Hall Ticket No | | | | | | | | | | | Question Paper Code:ACEC03

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022
Regulation:UG-20

FLUID MECHANICS

Time: 3 Hours **(CE)** **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) Explain the following terms:
   i) Dynamic viscosity and kinematic viscosity
   ii) Surface tension and capillarity. **[7M]**

   (b) A plate having an area of $1m^2$ is dragged down an inclined plane at 45^0 to horizontal with a velocity of 0.5m/s due to its own weight. There is a cushion of liquid 1mm thick between the inclined plane and the plate. If viscosity of oil is 0.1 PaS, find the weight of the plate. **[7M]**

MODULE – II

2. (a) Explain the importance of manometer with the neat sketch and discuss in detail the principle of working the manometers. **[7M]**

   (b) A hydraulic press has a ram of 30 cm diameter and a plunger of 4.5 cm diameter. Find the weight lifted by the hydraulic press when the force applied at the plunger is 500 N. **[7M]**

MODULE – III

3. (a) Derive the continuity equation in Cartesian coordinates for a steady, incompressible, three dimensional flow. **[7M]**

   (b) In a two dimensional incompressible flow the fluid velocity components are given by
   u = x – 4y and v = -y – 4x
   where u and v are x and y components of velocity of flow. Show that the flow satisfies the continuity equation and obtain the expression for stream function. **[7M]**

4. (a) Explain the following terms:
   i) Steady-uniform flow and unsteady- non uniform flow
   ii) Laminar flow and turbulent flow based on Reynolds number. **[7M]**

   (b) A stream function in a two dimensional flow is ψ= 2 x y. Show that the flow is irrotational and determine the corresponding velocity potential. **[7M]**

MODULE – IV

5. (a) State and derive Bernoulli's energy equation for one dimensional streamline flow. **[7M]**

(b) A horizontal venturimeter with inlet diameter 200 mm and throat diameter 100 mm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 60 lps. Find the reading of the oil-mercury differential manometer. Take $C_d = 0.98$. **[7M]**.

6. (a) What are the forces acting on the fluid in motion? Derive Euler's equation of motion. **[7M]**

(b) A Pitot-tube is inserted in a pipe of 300 mm diameter. The static pressure is 100 mm of mercury (vacuum). The stagnation pressure at the centre of pipe recorded by the Pitot-tube is 9.81 kPa. Calculate the rate of flow of water through the pipe, if the mean velocity of flow is 0.85 times the central velocity. Take $C_v = 0.98$. **[7M]**

MODULE – V

7. (a) What do you mean by water hammer in pipes? Explain the types of major and minor losses occurring in pipe flow. **[7M]**

(b) Two pipes are connected in parallel between two reservoirs that have difference in levels of 3.5 m. The length, the diameter, and friction factor (4 f) are 2400 m, 1.2 m, and 0.026 for the first pipe and 2400 m, 1 m, and 0.019 for the second pipe. **[7M]**

8. (a) What is meant by equivalent size of pipe? Derive an equation for equivalent size of pipe. **[7M]**

(b) Find the diameter of a Galvanized iron pipe required to carry a flow of 40lps of water, if the loss of head is not to exceed 5m per 1km length of pipe, assume f=0.02 in $h_f = flv^2/2gd$. **[7M]**

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