Printed Pages: 03 **Sub Code: NCE 052**

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B. TECH.

(SEM VIII) THEORY EXAMINATION 2018-19

ANALYSIS AND DESIGN OF HYDRAULIC STRUCTURES

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If you require any missing data, choose suitably.

SECTION A

1. Describe the following brief. **2 x 10 = 20**

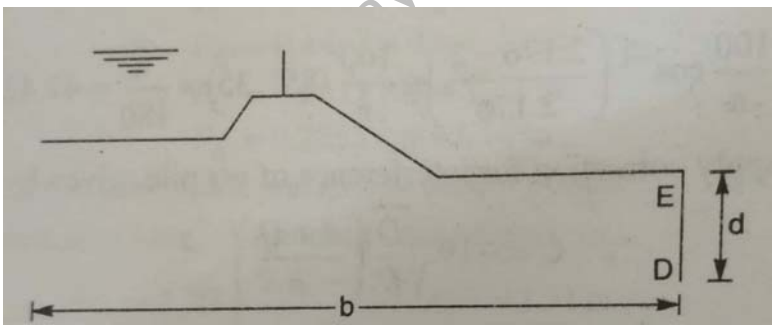
a. Regulation work
b. Bed bars
c. Syphon aqueduct
d. Silt excluder
e. Flood routing
f. Demand curve
g. Keys
h. Water stops
i. Controlled spillway
j. Surge tank

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a. Define canal fall. What are the factors considered to decide the location of fall?

b. The concrete floor of a head regulator is level with the channel bed (except for the short crest hump) and is 13 m long. The floor is provided with cutoff usually at its upstream and downstream ends. The depth of upstream cutoff is 1.5 m (below the floor level) and that the downstream wall is 2 m. Using Khosla's theory (See Fig. 1 for definition sketch and formula) determine the thickness of the floor at its mid length and also at its junction with upstream and downstream cutoff walls. The floor thickness may not be less than 30 cm anywhere. The upstream FSL is 1.5 m above the floor level. If the permissible exit gradient is 0.18, is the floor safe against failure by piping?



$$\Phi_E = \frac{2}{\pi}\cos^{-1}\left(\frac{\lambda-2}{\lambda}\right);\ \lambda = \frac{1+\sqrt{1+\alpha^2}}{2};\ \alpha = b/d$$

c. Explain divide wall and its functions. What are the conditions of designing divide wall?

d. Define gallery. What are the purpose for providing gallery in dam?

e. Classify hydroelectric scheme and explain them elaborately. Three turbo-generators each of capacity 10000 kW have been installed at a hydel power station. During a certain period of load, the load on the plant varies from 12000 kW to 26000 kW. Calculate (i) total installed capacity, (ii) load factor, (iii) plant factor and (iv) utilization factor.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) An impervious floor of a weir on permeable soil is 16 m long and has sheet piles at both the ends. The upstream pile is 4 m deep and the downstream pile is 5 m deep. The weir creates a net head of 2.5 m. Neglecting the thickness of the weir floor, calculate the uplift pressures at the junction of the inner faces of the pile with the weir floor, by using Khosla's theory.

(b) Define weir and its component parts with a neat sketch. What are the causes of failure of weirs?

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) Design a vertical drop weir on Bligh's theory for the following site conditions:

(i) Maximum flood discharge: 28000 cumecs
(ii) H.F.L. before constructions = 285.0 m
(iii) Minimum water level = d/s bed level = 278.0 m
(iv) F.S.L. of canal = 284.0 m
(v) Allowable afflux = 1 m
(vi) Coefficient of creep = 12
(vii) Permissible exit gradient = 1/6

Assume any other data not given. Perform Hydraulic calculation, wear wall design and design of impervious floor only.

(b) Define cross-drainage work and classify it. What points should be considered while selecting the site of a cross-drainage work?

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Classify reservoirs. What are the different investigations for reservoir planning? Name the zones of storage in reservoir.

(b) What are the different types of earth dams? Explain the causes of failure of earth dams.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) A masonry dam 10 m high is trapezoidal in section with a top width of 1 m and bottom width of 8.25 m. The face exposed to water has a batter 1:10. Test the stability of the dam. Find out the principal stresses at the toe and heel of the dam. Assume unit weight of masonry as 22.4 kN/m^3, unit weight of water = 9.81 kN/m^3 and permissible shear stress of joint = 1400 kN/m^2.

(b) (i) Classify joints and explain them elaborately.
(ii) How can we control the cracking in concrete dams?

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain briefly the components parts of spillways and classify spillways based on purpose. What are the factors affecting the required spillway capacity?

(b) Design an ogee spillway for concrete gravity dam, for the following data:

(i) Average river bed level = 250.00 m
(ii) R.L. of spillway crest = 350.00 m
(iii) Slope of d/s face of gravity dam = 0.75:1
(iv) Design discharge = 6500 cumecs
(v) Length of each pier = 5 spans with a clear length of 9 m each
(vi) Thickness of each pier = 2 m

Assume $C_d = 2.2$.