Total number of printed pages: 02

UG/4th Semester/UCE403

2023

HYDRAULIC ENGINEERING

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **ALL** questions.*

1. Write in details in the following: 5*4 = 20

a) Terminal fall velocity

b) syphon

c) Gradually varied flow

d) Application of dimensional analysis

2. a) Calculate critical depth and specific energy for a rectangular channel. Assume the necessary. 8

b) Find the diameter of a circular sewer pipe which is laid at a slope of 1 in 8000 and carries a discharge of 800 litres/s when flowing half full. Take the value of Manning's $n = 0.020$. 12

3. a) Derive the 3D governing mathematical equation of motion for viscous flow (Navier-Stokes equation). Assume the necessary. 14

b) Write a short note on hydraulic jump. Draw the necessary figure. 6

4. a) The water is flowing with a velocity of 1.5 m/s in a pipe of length 2500 m and of diameter 500 mm. At the end of pipe, a valve is provided. Find the rise in pressure if valve is closed in 25 sec. Take velocity of sound is 1460 m/s. 13

If, the valve is closed in 2 sec., then find the rise in pressure behind the valve. Consider pipe to be rigid and bulk modulus of water is $19.62*10^4$ N/cm^2.

b) Write a short note on boundary layer separation. Draw the necessary figure. 7

5. a) Find the displacement thickness and momentum thickness for the velocity distribution in the boundary layer given by 12

$$\frac{u}{v_0} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

b) A rectangular channel with a bottom width of 4.0 m and bottom slope of 0.0008 has a discharge of 1.50 m^3/s. In a gradually varied flow in this channel, the depth at a certain location is found to be 0.30 m. Assume, Manning's n = 0.016. Determine the type of gradual varied flow profile. 8

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