

B.Tech. Civil (Construction Management)

Term-End Examination

June, 2017

00075

ET-540(B) : FLOW IN OPEN CHANNEL

Time : 3 hours

Maximum Marks : 70

Note : *Solve any **five** questions. All questions carry equal marks. Neat and labelled sketches must be given, if required. Use of scientific calculator is allowed.*

1. (a) Classify the following as R.V.F./G.V.F, giving reasons : 4
 - (i) Flow over a broad-crested weir
 - (ii) Flow in a riser upstream of a dam
 - (iii) Flow through a hydraulic jump
 - (iv) Flow in the neighbourhood of a location where a prismatic channel changes bed slope
- (b) Classify the type of flow while a surge travels upstream, giving reasons. 4
- (c) Define hydraulic grade line, energy line and bed of the channel. When would these 3 lines be parallel to each other ? Give reasons. 6

2. (a) A 4 m wide rectangular channel has a bed slope of 0.0012 and $n = 0.015$. It carries a flow of $58 \text{ m}^3/\text{s}$. Determine the normal depth, Froude number and state of flow. 7
- (b) What is critical depth of flow ? On what factors does y_c depend, and why ? What is critical discharge ? 7
3. (a) What is specific energy ? How is it different from total energy ? Why is it preferred for use in equations concerning an open channel ? 6
- (b) Draw a typical E-y curve and explain its characteristics and use in solving problems. 8
4. (a) Derive the equation for specific force. What are the assumptions involved ? 8
- (b) When the specific force curve, critical depth curve and specific energy curve in an open channel are tangential to each other, what does it indicate ? Explain. 6
5. Derive the dynamic equation with respect to a gradually varied flow. 14
6. (a) Discuss the relationship amongst y_n , y_c and y in a gradually varied flow, explaining how it helps in classifying various water surface profiles. 10
- (b) Sketch (and label) the G.V.F. profile when the bed slope changes from mild to steep. 4

7. A rectangular channel ($b = 6.0$ m) carries a flow of $8 \text{ m}^3/\text{s}$ at a depth of 1 m when $n = 0.019$. A dam on it, just upstream of itself, causes the depth to increase by 0.2 m. Take $\alpha = 1.1$, and find (in one step), the distance upstream of the dam, where the depth is 0.10 m more than the normal depth. Tabulate your results. 14

8. Write short notes on any *two* of the following : $2 \times 7 = 14$

- (a) Reynolds number and its usefulness
 - (b) Isovels in open channel sections of different shapes
 - (c) Derivation of the momentum equation for the flow under a sluice gate
 - (d) Factors influencing Manning's n in an open channel
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