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320452(20)

B. E. (Fourth Semester) Examination, April-May 2021

(New Scheme)

(Civil Engg. Branch)

FLUID MECHANICS-II

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) of each question is compulsory and carries 2 marks. Attempt any two parts from (b), (c) and (d) each carrying 7 marks.*

Unit-I

1. (a) Define equivalent pipe & Write Dupuit's equation for that. 2

   (b) A smooth pipe of diameter 400 mm and length 800 m carries water at the rate of 0.04 m^3/s. Determine

the head loss due to friction, wall shear stress, centre-line velocity and thickness of laminar sub-layer. Take the kinematic viscosity of water as 0.018 stokes. 7

(c) Water is flowing through a rough pipe of diameter 500 mm and length 4000 m at the rate of 0.5 m^3/s. Find the power required to maintain this flow. Take the average height of roughness as $K = 0{\cdot}40$ mm. 7

(d) Short notes on : 7

(i) Colebrook-White equation

(ii) Moody's diagram

(iii) Hardy-cross method

Unit-II

2. (a) What do you mean by magnus effect? 2

(b) A plate of 600 mm length and 400 mm wide is immersed in a fluid of specific gravity 0.9 and kinematic viscosity 10^{-4} m^2/s. The fluid is moving with a velocity of 6 m/s. Determine : 7

(i) Boundary layer thickness

(ii) Shear stres at the end of the plane.

(iii) Drag force on one side of the plate.

(c) A kite 0.8 m × 0.8 m weighing 0.4 kgf assumes an angle of 12° to the horizontal. The string attached to the kite makes an angle of 45° to the horizontal. the pull on the string is 2.5 kgf when the wind is flowing at a speed of 30 km/hour. Find the corresponding co-efficient of drag and lift. Density of air is given as 1.25 kg/m^3. 7

(d) Derive expression for displacement thickenss over a flat plate. 7

Unit-III

3. (a) What do you mean by specific energy and alternate depths? 2

(b) A hydraulic jump forms at the downstream end of spillway carrying 17.93 m^3/s discharge. If the depth before jump is 0.80 m, determine the depth after the jump and energy loss. 7

(c) Find the slope of the free water surface in a rectangular channel of width 20 m having depth of flow 5 m. The discharge through the channel is 50 m^3/s. The bed of the channel is having a slope of 1 in 4000. Take the value of Chezy's constant C = 60. 7

(d) Derive the conditions for critical flow in an open channel. 7

Unit-IV

4. (a) What is dimensionally homogeneous equation? 2

(b) The efficiency (η) of a fan depends on density (ρ), viscosity μ of fluid, angular velocity (ω'), diameter (D) of the rotor and the discharge (Q). Express (η) in terms of dimensionless parameters. 7

(c) A ship 300 m long moves in sea-water, whose density is 1030 kg/m^3, A1 : 100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30 m/s and the resistance of the model is 60 N. Determine the velocity of ship in sea-water and also the resistance of the ship in sea-water. The density of air is given as 1.24 kg/m^3. Take the kinematic viscosity of sea water and air as 0.012 stokes and 0.018 stokes respectively. 7

(d) The water is flowing with a velocity of 1.5 m/sec in a pipe of length 2500 m and of diameter 500 mm. At the end of the pipe, a valve is provided. Find rise

in pressure if the valve is closed in 25 seconds. Take the value of C = 1460 m/sec. 7

Unit-V

5. (a) What do you mean by overall efficiency of turbine? 2

(b) A Pelton wheel is to be designed for the following specifications :
Shaft power = 11772 kW; Head = 380 m; Speed = 750 rpm; overall efficiency = 86%; Jet diameter is not to exceed one-sixth of wheel dia.

Determine :

(i) The wheel diameter;

(ii) number of jet required;

(iii) Diameter of the jet

Take K_{v1} = 0.985 & K_{u1} = 0.45. 7

(c) Write a short note on : 7

(i) Draft tube

(ii) Specific speed

(iii) Governing of turbine

(iv) Cavitation

(d) Give classification of water turbines. 7