

KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.E.

Year : III

Exam Roll No. :

Time: 30 mins.

Registration No.:

Course : CIEG 304

Semester : I

F. M. : 10

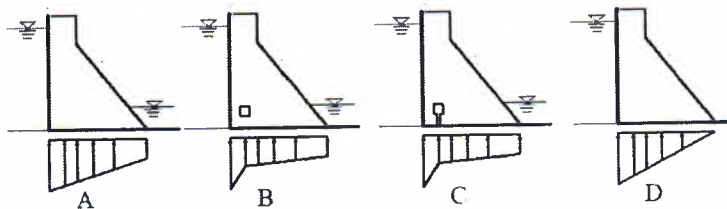
Date : 05 AUG 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

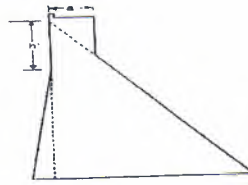
Choose and encircle in the most appropriate option from each set of choices

- For the gravity dam section, nature of assumed stress diagram is
 - Triangular for hydrodynamic
 - Trapezoidal for hydrostatic
 - Parabolic for water uplift
 - Triangular for silt/earth
- INCORRECT** statement for the selection of the dam type is
 - Earth dam is suitable for low rolling plains.
 - Gravity dam is not suitable on clay foundation.
 - If the length of dam is very long and height is low an arch dam is suitable.
 - Concrete gravity dam is suitable for providing overflow section at its middle.
- As per **IS 6512**, for load combination F and G, factor of safety against sliding (FSS) and Shear friction factor (SFF) are:
 - 2 and 4
 - 1.5 and 3
 - 1.2 and 1.5
 - 1 and 1.5
- INCORRECT** uplift pressure diagram is

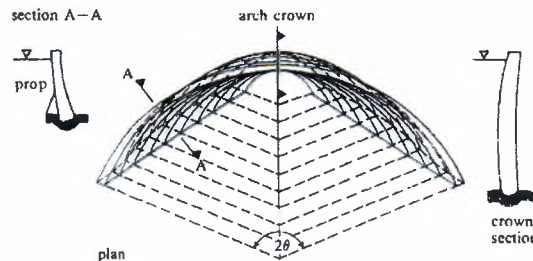


- A
 - B
 - C
 - D
- For method of zoning of gravity dam design, if line of resultant of for reservoir full case coincides with D/S extremity of middle third and line of resultant for reservoir empty case coincides with U/S extremity of middle one third, then the zone is
 - Zone II
 - Zone III
 - Zone IV
 - Zone V
 - Upon the analysis of concrete gravity dam, followings are obtained:
 $\sum V = 43470 \text{ kN} (\downarrow)$ and $\sum M = 1455545 \text{ (kNm)}$ clockwise moment, if the base width of dam is 52.2 meter, then
 - Resultant fall to the left of the center of dam base
 - Resultant fall to the right of the dam base
 - There is tension in the toe
 - There is tension in the heel

