Total number of printed pages: 02

UG/4th Semester/UCE403

2024

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) Hydraulic jump and its types

b) Application of dimensional analysis

c) Specific energy

d) Equivalent pipe

2. a) The Water is flowing with a velocity of 2 *m/s* in a pipe of length 2000 m and diameter 600 mm. At the end of pipe, a valve is provided. Find the rise in pressure if valve is closed in 20 sec. Take speed of sound is 1420 *m/s*. 10

If, the thickness of pipe is 10 mm and valve is closed suddenly. Find the rise in pressure if pipe is considered to be elastic. Take Young's modulus for pipe material is $19.62*10^6$ N/cm^2 and bulk modulus for water is $19.62*10^4$ N/cm^2.

b) Write in details about water hammer and its control measures. 10

3. a) Derive the 3D governing mathematical equation of motion for viscous flow (Navier-Stokes equation). Assume the necessary. 12

b) Write in details on positive and negative surge with an example of each. Draw the necessary figure. 8

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

b) Derive the governing equation for gradually varied flow (GVF). Assume the necessary. 13

5. a) Find the displacement thickness and momentum thickness for the velocity distribution in the boundary layer given by 10

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

b) In a 4.0 m wide rectangular channel with Manning's n = 0.017, the bed slope is 0.0006. When the channel is conveying 10 m^3/s of flow, then estimate the nature of gradually varied flow profiles at two far away section A & B in this channel where the depth of flow is measured as 1.6 m and 2.1 m respectively. 10

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