M. TECH. CIVIL (WATER RESOURCE ENGINEERING)

M. Tech. Civil (Water Resource Engineering) Sem-II :SUMMER- 2022

SUBJECT : OPEN CHANNEL FLOW

Day : Monday
Date : 1/8/2022

S-23659-2022

Time : 10:00 AM-01:00 PM
Max. Marks : 60

N. B. :

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the sections should be written in **SEPARATE** answer books.
4) Use of non-programmable calculator is **ALLOWED**.

SECTION – I

Q. 1 **a)** Explain the energy equation in case of open channel flow with a neat sketch. **(05)**

b) Explain about Momentum correction factor and its significance. **(05)**

OR

a) Write a note on pressure variation in the vertical in open channel flow. **(05)**

b) Explain with neat sketch the basic difference between open channel flow and closed conduit flow. **(05)**

Q. 2 **a)** Explain with neat sketch the term shear stress on the boundary of open channel flow. **(05)**

b) Discuss the factors affecting Manning's 'n'. **(05)**

OR

a) Derive Chezy's formula for uniform flow in open channel stating assumptions made in. **(05)**

b) A trapezoidal channel 4m wide having side slope 1:1 carries discharge of 12 m^3/s to a depth of 1.8 m under uniform flow conditions. Longitudinal slope of channel bed is 1:3000. Compute the average shear stress in N/m^2 on the boundary. Also compute Manning's 'n'. **(05)**

Q. 3 **a)** Define: **(05)**

i) Specific energy

ii) Specific force

iii) Critical depth

iv) Alternate depths

b) With usual notations prove that Specific energy, $E = \frac{y_1^2+y_1y_2+y_2^2}{(y_1+y_2)}$. **(05)**

OR

Derive the condition for critical flow for any channel section and prove that the critical depth for rectangular channel is $(q^2/g)^{1/3}$ where q is discharge per unit width and g is gravitational acceleration. **(10)**

P. T. O.

SECTION – II

Q. 4 **a)** List the gradually varied flow profiles which are possible. **(05)**

b) Derive the expression for the gradually varied flow for a wide rectangular channel in the form $\frac{dy}{dx} = S_0 \frac{(1-\frac{y_n}{y})^{10/3}}{(1-\frac{y_c}{y})^3}$ **(05)**

OR

a) Sketch and discuss the profiles on mild slope. Give examples. **(05)**

b) Discuss the Direct Step method of GVF profile computations. **(05)**

Q. 5 **a)** Define hydraulic jump. State the assumptions in the theory of hydraulic jump. **(05)**

b) Derive the expression for loss of energy in hydraulic jump. **(05)**

OR

a) Discuss the classification of hydraulic jump. **(05)**

b) For a hydraulic jump in a rectangular channel prove the following with usual notions: **(05)**

$$\sqrt{1 + 8\,Fr_1^2} - 1 = \frac{4}{\sqrt{1 + 8\,Fr_2^2} - 1}$$

Q. 6 Explain the terms: **(10)**

i) Celerity

ii) Surges

iii) Positive surge

iv) Negative surge

In case of open channel flow.

OR

Write St. Venant's equations. What are the assumptions made in the derivation of these equations? Explain the significance of terms in the St. Venant's equations. **(10)**

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