influence on the drag of an immersed body.
- b) Find the ratio of skin friction drag on front half and rear half positions of flat plate kept in uniform stream of zero incidence. Assume the boundary layer to be turbulent over the entire plate. [7+8]
5. A metal plate of  $10\text{ mm}$  thickness and  $200\text{ mm}$  square in hung so that it can swing freely about upper horizontal edge. A horizontal jet of water of  $20\text{ mm}$  diameter impinges with its axis perpendicular and  $50\text{ mm}$  below the edge of hing, and keeps it steadily inclined at  $30^{\circ}$  to vertical. Find the velocity of the jet if the specific weight of the metal is  $75.54\text{ kN/m}^3$ . [15]
6. What is draft tube? What are the uses of Draft tube? Describe with neat sketches different types of draft tube. [15]
- 7.a) Define the term governing of turbine. Describe with neat a sketch the working of an oil pressure governor.
- b) A turbine develops  $7460\text{ kW}$  under a head of  $24.7\text{ m}$  at  $135\text{ r.p.m.}$  What is the specific speed? What would be its normal speed and output under a head of  $19.5\text{ m}$ ? [7+8]
8. A one fourth scale model of a pump was tested in laboratory at  $1000\text{ r.p.m.}$  The head developed and the power input at the best efficiency point were found to be  $8\text{ m}$  and  $30\text{ kW}$  respectively. If the prototype pump has to work against a head of  $25\text{ m}$ , determine its working speed, the power required to drive it and the ratio of the flow rates handled by the two pumps. [15]