Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: X 70601 **Date: 03/01/2013**

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.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Discuss the various factors which govern the selection of type of dam **07**

(b) What factors affect the selection of site for a dam discuss them briefly **07**

Q.2 **(a)** Prove that the base width b for an elementary (or theoretical) profile of a low gravity dam is given by **07**

$b = h/\sqrt{(s-1)}$ in which

h = height of the dam, and

s = specific gravity of the dam material

assume that the uplift pressure acts on the full area of the base

Also calculate the maximum compressive stress developed in the dam.

(b) Following data were obtained from the stability analysis of a concrete gravity dam. **07**

(I) total overturning moment about toe = 1×10^6 kN-m

(II) total resisting moment about toe = 2×10^6 kN-m

(iii) total vertical force above the base = 50000 kN

(iv) base width of the dam = 50 m

(v) slope of the down stream face = 0.8 horizontal : 1 vertical

Calculate the maximum and minimum vertical stress to which the foundations will be subjected to. What is the maximum principal stress at the toe ? assume there is no tail water.

OR

(b) A 100 meter high concrete dam has base width 70 meter and top width 7 meter. Upstream slope is vertical and downstream slope starts from 10 meter below top of the dam and downstream slope is 0.7 horizontal : 1 vertical and free board is 4 meter is located in Seismic Zone V. Specific weight of concrete is 24.525 kN/cubic meter and its modulus of elasticity is 20.601×106 kN/m^2.Calculate the earth quake forces by seismic coefficient method per unit of the dam. **07**

Assume soil – foundation system factor = 1.0 , importance factor = 2.0 and basic seismic coefficient = 0.08

Q.3 **(a)** How earth dams are designed **07**

(b) Discuss the various causes of failure of the earth dam **07**

OR

Q.3 **(a)** A homogeneous earth dam 20 meter high has crest width 6 meter, upstream slope 4: 1 and downstream slope 3:1. The properties of the soil mass in the dam are : saturated unit weight = 21.19 kN/m^3 ; submerged unit weight = 11.38 kN/m^3; angle of internal friction = 26 degree ; and cohesion = 39.24 kN/m^2. Check the stability of the upstream portion of the dam against horizontal shear at the base of the **07**

dam. At the top of shoulder of the upstream slope of the dam the seepage line may be assumed to be 5 meter below the crest of the dam.

(b) Design an upstream blanket for a dam of height 15 meter, base width 66 meter, crest width 6 meter, upstream slope and downstream slope 2 horizontal : 1 vertical. Height of reservoir water surface 12 meter and height of pervious strata 10 meter below the base width of dam. Width of the rock toe on downstream side of the dam is 15 meter. The thickness of the blanket may be taken as 1.5 meter. The coefficient of permeability of the blanket soil is 0.08 meter/day and that of the foundation soil is 67 m/day. **07**

Q.4 **(a)** How spillways are classified? Describe briefly the types of the spillways. **07**

(b) An ogee type of spillway has 20 crest gates each having 10 meter clear span. Find the maximum flood that can be safely passed by lifting all the gates when the maximum reservoir elevation is 110 meter and the crest level is 106.00 meter. **07**

Take coefficient C as 2.16 √ (meter)/sec

Coefficients of end contractions are 0.05 and 0.10 for the piers and the abutments respectively. Neglect velocity of approach.

OR

Q.4 **(a)** What are the functions of (I) chute blocks and (ii) baffle blocks in stilling basins ? **07**

(b) An ogee spillway has 2.5 m head above the crest. Depth of flow at the toe of the spillways is 0.6 meter. **07**

Assume coefficient C as 2.16 √ (meter) /sec

Compute:

(i) the discharge per meter length of the spillway

(ii) Pre jump velocity at the toe

(iii) Prejump Froude number of the flow

(iv) conjugate depth required for hydraulic jump.

If the actual tailwater depth is 4.5 meter , what type of energy dissipator would you provide ?

Q.5 **(a)** Describe with neat sketches the various types of bucket energy dissipators. **07**

(b) Discuss the various types of energy dissipation devices used below spillways in relation to the positions of the tailwater rating curves (TWRC) and jump height curve (JHC). **07**

OR

Q.5 **(a)** Discuss the procedure for designing a sarda type fall **07**

(b) What is canal head works? Describe briefly the functions of the canal headworks. **07**

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