

(3 Hours)

[Total Marks: 100]

- N.B. (1) Question No. 1 is compulsory  
 (2). Attempt any 4 questions out of remaining 6 questions  
 (3) Illustrate with figures wherever necessary.  
 (4) Assume suitable additional data if necessary and state clearly.

1. Attempt any four of the following

20

- (a) Discuss the factors affecting the site selection of the type of the dam  
 (b) Explain various types of the galleries provided in gravity dam  
 (c) Enlist various types of arch dams and buttress dams.  
 (d) Explain side channel spillway  
 (e) Define canal outlet and state various types of canal outlets

2. (a) Following data refer to the non-overflow section of gravity dam:

12

The RL of the bottom of the dam = 260.0 m; Full Reservoir level in the dam = 312.0m; R.L of the top of the dam = 315.0 m.; The top width of the dam is 12 m. The upstream face is vertical and downstream face is vertical upto 304.0 m, and thereafter d/s face slopes 0.7H; 1V upto base. Drainage holes are located at 8 m from vertical face. Consider only forces due to water, uplift, and self-weight. Uplift pressure intensity factor 0.5, coefficient of friction between masonry and foundation material 0.8.

- i) The maximum vertical stress at the toe of the dam  
 ii) The major principal stress on a horizontal plane near the toe  
 iii) Also check stability of the dam.

Assume unit weight of concrete = 23.5 kN/m<sup>3</sup> and unit length of the dam.

Allowable stress in concrete may be taken as 2500 kN/m<sup>2</sup>

- (b) Write procedure to fix the capacity of a dam reservoir at a particular river site, provided the inflow and pattern and demand pattern known.

8

3(a) Design and draw a section of constant radius of arch dam for the data given

below

12

Depth from the top (m)	0	10	20	30	40	50	60
Width of the valley (m)	178	153	133	120	106	101	84

Consider top thickness of arch 5.1m  $\sigma = 3600 \text{ kN/m}^2$ . Angle subtended at top 150°.

- (b) Design a practical profile of a gravity dam made of stone masonry given the following data.

8

[TURN OVER

R.L of base of dam=198m

R.L of HFL of reservoir=228m

Specific gravity of masonry=2.4

Safe compressive stress in concrete=1200 kN/m<sup>2</sup>

4 (a) Draw the Pheratic line for the earth dam of homogeneous section with a horizontal filter for the following details 12

Height of the dam = 20m; Freeboard= 2m; U/S slope =2.5:1; D/S slope =2:1

Top width =4m; Length of filter =28 m

Coefficient of permeability of the soil material used in the dam =  $8 \times 10^{-5}$  m/sec. Also find the seepage flow per unit length of the dam (Assume any other data if necessary)

(b) Distinguish between elementary and practical profile of gravity dam 8

5. (a) Explain in detail with diagrams causes of failure of earthen dams 12

(b) For a homogeneous earth dam 42 m high and 2 m free board, a flow line was constructed and the following results were obtained. 8

Number of potential drops=25

Number of flow channels= 4

The dam has a horizontal filter of 40 m length at its downstream end. Calculate the discharge per meter length of the dam if the coefficient of permeability of the dam is  $3 \times 10^{-3}$  cm/sec.

6 (a) Design an ogee spillway for concrete gravity dam for the following data 12

(i) Average river bed level = 200.00 m

(ii) R.L. of spillway crest = 250.0 m

(iii) Slope of d/s face of gravity dam=0.75:1

(iv) Design discharge =6500 Cumecs

(v) Length of the spillway= 5 spans with clear length of 9m each

(vi) Thickness of each pier=2m; Take coefficient of Discharge=2.2; Take  $K_p=0.01$  and  $K_a=0.1$ .

(b) What are the different kinds of energy dissipators and how are they selected for individual conditions based on hydraulic jump ? 8

7. Write short notes 20

(a) Canal falls

(b) Superpassage

(c) Culverts

(d) Canal Escapes