

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024

Design of Hydraulic Structures

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1
 - a. What are the modes of failure of gravity dams? Explain. (06 Marks)
 - b. List the functions of drainage gallery. (06 Marks)
 - c. Determine the base with for elementary profile of gravity dam to store water up to a height of 60m. Given $\mu = 0.75$, $G = 2.4$ and $C = 1$. Also draw the practical profile if height of wave is 1.5m. (08 Marks)

OR

- 2

A concrete gravity dam has top width 8m and bottom width 30m. The depth of water stored is 36m with free board 4m. upstream face of the dam is vertical but the downstream face is sloping uniformly from the height 5m below the top up to the base. Drainage holes are located at 6m from the upstream face of dam. Calculate :

 - i) Factor of safety against overturning
 - ii) Factor of safety against sliding
 - iii) Vertical stresses at toe and heel and
 - iv) Principal stresses at toe and heel. Consider only self weight, hydrostatic pressure and uplist, specific weight of concrete = 24kN/m^3 , $\mu = 0.65$. (20 Marks)

Module-2

- 3
 - a. Explain the types of Earthen dams. (08 Marks)
 - b. Draw the phreatic line for the homogeneous dam section shown in Fig Q3(b) and find the seepage quantity in liters/day per meter length of dam if $K = 5 \times 10^{-4}\text{cm/s}$. (12 Marks)

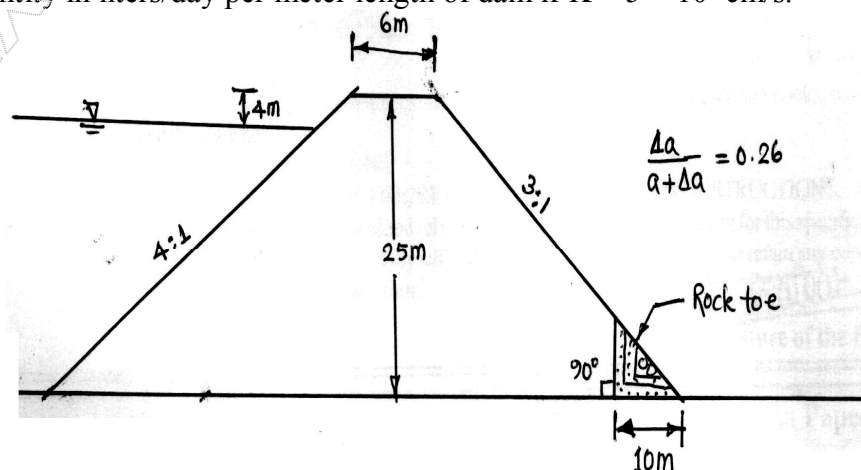


Fig Q3(b)

OR

- 4
 - a. Explain the causes of failure of eathdams. Also mention remedial measures. (14 Marks)
 - b. List the criteria for safe design of earthen dams. (06 Marks)

Module-3

- 5 a. Define Spillway. List different types of spillways. Explain Ogee spillway with neat sketch. (08 Marks)
- b. An Ogee spillway with vertical upstream face has the following data :
- Design discharge = $3000\text{m}^3/\text{s}$
 Crest length effective = 150m
 Normal reservoir level = 700m
 Coefficient of discharge = 2.2
- Determine the crest level and profile of the overflow section. Take d/s slope – 0.7H : 1V. (12 Marks)

OR

- 6 a. Explain Bligh's theory of design of apron. (10 Marks)
- b. Explain energy dissipation devices. (10 Marks)

Module-4

- 7 Design aqueduct for the following data :

Details	Canal	Drain
Full supply/High Flood Discharge	$50\text{m}^3/\text{s}$	$150\text{m}^3/\text{s}$
Bed level	260.00m	256.50m
Full supply/High Flood level	262.00m	258.50m
Bed width	30.0m	-
Side slope	1.5H:1V	-

- i) Determine drainage waterway
 ii) Determine canal fluming and bed width along with canal bed levels
- Assume manning's $n = 0.016$ (20 Marks)

OR

- 8 a. Derive Mitra's equation an canal transitions. (08 Marks)
- b. With neat sketches, explain different types of cross drainage work giving their selection criteria. (12 Marks)

Module-5

- 9 a. What is a canal regulator? Give the functions of cross and heat regulations. (10 Marks)
- b. What are canal outlets? Mention the requirements of good outlet. (10 Marks)

OR

- 10 a. What is a canal fall? What is its necessity? Explain any two types canal falls with neat sketches. (10 Marks)
- b. Explain :
 i) Non-modular outlets ii) Rigid modules. (10 Marks)

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