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Sub Code: NCE 052

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B.TECH
(SEM VIII) THEORY EXAMINATION 2017-18
ANALYSIS AND DESIGN OF HYDRAULIC STRUCTURES

Time: 3 Hours

Total Marks: 100

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

- 1. Attempt *all* questions in brief. 2 x 10 = 20**
- a. Explain with neat sketch various type of cross drainage works. Also write the necessity of cross drainage works.
 - b. What do you mean by fall and where are they located.
 - c. Explain the term Level Crossing, Inlets and Outlets.
 - d. Why the silt control is essential at headworks? Explain with neat sketches the functions and working of silt excluder.
 - e. Explain the various storage zones of a multipurpose reservoir with neat sketch.
 - f. Explain with neat sketch the difference between weir and barrage.
 - g. What are the various types of galleries in gravity dam?
 - h. Enlist the various forces acting on a gravity dam?
 - i. Differentiate between load factor, plant factor and utilization factor in connection with hydropower.
 - j. What are the spillways and where are they provided?

SECTION B

- 2. Attempt any *three* of the following: 10 x 3 = 30**
- a. Explain the procedure of designing Sarda Type Fall.
 - b. Explain (i) Aqueduct, (ii) syphon aqueduct, (iii) canal syphon and level crossing. With neat sketches
 - c. Explain the mass curve method that can be used for determining:
 - (i) Reservoir capacity for fulfilling given demand.
 - (ii) Demand rate from a reservoir of a given capacity.
 - d. Explain various forces causing instability in gravity dam; indicate their magnitude, direction and locations. What should be maximum depth of elementary profile of a dam if the safe limit of stress on the masonry should not exceed 1500 kN/ square meter?
 - e. A run-off river plant is installed on a river having a minimum flow of 20 cumecs. If the plant is used as a peak load plant operating only for 8 hours daily. Compute firm capacity of plant. (i) Without pondage, (ii) with pondage but allowing 7% water lost in evaporation and other losses. Net head is 16m at plant. Taking plant efficiency 80%.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10
- (a) Differentiate between a Silt Extractor and a Silt Excluder. Draw neat sketches and discuss the principles involved in designing components
- (b) Design a Sarda type fall across a canal for the following data:
- | | |
|-----------------------|-------------|
| full supply discharge | = 12 cumecs |
| drop | = 1.0 m |
| full supply level | = 104.5 m |
| full supply depth | = 1.5 m |
| bed width | = 10 m |
4. Attempt any *one* part of the following: 10 x 1 = 10
- (a) A weir with a vertical drop has the following data:
- | | |
|-------------------------|--|
| Nature of bed | : coarse sand with value of Bligh's C=12 |
| Flood discharge | : 300 cumecs |
| Length of weir | : 40 m |
| Height of weir | : 2 m |
| Height of falling water | : 0.6 m |
| Top width of weir | : 2.0 m |
| Bottom width of weir | : 3.2 m |
- Design the length and thickness of aprons and draw the cross-section of the weir.
- (b) Enumerate the different methods which may be used for designing the canal transition for flumed canal, and condition under which can be used. Describe in details a method of designing canal transitions when water depth may or may not remain constant.
5. Attempt any *one* part of the following: 10 x 1 = 10
- (a) A flow net is plotted for a homogenous earthen dam of 30m height with a free board of 5m. The numbers of potential drops are 10. The permeability in horizontal and vertical direction are 3×10^{-4} cm/sec and 2×10^{-4} m/sec . Determine the number of flow channels for the given discharge of 72×10^{-6} m³/sec per meter run of dam. How will you determine the phreatic line for a homogenous dam provided with a horizontal filter.
- (b) What is flood routing? Explain the basic flood routing equation and summarize its method of solution.
6. Attempt any *one* part of the following: 10 x 1 = 10
- (a) Explain how uplift considerations affect the design of gravity dam. What measures can be adopted to reduce the undesirable effects due to uplift in such cases? Differentiate between rigid dams and non rigid dams.
- (b) What do you understand by elementary profile of a gravity dam? Explain step by step method of scheming a high gravity dam and low gravity dam.

7. Attempt any *one* part of the following:

10 x 1 = 10

- (a) Give the classification of Hydro-power plants on the basis of their function. And calculate (i) Total installed capacity,
(ii) Load factor,
(iii) Plant factor
(iv) Utilization factor.

If three generators each of capacity 10000kw have been installed at a hydel power station. During a certain period of load, the load on the plant varies from 12000kw to 20000kw.

- (b) What should be the minimum discharge in the stream so that it may serve as a peak load station? If a runoff-river plant has an installed capacity of 18000 kW and operates at 30% load factor when it serves as a peak load station. The plant efficiency may be taken as 82% when working under a head of 30 m. If the daily load pattern indicates 16 hours average load and 4 hours peak load, determine the pondage to be provided to supply daily demand.