

Roll No.

Total Pages : 3

002620

May 2024

B.Tech. (Civil) - VI SEMESTER

HYDRAULIC ENGINEERING

(PCC-CE-302)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) Determine the nature of flow when an oil of specific gravity 0.85 and viscosity 0.38 Ns/m² flows in a 5 cm diameter horizontal pipe with velocity 2 m/s. (1.5)
(b) What is meant by turbulence? Also write what are the causes of turbulence? (1.5)
(c) Define displacement thickness. (1.5)

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- (d) What are the limitations of hydraulic similitude? (1.5)
- (e) Differentiate between open channel flow and pipe flow. (1.5)
- (f) What is Chezy's formula? (1.5)
- (g) Explain Impulse-Momentum Principle. (1.5)
- (h) State the conditions under which uniform and non-uniform flows are produced. (1.5)
- (i) Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 litres/sec. (1.5)
- (j) What do you mean by grid generation in CFD? (1.5)

PART-B

2. (a) Derive Hagen-Poiseuille equation and state the assumptions made. (8)
- (b) What are the semi-empirical theories of turbulence? Explain the concept of mixing length introduced by Prandtl and state the relationship that exists between the turbulent shearing stress and mixing length. (7)
3. (a) What do you mean by separation of boundary layer? What is the effect of pressure gradient on boundary layer separation? (7)
- (b) What is a boundary layer? Why does it increase with distance from the upstream edge? Also write characteristics of a boundary layer. (8)

4. Using the method of dimensional analysis obtain an expression for the discharge Q over a rectangular weir. The discharge depends on the head H over the weir, acceleration due to gravity g , length of weir crest L , height of the weir crest over the channel bottom Z and the kinematic viscosity ν of the liquid. (15)
5. (a) The discharge of water through a rectangular channel of width 8 m, is $15 \text{ m}^3/\text{s}$ when depth of flow of water is 1.2 m. Calculate : (10)
- (i) Specific energy of the flowing water.
- (ii) Critical depth and critical velocity.
- (iii) Value of minimum specific energy. (10)
- (b) Briefly explain classification of flow in open channels. (5)
6. (a) Explain the term hydraulic jump. Prove that loss of energy head in a hydraulic jump is equal to $(d_2 - d_1)^3 / (4d_1d_2)$, where d_1 and d_2 are the conjugate depths. (10)
- (b) What do you mean by 'Most-economical section' of an open channel? How is it determined? (5)
7. Write short notes on the following : (5)
- (a) Hydro informatics. (5)
- (b) Darcy-Wiesbatch equation. (5)
- (c) Water hammer in pipes. (5)