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320452(20)

B. E. (Fourth Semester) Examination, April-May 2020

(New Scheme)

(Civil Engg. Branch)

FLUID MECHANICS-II

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) of each question is compulsory. Attempt any two parts from (b), (c) and (d) of each question.*

Unit-I

1. (a) Define free & wall turbulence. 2

(b) Derive the velocity distribution equation for turbulent flow is smooth pipes. 7

(c) A smooth pipe of diameter 80 mm & 800 m long carries water at a rate of 0·480 m^3/minute. Calculate the loss of head, wall shear stress, centre line velocity, velocity & shear stress at 30 mm pipe wall. Also calculate the thickness of laminar sub-layer. Take kinematic viscosity of water as 0·015 stokes. Take the value of coefficient of friction f from the relation given as $f = 0{\cdot}0791/(Re)^{1/4}$, where Re = Reynold's no. 7

(d) Write short note on Hardy-cross method. 7

Unit-II

2. (a) Define laminar boundary layer & turbulent boundary layer. 2

(b) A kite 0·8 m × 0·8 m weighing 0·4 kg assumes an angle of 12° to the horizontal. The string is attached to the kite makes an angle of 45° to the horizontal. The pull on the string is 2·5 kg when the wind is flowing at a speed of 30 km/hr. Find the corresponding coefficients of drag & lift. Specific weight of air is given as 1·25 kg/m^3. 7

(c) Derive the expression for Von Karman integral equation. 7

(d) Explain the phenomenon of boundary layer separation. 7

Unit-III

3. (a) Subcritical & supercritical flow. 2

(b) Explain specific energy curve with neat sketch. 7

(c) Derive the equation for gradually varied flow. 7

(d) The depth of flow of water, at a certain section of a rectangular channel of 2 m wide, is 0·3 m. The discharge through the channel is 1·5 m^3/s. Determine whether a hydraulic jump will occur and if so, find its height and loss of energy per kg of water. 7

Unit-IV

4. (a) Define Diamentional analysis. 2

(b) The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by :

$$T = D^5 N^2 \rho \phi \left[\frac{\mu}{D^2 N \rho} \right]$$

Prove this by the method of Buckingham's π-theorem. 7

(c) Explain the different dimensionless number and their significance. 7

(d) A valve is provided at the end of a cast iron pipe of diameter 150 mm and of thickness 10 mm. The water is flowing through the pipe, which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is 196·2 N/cm^2. Take K for water as 19·62 × 10^4 N/cm^2 and E for cast iron pipe as 11·772 × 10^6 N/cm^2. 7

Unit-V

5. (a) Define specific speed of a centrifugal pump. 2

(b) A turbine is to operate under a head of 25 m and run at 200 rpm. The discharge is 9 cumecs. If the overall efficiency is 90% determine : 7

(i) Specific speed of turbine

(ii) Power generated

(iii) Type of turbine

(c) Obtain an expressions for unit speed, unit discharge and unit power of turbine. 7

(d) Discuss characteristics cruves of turbine in brief. 7