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INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular / Supplementary) - May 2019

Regulation: IARE – R16

FLUID MECHANICS

Time: 3 Hours

(CE)

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

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

UNIT – I

1. (a) Define mass density, specific gravity, viscosity and vapour pressure. Illustrate the expression for the capillary rise or fall of liquid in a glass tube with a neat sketch. [7M]
- (b) Calculate the specific weight, specific mass, specific volume and specific gravity of a liquid having a volume of 6 m^3 and weight of 44 kN. [7M]
2. (a) State Pascal's Law. Deduce the expression for total pressure and center of pressure when the plane is immersed inclined to the water surface. [7M]
- (b) An annular plate 2 m external diameter and 1m internal diameter with its greatest and least depths below the surface being 1.5 m and 0.75 m respectively. Calculate the magnitude, direction and location of the force acting upon one side of the plate due to water pressure. [7M]

UNIT – II

3. (a) Explain the description of fluid motion. Classify flows with respect to space, time and Reynolds number. [7M]
- (b) For a two dimensional flow field given by $V = (3 + 2xy + 4t^2) i + (xy^2 + 3t) j$, determine the velocity and acceleration at a point (1,2) after 2 sec. [7M]
4. (a) Deduce the continuity equation in three dimensional Cartesian coordinate system. [7M]
- (b) The velocity potential function for a two dimensional flow is $\varphi = x(2y - 1)$. At a point (4, 5) determine the velocity and the value of stream function. [7M]

UNIT – III

5. (a) Discuss different types of equilibrium of floating bodies and explain the determination of metacentric height using analytical method. [7M]
- (b) A log of wood 0.9 m in diameter and 7.5 m long is floating in river water. If the specific gravity of log is 0.7, what is the depth of the wooden log in water. [7M]
6. (a) What is Euler's equation? How will you obtain Bernoulli's equation from it? [7M]
- (b) A horizontal venturimeter with inlet and throat diameters 300 mm and 100 mm respectively is used to measure the flow of water. The pressure intensity at inlet is 130 kN/m^2 while vacuum pressure head at the throat is 350 mm of mercury. Assuming 3 percent of head lost in between the inlet and throat, find the value of coefficient of discharge and rate of flow. [7M]

UNIT – IV

7. (a) Define boundary layer thickness and explain the characteristics of boundary layer with a neat sketch. [7M]
- (b) A plate 450 mm x 150 mm has been placed longitudinally in a stream of crude oil of specific gravity 0.925 and kinematic viscosity of 0.9 stoke which flows with velocity of 6 m/s. Calculate friction drag on the plate, thickness of the boundary layer at the trailing edge and shear stress at the trailing edge. [7M]
8. (a) Explain boundary layer separation and control methods. [7M]
- (b) A kite dimensions 0.8 m X 0.8 m and weighing 6 N is maintained in air at an angle of 10° to the horizontal. The string attached to the kite makes an angle of 45° to the horizontal and at this position, the drag and lift coefficients are estimated to be 0.6 and 0.8. Determine wind speed and tension in the air. Take density of air as 1.2 kg/m^3 [7M]

UNIT – V

9. (a) Define couette flow and describe flow of viscous fluid between two parallel plates. [7M]
- (b) The diameter of a horizontal pipe which is 300 mm is suddenly enlarged to 600 mm. The rate of flow of water through this pipe is 0.4 cumec. If the intensity of pressure in the smaller pipe is 125 kN/m^2 , determine loss of head due to sudden enlargement, intensity of pressure in the larger pipe and power lost due to enlargement. [7M]
10. (a) Define hydraulic gradient line and total energy line. Explain pipes in series and equivalent pipe with a neat sketch. [7M]
- (b) A pipe line of 600 mm diameter is 1.5 km long. To increase the discharge another line of the same diameter is introduced parallel to the first in the second half of the length. If $f = 0.01$ and head at inlet is 300 mm calculate the increase in discharge. Neglect minor losses. [7M]

