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# **GUJARAT TECHNOLOGICAL UNIVERSITY** PDDC - SEMESTER-VII • EXAMINATION – WINTER 2013

Subject Code: X70601

Date: 03-12-2013

Subject Name: Design of Hydraulic Structures Time: 10.30 am - 01.00 pm **Total Marks: 70 Instructions:** 1. Attempt all questions.

- 2. Make suitable assumptions wherever necessary.
- Figures to the right indicate full marks. 3.
- 0.1 (a) How dams are classified? Discuss in detail.
  - Discuss the various investigations required to be carried out to determine the 07 **(b)** most suitable site for a dam

#### **Q.2** 07 (a) What is gravity dam? Enumerate the various forces acting on a gravity dam

A concrete gravity dam has maximum water level 305.0 meter, bed level 225.0 **(b)** meter, top RL of dam 309.0 meter, d/s face slope starts at RL of 300.0 meter, d/s slope 2 Horizontal: 3 Vertical, tail water is nil, upstream face of dam is vertical, center line of drainage gallery is 8 meter from u/s face of the dam, uplift pressure is 100% at heel, 50% at line of gallery and zero at toe, top width of dam is 14% of dam height, weight of the concrete is 24 KN/cubic meter. Considering only weight, water pressure and uplift, determine (i) Maximum vertical stresses at the toe and heel of the dam, (ii) Major principal stresses at the toe of dam, and (iii) Intensity of shear stress on a horizontal plane near the toe.

### OR

- (b) A triangular section gravity dam 40 meters high has water stored up to top and 07 base width is 30 meter. Analyze the dam section to determine (i) Factor of safety against sliding, (ii) Factor of safety against overturning, (iii) there is no tension anywhere along the base of dam and (iv) maximum compressive stress in the dam body is within safe crushing strength of the material (10 kg/square centimeter). Assume coefficient of friction between the base and foundation as 0.7 and uplift pressure intensity coefficient as 0.45.
- 0.3 (a) What are the different types of the earth dams? Support your answer with neat 07 sketches.
  - (b) Discuss control of seepage in earthen dam.

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## OR

- Q.3 A flow net is plotted for a homogeneous earthen dam of height 25 meters and 07 (a) length 2000 meters with freeboard 2 meters. The results obtained indicate number of potential drops as 10 and number of flow channels as 4. The dam has a horizontal filter of 30 cm at the downstream end and the coefficient of permeability of the dam material is  $5 \times 10^{-4}$  cm/second. Calculate the discharge through the dam.
  - Determine the length and thickness of the upstream impervious blanket for an 07 **(b)** earthen dam of the dimensions; top width 5 m, base width 100 m, free board 3 m, minimum water head 16 m, depth up to impervious foundation 25 m, permeability coefficient of pervious foundation is 3 cm/minute, and desirable reduction in seepage 80%. Neglect seepage through the blanket.

#### What are the spillways, why provided and enlist various types of spillways. 07 0.4 (a) Describe ogee spillway and sketch an ogee profile. How it is designed?

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- Q.4 (a) An ogee spillway with vertical upstream face has design discharge of 3000 07 cubic meter per second, crest length of 150 m, normal reservoir level is 700.0, average river bed level is 650.0 m, coefficient of pier is 0.01, coefficient of abutments is 0.1, number of span is 10 and coefficient of discharge is 2.2. Determine the crest level and profile of the overflow spillway section.
  - (b) Calculate discharge over a spillway, crest length 100 m, wherein water flow 07 depth changes from 1 m to 4 m in hydraulic jump formation in stilling basin.
- Q.5 (a) Define energy dissipation. Discuss various methods used for energy dissipation. 07
  - (b) Describe with neat sketches the various types of bucket type energy dissipation. 07

### OR

Q.5 (a) What is a fall in a canal? Why is it necessary to provide a fall in a canal?
(b) What is cross-regulator? What are the functions of a cross regulator?
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