

Code : 011725

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B.Tech 7th Semester Exam., 2018

DESIGN OF HYDRAULIC STRUCTURES

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct option of the following
(any seven) : $2 \times 7 = 14$

(a) Uplift pressure acting on a dam is controlled by

- (i) pressure grouting in foundation
- (ii) constructing drainage channel between dam and its foundation
- (iii) constructing cut-off under upstream faces

~~(iv)~~ All of the above

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(b) The depth of flow in alluvial channel is 1.5 m. If critical velocity is 1.1 and Manning's n is 0.018, the critical velocity of the channel as per Kennedy's method is

- (i) 0.713 m/s
- ~~(ii)~~ 0.784 m/s
- (iii) 0.879 m/s
- (iv) 1.108 m/s

(c) A person standing on the bank of a canal drops a stone on the water surface. He notices that the disturbance on the water surface is not travelling upstream. This is because the flow in the canal is

- (i) subcritical
- (ii) supercritical
- (iii) study
- (iv) uniform

(d) The base width of a solid gravity dam is 25. The material of the dam has a specific gravity of 2.56 and the dam is designed as an elementary profile ignoring uplift. What is approximate allowable height of the dam?

- (i) 46 m
- (ii) 40 m
- (iii) 164 m
- (iv) 80 m

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- (e) A canal headwork has nothing to do with
- (i) weir
 - (ii) guide bank
 - (iii) head regulator
 - ☒ (iv) safety ladder
- (f) In a diversion headwork project, the canal head regulator is usually aligned
- (i) parallel to the barrage axis
 - (ii) perpendicular to the wall
 - ☒ (iii) parallel to the divide wall
 - (iv) None of the above
- (g) Multiple dome buttress dam is a type of
- ☒ (i) rigid buttress dam
 - (ii) deck slab buttress dam
 - (iii) bulkhead buttress dam
 - (iv) None of the above

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- (h) An arch dam looks like a single arch in
- (i) plan
 - (ii) front elevation
 - (iii) side elevation
 - (iv) None of the above
- (i) The only spillway among the following through which the discharge does not increase as fast as it increases in all other is
- (i) chute spillway
 - (ii) side channel spillway
 - (iii) ogee spillway
 - ☒ (iv) shaft spillway
- (j) Leakage through the transverse joint in a gravity dam is prevented by
- (i) shear key
 - (ii) key ways
 - ☒ (iii) water stops
 - (iv) None of the above

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2. Write detailed notes on any two of the following : 14
- Stability analysis of gravity dams
 - Optimum utilization of irrigation water
 - Design of Sharda type falls
3. Define and explain the term phreatic line in earthen dams. How would you proceed to determine the phreatic line through homogenous earthen dams provided—
- with a horizontal filter;
 - without a horizontal filter? 14
4. (a) What are the different types of spillway and how are they selected for individual condition? Sketch an ogee profile and mark it in the different zones. 7
- (b) Discuss the geological and topographical features which affect the selection of type of dam. 7
5. What is meant by canal regulation and what are the different canal regulation works? Describe the necessity and functioning of 'tributary head regulator' and a 'cross-regulator' in a canal project. Also discuss the procedure that you will adopt for designing these regulation works. 14

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6. A lined rectangular channel with $n = 0.015$ is 5 m wide and has a flow depth of 2 m with the bed slope of 1 in 1600. Retaining the rectangular shape of channel section and the same total area of lining, to what maximum extent can discharge be increased without changing the bed slope? Does the flow change from sub-critical to super-critical by this increase in discharge? 14
7. (a) What are meant by cross-drainage works and what is their importance in a canal project? Describe briefly the step-by-step procedure that you will adopt for designing an unflumed syphon aqueduct. 7
- (b) Design a submerged pipe outlet for the following data : 7
- Discharge through outlet
= 0.04 cumecs
- FSL of distributing canal = 100.00 m
- FSL of water course = 99.90 m
- Full supply depth of distributing canal = 1.1 m
- Assume an average value of coefficient of discharge as 0.7.

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8. (a) Discuss the structural and non-structural measures for flood management and with a specific bias to levee. 7
- (b) Explain why trapezoidal notch is preferred to rectangular notches in the design of canal drops. 7
9. (a) Differentiate between the following : 7
- (i) Silt excluders and silt ejectors
 - (ii) Barrage and dam
- (b) What do you understand by a rigid module? Describe the working of a Gibbs module. 7

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