27/6/2016

4E4141

Roll No. _____ Total No of Pages: 4

4E4141

B.Tech. IV-Sem (Back) Examination June-July 2016
Automobile Engineering
4AE2A(O) Fluid Mechanics

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks (Main & Back): 26
Min. Passing Marks (Old Back): 24

Instructions to Candidates:-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No.205)

1. NIL 2. NIL

UNIT-I

Q.1 (a) Calculate the density, specific weight and weight of one litre of petrol of specific gravity = 0.7 [4]

(b) Explain surface tension and capillarity in detail. [6]

(c) What is manometers? Classify and explain simple manometers and differential manometers. [6]

OR

Q.1 (a) Calculate the capillary rise in a glass tube of 2.5 mm diameter when immersed vertically in (a) water and (b) mercury. Take surface tensions $\sigma = 0.0725$ N/m for water and $\sigma = 0.52$ N/m for mercury in contact with air. The specific gravity of mercury is given as 13.6 and angle of contact =130°

[6]

(b) Derive the formula for centre of pressure when inclined plane surface submerged in liquid.

[10]

Q.2 (a) Derive continuity equation in three Dimensions.

[8]

(b) The velocity Potentials function (ϕ) is given by an expression.

$$\varphi = \frac{xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$$

(i) Find velocity components in x & y directions.

(ii) Show that ϕ represents a possible case of flow.

[8]

OR

Q.2 (a) Derive Euler's equation of motion.

[8]

(b) The head of water over an orifice of diameter 100 mm is 10 m. The water coming out from the orifice is collected in a circular tank of diameter 1.5m. The rise of water level in this tank is 1.0m. in 25 seconds. Also the coordinates of the point on the jet, measured from vena contracta are 4.3m. horizontal and 0.5m. vertical. Find the coefficients, C_d, C_v and C_c.

[8]

UNIT-III

Q.3 (a) State Buckingham's $\prod$ theorem [4]

(b) The efficiency η of a fan depends on density ρ, Dynamic viscosity μ of the fluid, angular velocity w, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. [12]

OR

Q.3 (a) Define dimensionless numbers. Explain various dimensionless numbers and also write their significance [2+4]

(b) Derive the equation for laminar flow between parallel plates. [10]

UNIT-IV

Q.4 (a) Describe in detail Prandtl mixing length theory for turbulent shear stress. [6]

(b) Determine the wall shearing stress in a pipe of diameter 100mm, which carries water. The velocities at the pipe centre and 30mm from the pipe center are 2m/s and 1.5m/s respectively. The flow in pipe is given as turbulent. [6]

(c) A pipeline carrying water has average height of irregularities projecting from the surface of the boundary of the pipe as 0.15mm. What type of boundary is it? The shear stress developed is $4.9N/m^{2.}$ The kinematic viscosity of water is 0.01 stokes. [4]

OR

Q.4 (a) Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3m/s using.

(i) Darcy formula

(ii) Chezy's formula for which c = 60 [8]

(b) At a sudden enlargement of water main from 240mm to 480mm diameter, the hydraulic gradient raises by 10mm. Estimate the rate of flow. [8]

UNIT-V

Q.5 (a) Derive the formula for the drag force on a flat plate due to boundary layer. [8]

(b) Describe in detail –

(i) Laminar boundary layer

(ii) Turbulent boundary layer [5+3]

OR

Q.5 (a) Derive the expression for drag and lift. [8]

(b) Write short notes on (Any Two)

(i) Drag on sphere and cylinder

(ii) Development of lift on circular cylinder

(ii) Development of lift on an airfoil [4×2=8]
