M. TECH.-II (CIVIL-HYDRAULIC ENGINEERING) (CBCS – 2015 COURSE) : SUMMER - 2018

SUBJECT: OPEN CHANNEL FLOW

Day: **Friday** Time: **11.00 AM TO 02.00 PM**

Date: **15/06/2018** **S-2018-2996** Max. Marks: 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the section should be written in **SEPARATE** answer books.
4) Draw neat and labeled diagram **WHEREVER** necessary.
5) Assume suitable data, if **necessary**.

SECTION - I

Q.1 **a)** Derive equation of conservation of mass in open channel flow. **(05)**

b) Explain with sketches gradually varied flow, rapidly varied flow and spatially varied flow. **(05)**

OR

a) What is hydraulically efficient channel section? **(05)**

b) Derive an expression to obtain the value of energy correction factor in an open channel flow. **(05)**

Q.2 **a)** State the factors affecting Manning's n. **(05)**

b) What is equivalent roughness and explain how it is determined. **(05)**

OR

State two standard resistance laws applicable to uniform flow in open channel. Explain their limitations. Which is convenient for practical use? **(10)**

Q.3 **a)** Explain with neat sketch the specific energy curve. **(05)**

b) For flow in rectangular channel at a constant specific energy show that with usual notations **(05)**

$$\frac{q}{q_{max}} \sqrt{3\left(\frac{y}{y_c}\right)^2 - 2\left(\frac{y}{y_c}\right)^3}$$

OR

a) What is Froude's number? Show that in an open channel, minimum specific energy at a given flow occurs when Froude's number is unity. **(05)**

b) A rectangular channel has width 2m and carries a discharge of 2 m^3/sec with a depth of 0.4 m. Calculate specific energy, alternate depth (to existing depth) and Froude number for alternate depth. **(05)**

SECTION – II

Q.4 **a)** Derive the dynamic equation of gradually varied flow. **(05)**

b) Draw sketches of profiles on mild slope. Give examples. **(05)**

OR

a) Discuss the direct step method of GVF profile computation. **(05)**

b) Sketch the profiles on steep slope. Give examples **(05)**

P.T.O.

Q.5 **a)** Define : **(05)**

i) Hydraulic jump
ii) Height of hydraulic jump
iii) Efficiency of hydraulic jump
iv) Relative loss

b) With usual notations for jump in rectangular channel on horizontal bed, prove that $(y_1 + y_2) = \frac{2q^2}{gy_1y_2}$ **(05)**

OR

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

b) In case of hydraulic jump in a rectangular channel, prove with usual notation $F_{r1}^{\ 2} = \frac{8F_{r2}^{\ 2}}{\left(\sqrt{1+8F_{r2}^{\ 2}} - 1\right)^3}$ **(05)**

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

i) Celerity
ii) Surges
iii) Positive surge
iv) Negative surge

in case of open channel flow

OR

Explain how the St. Venarnt's equations are transformed into the four characteristic equations in the method of characteristics. **(10)**

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