B. Tech.

(SEM. VIII) THEORY EXAMINATION 2011-12

ANALYSIS AND DESIGN OF HYDRAULIC STRUCTURES

Time : 3 Hours   *Total Marks : 100*

Note :—(1) Attempt *all* the questions.

(2) Use illustrations, wherever required.

(3) Assume missing data suitably, if any, and state the assumptions made.

(4) Use of Khosla's curve and Blench's curve is permitted.

1. Attempt any *two* parts of the following :—   (2×10=20)

   (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) (i) Discuss Bligh's creep theory for the design of weir constructed over previous foundation and its limitation.

(ii) Explain the various components of a diversion headwork with neat sketch.

(c) Discuss the design procedure for designing of a Sharda type fall.

2. Attempt any *two* parts of the following :— **(2×10=20)**

(a) Differentiate between a weir and a barrage. Describe the design procedure for designing a head regulator for a distributary.

(b) Classify the various types of cross-drainage works used in canal systems. Explain any two with neat sketches.

(c) The data given below is collected for a syphon aqueduct :

Diameter of the barrel (single) = 4m

—Length of the barrel = 120 m

—Discharge through the barrel = 30 m³/sec

—Friction factor = 0.013

—Bendloss coefficient (2 bends) = 0.10

—Coefficient of head loss in expansion at outlet = 0.20

—Coefficient of head loss in contraction at outlet = 0.10

Determine afflux, neglecting velocity head in drainage channel.

3. Attempt any *two* parts of the following :— **(2×10=20)**

(a) What is flood routing ? Explain the basic flood routing equation. Explain any one method of flood routing.

(b) For a homogenous earth dam 62 m high, and 2 m free board, a flow net was constructed and the following results were obtained :—

      —Number of potential drop   = 25

      —Number of flow channels   = 5

The dam has a horizontal filter of 40 m lengths at the downstream end. Calculate the discharge per meter length of the dam.

Given :

Coefficient of permeability of dam = 3×10^{-3} cum/sec.

(c) Write short notes on any *two* of the following :—

    (i) Reservoir sedimentation and its control.

    (ii) Phreatic line and its determination.

    (iii) Seepage control in earth dams.

4. Attempt any *two* parts of the following :—   (2×10=20)

  (a) Write short notes on any *two* of the following :—

    (i) Galleries : its function and necessity.

    (ii) Low and high gravity dams.

    (iii) Earthquake effects in the design of a gravity dam.

  (b) What do you understand by the elementary profile of a gravity dam ? Derive expression for determining the base width of such a dam on any one criterion.

  (c) A masonry dam is 150 m high having upstream side slope 1 in 10 has a freeboard of 2.0 m. Taking acceleration coefficient $\alpha = 0.12$, determine

    (i) the hydrodynamic earthquake pressure.

    (ii) the moment at a joint 80 m below maximum water level.

5. Attempt any *four* parts of the following :— (4×5=20)

   (a) Enlist the various types of spillways. Discuss the design criteria of "ogee" spillway.

   (b) Give the criterion for the selection of suitable type of turbines for hydroelectric scheme.

   (c) What is a stilling basin ? Explain the design procedure for the standard stilling basin type I.

   (d) Compute the discharge over an ogee spillway with a coefficient of discharge C = 2.5 at a head of 4 m. The effective length of the spillway is 150 m. Neglect the velocity of approach.

   (e) The load on a hydel plant varies from a maximum 10 MW to a maximum of 35 MW. Two turbogenerators of capacities 22 MW each have been installed. Determine the total installed capacity of the plant, plant factor, maximum demand, load factor and utilization factor.

   (f) Write short notes on the following :—

       (i) Draft tube : its uses and types

       (ii) Surge tank : its uses and types.