7. Shown concrete gravity dam profile is designed as per

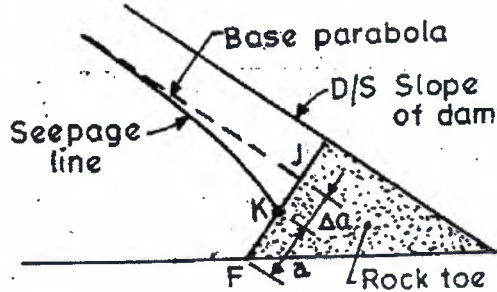


- a. Single step method
b. Multiple step method
c. Strip method
d. Zoning method
8. For a homogeneous earth dam of 52 meter height including 2 meter of free board, flow net results were: number of flow lines = 5, number of potential drop = 25, coefficient of the permeability of dam material is 3×10^{-5} (m/sec). then the seepage discharge is
a. 3×10^{-4} (cumec/meter)
b. 3.12×10^{-4} (cumec/meter)
c. 2.4×10^{-4} (cumec/meter)
d. 2.496×10^{-4} (cumec/meter)
9. For gravity dam base
a. Maximum compressive stress is $(3V/W)$ when eccentricity is equal to $(B/6)$
b. There will be no tension if eccentricity is more than $(B/6)$
c. There will be no any stress in dam base if eccentricity is zero
d. There will be only direct compression if eccentricity is zero
10. Wave height, for the dam site having horizontal fetch of 40 kilometer, and wind velocity as 90 kmph is
a. 1.92 meter
b. 19.2 meter
c. 2.0 meter
d. 19.28 meter
11. Seepage discharge through the isotropic soil is (each symbol has unique meaning)
a. $q = \sqrt{K_v K_h} \times H \times \frac{N_F}{N_D}$
b. $q = K \times H \times \frac{N_F}{N_D}$
c. $q = \frac{b'}{\cos \alpha} - \sqrt{\frac{b'^2}{\cos^2 \alpha} - \frac{H^2}{\sin^2 \alpha}}$
d. $q = \sqrt{b^2 + H^2} - \sqrt{b^2 + H^2 \cot^2 \alpha}$
12. U/S and D/S slope of the earth dam generally does not depends on
a. Type of soil used in the dam construction
b. Foundation condition
c. Height of the dam
d. Top width of the dam
13. The arch dam shown in figure is

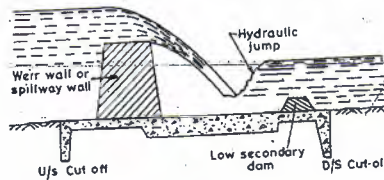


- a. Constant radius arch dam
b. Cupola type arch dam
c. Constant angle arch dam
d. Concrete gravity arch dam

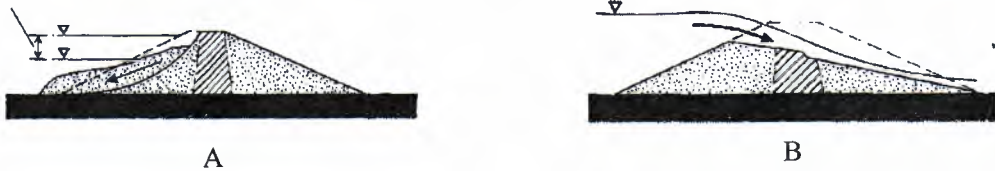
14. For an earth dam discharge face is shown in figure, the angle made by discharge face with the base is



- a. Less than 90 degree
 b. 90 degree
 c. More than 90 degree
 d. Between 30 and 60 degree
15. The equation of the D/S profile of the Ogee spillway is $(x^n = K H_d^{n-1} y)$, if the U/S side of the spillway is 1:3 (H:V), then values of K and n are
 a. 2 and 1.85
 b. 1.94 and 1.84
 c. 1.94 and 1.80
 d. 1.85 and 2
16. Spillway type is

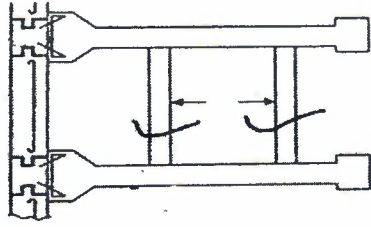


- a. Weir wall spillway
 b. Inclined spillway
 c. Overflow spillway
 d. Overfall spillway
17. **CORRECT** statement for the failure of earthen dam shown in figure is



- a. A is steady seepage failure and B is sudden drawdown failure
 b. A is sudden drawdown failure and B is foundation failure
 c. A is sudden drawdown and B is Overtopping
 d. A is foundation failure and B is Overtopping
18. For the earth dam, D15 of filter material is 5 mm, then D85 of dam base material is
 a. 1 or less than 1
 b. 1 or more than 1
 c. 5 or more than 5
 d. 5 or less than 5
19. For arch dam, **CORRECT** statement is
 a. Uplift pressure is significant
 b. Central angle for minimum concrete is less than 90 degree
 c. Thickness is independent of radius
 d. It can be designed by trail load analysis

