

TCE-401

158

Even Semester Examination, 2017-18

B.Tech. (SEMESTER-IV)

HYDRAULICS AND HYDRAULIC MACHINE

Time: 03:00 Hours

Max Marks : 100

Note : Attempt all questions. Assume suitable data if required. Use of calculators are permitted

1) Attempt any 4 of the following.

(4×5=20)

- a. Why open channel flow problems are more difficult to analyze compared to pipe flow problems?
- b. What is the maximum discharge that may be carried by 3 m wide rectangular channel at a specific energy of 1.5 m?
- c. Write difference between open channel flow and pipe flow. What causes the flow in an open channel?
- d. Derive equation of continuity for unsteady flow in an open channel.
- e. A discharge of $25 \text{ m}^3/\text{s}$ flows in a 12m wide rectangular channel under the critical condition. Find the depth, specific energy and critical slope of the channel if $n=0.015$.
- f. What do you understand by the most efficient channel section? Find the condition for most efficient Rectangular channel section.

2) Attempt any 4 of the following.

(4×5=20)

- a. Determine the critical depth in a triangular channel of angle 90° for a discharge of $1.0 \text{ m}^3/\text{s}$.
- b. Write the expression for specific force in a rectangular channel and obtain the condition for maximum discharge for a given specific force.
- c. Derive discharge formula in case of horizontal contractions channel.

- d. Discuss the use of the hydraulic jump as an energy dissipater below a hydraulic structure.
- e. What is difference between gradually varied flow and rapidly varied flow?
- f. Describe Manning's equation for uniform flow in an open channel with its limitations.

3) Attempt any two of the following. (2×10=20)

- a. Define hydraulic jump. Write their uses. Describe with sketches types of hydraulic jumps on the basis of Froude number and jumps at vena contracta, repelled jump and submerged jump.
- b. Determine the most efficient section of a trapezoidal channel with side slopes 2H:1V carrying a discharge of $12.0 \text{ m}^3/\text{s}$ with a velocity of 0.70 m/s . what should be the bed slope of the channel? Take manning's $N= 0.025$
- c. A trapezoidal channel is to carry a discharge of $40 \text{ m}^3/\text{s}$. the maximum slope can be used is 1:2500 and soil is hard. Design the channel as unlined non erodible channel. Take $n=0.020$ and side slope 1:1.

4) Attempt any two of the following. (2×10=20)

- a. Giving classification of surge with neat sketches and describe positive surge moving downstream and deduce expression.
- b. How does a centrifugal pump impart pressure energy to the flowing fluid? A centrifugal pump with impeller diameter 20 cm at outlet and width of outlet passage 2 cm has swept back blades at 25° to the tangent to the periphery. Calculate the flow rate and power required while operating at 300 rpm under the condition of maximum efficiency.
- c. Determine the length of back water curve caused by an afflux 2.0 m in a rectangular channel of width 40 m and depth 2.5 m. the slope of bed is given as 1 in 1000. Take Manning's $N=0.03$

5) Attempt any two of the following.

(2×10=20)

- a. (i) Define and explain hydraulic efficiency mechanical efficiency and overall efficiency of a turbine.
- (ii) Differentiate between- Impulse and reaction turbine; Radial and axial flow turbine.
- b. (i) Write short note on characteristic curves of a turbine.
- (ii) Obtain an expression for the specific speed of a turbine.
- c. Design a pelton wheel turbine which is required to develop 1500 HP, when working under a head of 150 m at a speed of 320 rpm. The overall efficiency may be taken as 85%. Assume any other missing data suitably. Take $C_v = 0.985$, $d/D = 1/6$, $K_u = 0.45$

**** X ****