Code No: 157CH **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, December-2023/January-2024
IRRIGATION AND HYDRAULIC STRUCTURES
(Civil Engineering)

Time: 3 Hours **Max.Marks:75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A
(25 Marks)

1.a) Differentiate mass curve and demand curve. [2]
b) What is Trap efficiency? What is its significance? [3]
c) What do you mean by limiting height of a low gravity dam? [2]
d) Explain the importance of drainage in gravity dams. [3]
e) What is phreatic line? Give its importance. [2]
f) What are various types of spillways? Give line sketches. [3]
g) List the causes of failure of Weirs and Barrages on permeable foundations. [2]
h) Differentiate rockfill weirs and sloping glacis concrete weir. [3]
i) Write a brief note on Canal regulation works. [2]
j) What are types of Canal escapes? Give their salient aspects? [3]

PART – B
(50 Marks)

2.a) Explain the various factors affecting selection of site for a reservoir.
b) Monthly inflows at a proposed reservoir site for a drought period of 12 months along with target demands are given below. Compute the storage required using analytical methods. [5+5]

Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Inflow (MCM)	250	350	400	200	150	150	100	50	150	150	100	250
Outflow (MCM)	150	150	200	250	300	400	250	200	150	150	100	250

OR

3.a) Explain process of reservoir sedimentation and control measures for reducing it.
b) A reservoir has a capacity of 3.6 Mha-m upto the level of the spillway crest. The average annual inflow is 1.5 Mha-m of water. If the average annual sediment inflow is 3×10^{11} kg, determine the useful life of the reservoir assuming that the usefulness of the reservoir is terminated when 2/3 of the total capacity is filled with sediments. Assume suitable value for specific weight of sediment. [5+5]

C/I ratio	2.4	2	1.6	1.2	0.8	0.4
Trap efficiency (%)	98.2	98	97.5	97	96	95

4.a) Explain the various forces acting on a gravity dam and how are they estimated.

b) A gravity dam 8m high, 1.5 m wide at the top and 5m wide at the base retains water to a depth of 7.5m, the water face of the dam being vertical. If the weight of water is 9.81 k N/m^3, weight of masonry is 22 k N/m^3, the max. intensity of stress developed at the base will be nearly: (in k N/m^2). [5+5]

OR

5.a) Explaining the elementary profile of a dam, describe how it is different from practical profile.

b) Find the max. height of a low gravity dam of elementary profile made of concrete of relative density 2.5 and safe allowable stress of foundation material 3.87 MPa neglecting the uplift pressure force. [5+5]

6.a) With help of sketches, explain various types of Earth dams.

b) For the embankment section shown in Figure 1, if $K_x = 9 \times 10^{-4}$ cm/s and $K_y = 6 \times 10^{-4}$ cm/s, estimate the discharge through the dam section per metre length.[5+5]

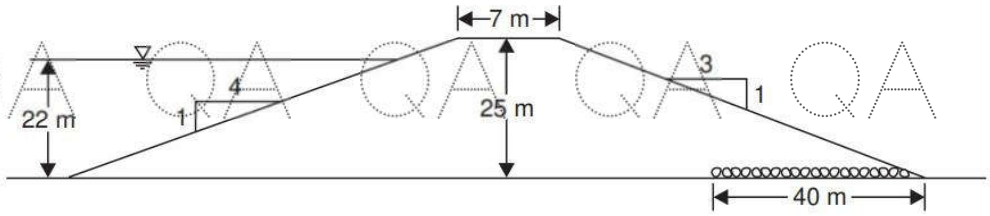

Figure 1

OR

7.a) Design an overflow spillway section for design discharge of 1500 m^3/s. The u/s water surface level is at elevation 240m and u/s channel floor is at 300m. The spillway having vertical face, is 50m long.

b) Write a detailed note on energy dissipation and stilling basins. [5+5]

8.a) With help of a sketch, explain the layout and components of weirs and barrages

b) Using the data of a weir given below compute the max. Flood discharge which can safely pass over the weir without exceeding the full reservoir level. Neglect velocity of approach.
Total number of vertical gates = 51
Span of each gate = 10 m
Full reservoir level (u/s) = 110 m
Crest level = 106 m
Coefficient of end contraction for piers = 0.02
Coefficient of discharge (in Francis formula) Cd = 1.70 $m^{1/2}$. [5+5]

OR

9.a) Discuss briefly the following: (i) Bligh's creep theory for seepage flow. (ii) Exit gradient and its importance.

b) An impervious floor of a weir on permeable soil is 17 m long and sheet piles at the both ends. The upstream pile is 5 m deep and the downstream pile is 6 m deep. The weir creates a net head of 3 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.[5+5]

10. The head regulator of a canal has 3 openings each of 3m wide. Water is flowing between upper and lower gates. The vertical opening of the gate is 1 m. The head on te regulator is 0.45m (afflux). If the U/s water level rises by 0.20 m, find how much the upper gates must be lowered to maintain canal discharge unaltered. As shown in figure 2. [10]

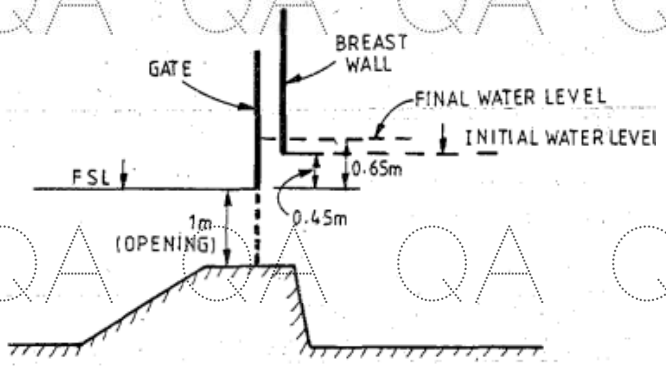

Figure 2

OR

11.a) Explain principles of design of cross and distributary head regulators

b) For the following data of CD works at the crossing of a canal and drainage. Find i) Design of Drainage Waterway ii) Canal Waterway:

Canal Drainage
Full supply discharge = 32 cumecs
Full supply level = R.L. 213.5
Canal bed level = R.L. 212.0
Canal bed width = 20 m
Trapezoidal canal section with 1.5 H: 1 V slopes.
Canal water depth = 1.5 m
High flood discharge = 300 cumecs
High flood level = 210.0 m
High flood depth = 2.5 m
General ground level = 212.5 m. [5+5]

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