4E4148

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B. Tech. IV Sem. (Back) Exam., May - 2019
Automobile Engineering
4AE2A Fluid Mechanics & Machines

Time: 3 Hours **Maximum Marks: 80**
Min. Passing Marks: 26

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) Define Surface tension. Prove that the relationship between surface tension and pressure inside a droplet of liquid in excess of outside pressure is given by $P=4\sigma/d$. [8]

(b) Calculate the pressure at a height of 8000 m above sea-level if the atmospheric pressure is 101.3 KN/m^2 and temperature is 15°C at the sea-level assuming (i) air is incompressible (ii) pressure variation follows adiabatic law, and (iii) pressure variation follows isothermal law. Take the density of air at the sea-level as equal to 1.285 kg/m^3. Neglect variation of g with altitude. [8]

OR

Q.1 Differentiate between:

(a) Dynamic viscosity and kinematics viscosity [4]

(b) Absolute and gauge pressure [4]

(c) Simple and differential manometers [4]

(d) Centre of gravity and centre of buoyancy [4]

UNIT- II

Q.2 (a) Define the equation of continuity. Obtain an expression for continuity equation for a three-dimensional flow. **http://rtuonline.com** [8]

(b) Gasoline flows through a constriction in a horizontal pipe where the diameter is reduced from 20 cm to 10 cm. The pressure in the 20 cm pipe just upstream of constriction is 60 kPa. Considering no loss of energy in the flow passage, make calculations for the maximum discharge that can be passed through the constriction without the occurrence of cavitation. The barometer reads 76 cm of mercury and for gasoline vapour pressure is 56 kPa (abs) density is 650kg/m^3 for the pressure and temperature conditions involved. [8]

OR

Q.2 (a) State Euler's equation of motion and obtain the Bernoulli's equation from it. [8]

(b) Pipeline carrying oil of specific gravity 0.87, change in diameters from 200mm diameter at a position A to 500mm diameter at a position B which is 4m at a higher level. If the pressure at A to B are 9.81 N/cm^2 and 5.9 N/cm^2 respectively and discharge is 200 litres/sec. Determine loss of head and direction of flow. [8]

UNIT- III

Q.3 Show that the ratio of average velocity to maximum velocity for viscous flow between two stationary parallel plates is 2/3. [16]

OR

Q.3 A smooth pipe of diameter 80 mm and 800 m long carries water at the rate 0.480 m3/minute. Calculate the loss of head, wall shearing stress, centre line velocity, velocity and shear stress at 30 mm from pipe wall. Also calculate the thickness of laminar sub-layer. Take kinematic viscosity of water as 0.015 stokes. Take the value of co-efficient of friction 'f' from the relation given as: **http://rtuonline.com** [16]

$f = \frac{0.0791}{(R_e)^{1/4}}$, where Re = Reynolds number.

UNIT- IV

Q.4 (a) What are the uses of notches and weirs? Derive an expression for the discharge over a cipolletti weir? [8]

(b) A hemispherical tank of diameter 4 m contains water upto a height of 1.5 m. An orifice of diameter 50mm is provided at the bottom. Find the time required by water (i) to fall from 1.5 m to 1.0 m (ii) for completely emptying the tank. Take $C_d = 0.6$. [8]

OR

Q.4 (a) Derive an expression for the loss of head due to sudden enlargement. [8]

(b) Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 200 mm and length 400m. The rate of flow of water through the pipe is 250 litres/s. Consider all losses and take the value of f=0.008. http://rtuonline.com [8]

UNIT- V

Q.5 (a) Write short note on Hydraulic Intensifier. http://rtuonline.com [4]

(b) Explain the theory and function of a draft tube. Derive an expression for draft tube. [12]

OR

Q.5 (a) Explain briefly about Hydraulic Ram. [4]

(b) Prove that the maximum efficiency of Pelton wheel is given by :

$$\eta_{max.} = \frac{1+k\cos\phi}{2}$$ [12]
