

KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.E.

Year : III

Exam Roll No. :

Time: 30 mins.

Registration No.:

Course : CIEG 304

Semester : I


F. M. : 10

Date : 12 DEC 2024

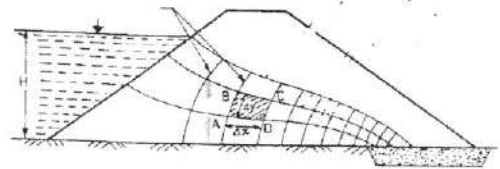
SECTION "A"

[20 Q. \times 0.5 = 10 marks]

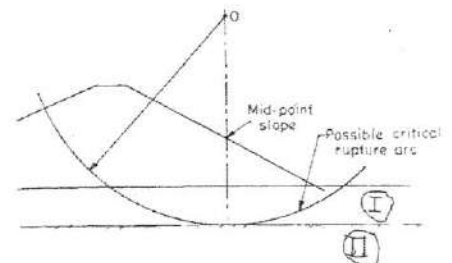
Choose and encircle in the most appropriate option from each set of choices

- For the gravity dam analysis, nature of hydrodynamic stress diagram is
 - Triangular
 - Rectangular
 - Cubic
 - Parabolic
- For no tension in the dam base**
 - Sum of horizontal force should be zero
 - Sum of vertical force should be zero
 - Resultant should lie within base
 - Resultant should lie within central one third of the dam base
- For the elementary profile of the gravity dam, width of the base is
 - Inversely proportional to dam height
 - Inversely proportional to the square root of the specific gravity of dam material
 - Directly proportional to the coefficient of friction
 - Is independent of friction coefficient and dam material
- Uplift Pressure in the base of gravity dam is
 - Rectangular if the height of U/S reservoir water and of D/S tail water is same
 - Triangular if the height of U/S reservoir water is more than D/S tail water
 - Parabolic if the height of U/S reservoir water and D/S tail water is same
 - Parabolic if the height of U/S reservoir water is more than D/S tail water
- Category of the Water Stop shown in the figure is

 - Ribbed with central bulb
 - Kicker
 - Dumb bell with central bulb
 - Serrated with central bulb
- Upon the analysis of concrete gravity dam, followings are obtained: $\sum V = 53939 \text{ kN}$ (\downarrow) and $\sum M = 990240 \text{ (kNm)}$ clockwise moment, if the base width of dam is 69 meter, then
 - Resultant is near the toe and tension is developed at the heel
 - Resultant is near the heel and tension is developed at the toe
 - Resultant is near the toe and there is no tension
 - Resultant is near the heel and there is no tension
- For the gravity dam having base width of 69 meter, if the eccentricity for load Combination A is 9.6 meter, then
 - Tension will be induced in toe
 - Tension will be induce in heel
 - Tension will be induced in both toe and heel
 - No tension will be induced

8. If the Shear Friction Factor SFF is 2.8,
- Dam is safe in sliding
 - Dam is unsafe in sliding
 - Dam is safe in overturning
 - Dam is unsafe in overturning
9. The equation $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$ is
- Laplacian equation for 2D flow
 - Darcy's equation for 2D flow
 - Laplacian equation for 3D flow
 - Darcy's equation for 3D flow
10. As per Strange's Recommendation, the slope of U/S and D/S faces for low earth dam of height 20 meter is
- 2:1 and 2:1
 - 2:1 and 1:1
 - 3:1 and 1:1
 - 3:1 and 2:1
11. For an earth dam, if the side slope is 4:1 (H:V), to locate center of critical slip circle, the value of α_1 and α_2 are
- 27.5 and 37 degree respectively
 - 37 and 27.5 degree respectively
 - 25 and 35 degree respectively
 - 35 and 25 degree respectively
12. Base width of an elementary profile of a gravity dam (specific gravity of material 2.4, uplift intensity 1, coefficient of static friction is 0.8 and height of the dam is 20 meter)
- 16.89 meter
 - 17.86 meter
 - 12.9 meter
 - 10.4 meter
13. The lateral braces are provided between buttress, in buttress dam, to
- Transfer the load from deck to the foundation
 - Transfer the load from deck to the buttress
 - Provide resistance against buckling of buttress
 - Provide the resistance against overturning of buttress
14. The base width of the rock fill dam in comparison to that of an earth dam is
- Much larger
 - Much smaller
 - Sometimes larger sometimes smaller
 - Almost equal
15. The lines shown by two arrow in earth dam are
- Flow lines
 - Equipotential lines
 - Phreatic lines
 - Stream lies

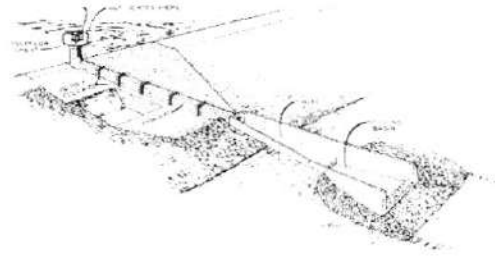


16. For an earth dam, if the possible critical rupture arc is shown below then the Zones I and II contains
- Clay and hard strata respectively
 - Hard strata and clay respectively
 - Rock and gravel respectively
 - Gravel and Rock respectively



17. For the Ogee Spillway, $x^n = K H_d^{n-1} y$, if the slope of the U/S faces of the spillway is 1: 1 (H:V), then the value of K and n are
- 2 and 1.85
 - 1.93 and 1.83
 - 1.93 and 1.81
 - 2 and 0.85
18. A berm is recommended for every vertical elevation of
- 3 to 6 meter
 - 6 to 10 meter
 - 10 to 15 meter
 - 15 to 20 meter