20. Plan of flat slab buttress dam is shown in figure, the name of component showing by arrow is



- a. Lateral braces
- b. Buttress
- c. Slab
- d. Joint compound

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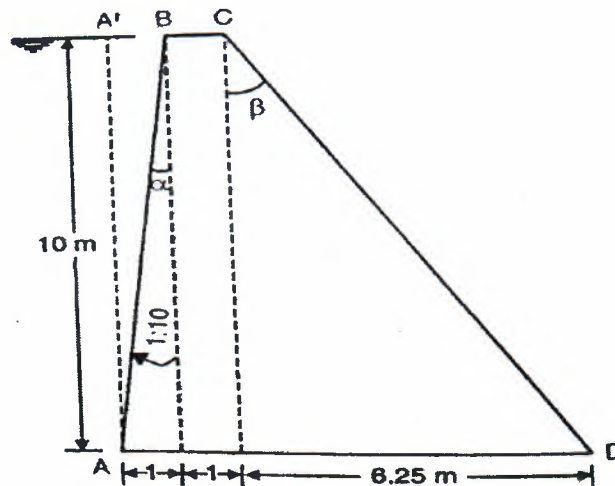
SECTION "B"

Attempt ALL questions. Assume data suitably if required.

1. a. Differentiate between Embankment and arch dams. [2]
b. Briefly describe the process of construction of gravity dam with necessary sketches. [2]
2. A masonry gravity dam 6 meter high and 1.5 meter wide at the top (crest) has vertical water face and inclined D/S face. Find the base width of the dam if no tension is to be developed. Consider there is no tail waer and water in U/S face is up to top of the dam. Take unit weight of masonry 20kN/m^3 and Coefficient for uplift is $C = 1$. [4]
3. A masonry (Gravity) dam 10 meter high is trapezoidal in section with a top width of 1 meter and total bottom width of 8.25 meter. The face exposed to water has a batter of 1:10. The unit weight of masonry is 22.4 kN/m^3 and of water is 9.81 kN/m^3 . Permissible shear stress of joint is 1400 kN/m^2 . [7]

Determine:

- i. Vertical forces (self-weight, water weight in vertical U/S face and Uplift)
- ii. Horizontal water static force
- iii. Moment due to above forces at toe
- iv. Compressive stress at toe and heel
- v. Principle stress at toe and heel
- vi. Shear stress at toe and heel
- vii. Test the stability of dam against (overturning and Sliding)



P.T.O.

4. Briefly explain for which conditions a designer should recommend double curvature arch dam? **Design and draw (section)** the constant radius arch dam for a valley 75 meter wide at the base and 150 meter wide at the top of height 100 meter from the base. (Assume allowable permissible stress of material is 7 MPa, top width of dam is 3 meter, unit weight of water is 9.81 kN/m^3 and consider angle subtended at the top of the dam is 134 degree). [1+4=5]
5. An earth dam made up of homogeneous material has the following data
- i. Height of the dam = 30 meter
 - ii. Top width of the dam = 5 meter
 - iii. U/S and D/S slope = 4:1 and 3:1 respectively
 - iv. Length of the D/S horizontal filter = 30 meter
 - v. Free board = 3 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) [3]
 - 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) [4]
6. Briefly describe the process of stability analysis of an earth dam by one of the most accepted method i.e. **Swedish Slip Circle method**. [4]
7. Design an Ogee spillway for concrete gravity dam, for the following data:
- Average river bed level = 200 m
 - R.L. of spillway crest = 300 m
 - Slope of D/S face of a gravity dam = 0.8:1
 - Design discharge 6000 cumecs
 - Length of spillway 10 spans with 5 meter each
 - Thickness of each pier = 2.5 meter
- Determine D/S profile only (no need to determine U/S profile).** [5]
8. Write short notes (**ANY TWO**) [2 Q.×2 = 4]
- a. Criteria for design of filter for earth dam
 - b. Zoning method for design of gravity dam
 - c. Limitation of thin cylinder theory for arch dam
 - d. Advantage and disadvantage of buttress dam