19. **The spillway shown is**
- a. Drop inlet spillway
 - b. Morning glory spillway
 - c. Siphon spillway
 - d. Tunnel spillway



20. The type of an arch dam which generally requires "overhangs" at abutments is of
- a. Constant radius
 - b. Variable radius
 - c. Constant angle
 - d. Double curvature

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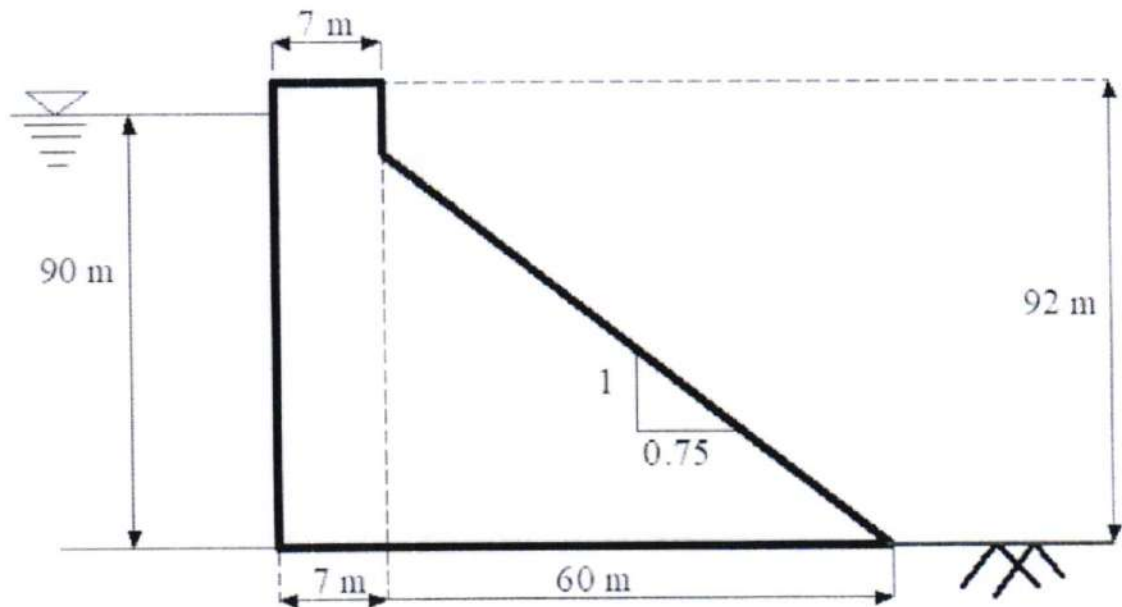
12 DEC 2024

Course : CIEG 304
Semester : I
F. M. : 40

SECTION "B"

Attempt ALL questions. Assume data suitably if required.

1. Explain the requirement of a site for dam in which Gravity Dam is suitable for the construction. [3]
2. Derive the expression for the shear stress on the horizontal plane near the toe of the gravity dam. Furthermore comment on the shear stress if there is no tail water and if there is earthquake effect. [4]
3. For a Gravity dam shown in figure, **neglecting the earthquake effect, Determine**
 - i. Maximum Vertical Stress at the toe and heel of dam. [2]
 - ii. Major Principal Stress and Horizontal Shear stress at the toe. [2]
 - iii. Factor of Safety against Overturning, Sliding and Shear Sliding. [3](Assume unit weight of water and concrete γ_w and γ_c are 9.81 kN/m^3 and 24 kN/m^3 , unit shear of dam material $C = 1500 \text{ kN/m}^2$ and Coefficient of friction (μ) between dam base and dam is 0.75, permissible compressive stress of the dam material is 3000 kN/m^2)



4.
 - a. Prove that at a given elevation the required thickness of the arch is proportional to the radius of the arch at that elevation. [3]
 - b. Design and Draw a double curvature arch dam by USSBR method for the following data, $H = 220$ meter, $L_1 = 400$ meter and $L_2 = 120$ meter. [3]

P.T.O.

5. An earth dam made up of homogeneous material has the following data
- i. Height of the dam = 35 meter
 - ii. Top width of the dam = 8 meter
 - iii. U/S and D/S slope = 4:1 and 3:1 respectively
 - iv. Length of the D/S horizontal filter = 40 meter
 - v. Free board = 5 meter
 - vi. Dry density of dam material = 20 kN/m^3
 - vii. Saturated density of dam material = 22 kN/m^3
 - viii. Average angle of friction of dam material is 20 degree
 - ix. Average cohesion of dam material is 25 kN/m^2
 - x. Coefficient of permeability = 5×10^{-6} (meter/second)
- a. **Determine and Draw** the corrected phreatic line and base parabola (in 1:1000 scale in normal graph paper) [4]
- b. Furthermore **check the stability** of any one arbitrary slip circle on D/S side of the dam. (*considering felleneous method take slip circle in such a way that it intersect phreatic line and it passes from toe and crest*) [3]
6. For an earth dam section which is homogeneous and isotropic having horizontal filter in D/S. Derive, the seepage discharge is proportional to the focal distance. [3]
7. With examples, classify the spillway based on the location. Explain the essential requirement of the spillway. State the effect of the U/S slope of Ogee spillway on the coefficient of the discharge. [2+2+2=6]
8. Write short notes (**ANY TWO**) [2×2=4]
- a. Seepage control in earth dam.
 - b. Limiting height of gravity dam.
 - c. Design Consideration for Buttress dam.