



**DEPARTMENT OF CIVIL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY PATNA**

B. Tech 6th Semester End-Sem Exam, 16th May-2024

Subject: Hydraulic Structures
Time: 3 hours

Course Code: CE63134
Max. Marks: 70

Instruction: Answer all the questions

Q. No.	Question	Marks	Course Outcome (CO)	Blooms Taxonomy Level (BL)
1	Explain difference between storage structures and diversion structures. Discuss all types of storage structures and diversion structures with suitable design, their differences and uses.	10	4	5
2	Define (a) Design flood, (b) Afflux, (c) free-board, (d) pond level, (e) water way, (f) flank wall, (g) under sluices bays, (h) crest levels of under sluices bays, (i) Abutment, (j) guide bunds	10	4	4
3	Discuss different forces acting on Gravity Dam with governing equations and diagrams. (i) self-weight (ii) water pressure force, (iii) uplift pressure forces, (iv) earthquake force	8	3	4
4	<p>Q. Calculate the following for Gravity Dam as shown -</p> <p>① The maximum Vertical Stress at the heel and toe of the Dam.</p> <p>② The major Principal Stress at the toe of the Dam.</p> <p>③ The Intensity of Shear Stress on a horizontal Plane near the toe, neglect Earthquake effects.</p> <p>Ans : →</p>	12	5	5
5	<p>(a) Which of the following are the causes of failure of weirs:</p> <ol style="list-style-type: none"> 1. Rupture of floor due to uplift. 2. Rupture of floor due to suction caused by standing wave. 3. Scour on the upstream and downstream of the weir. <p>(b) The volume of water below the minimum pool level in a reservoir is known as _____.</p> <p>(c) Tehri Dam of Uttarakhand has been constructed on the river _____.</p> <p>(d) A graph showing the stage, discharge, velocity or some other features of flowing water with respect to time, at a given site is _____.</p>	8	3	4
6	<p>(a) Discuss Rubber Dam design and purpose with suitable diagram. Is there any Rubber Dam constructed in India, discuss in details?</p>	5	3	4

(b) Explain different types of Dams in details. Include Coffer dam and Check dams.

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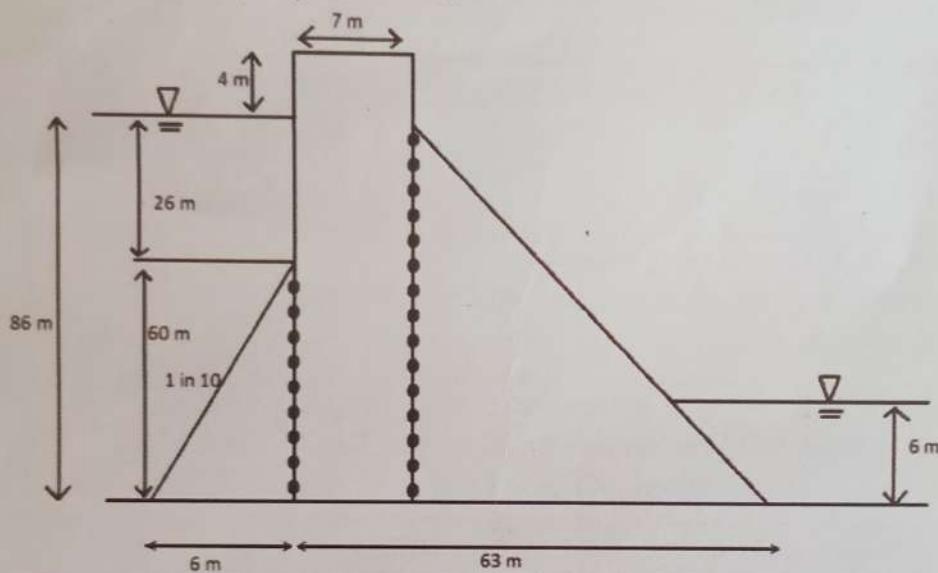
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7. Q. Examine the stability of the given dam at the Base. The earthquake forces may be taken as equivalent to 0.1gm for horizontal and 0.005 g for vertical forces. The Uplift may be taken as equal to the hydrostatic pressure at the either ends and is considered to act over 60 % of the area of the Section. A tail water depth of 6m is assumed to be present when reservoir is full and there is no tail water when reservoir is empty. Assume $\gamma_c = 24 \text{ KN/m}^3$, $\gamma_w = 10 \text{ KN/m}^3$.

12

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5





NATIONAL INSTITUTE OF TECHNOLOGY, PATNA
End SEMESTER EXAMINATION, 2024

Program: B. Tech. (Civil)
Course Code: CE63120
Full Marks: 60

Semester: 6th (Group B)
Course Name: Foundation Engineering
Duration of Examination: 3 hours

Answer any **five** questions

1. A.

A large scale bearing capacity test on a footing of size $1.05 \text{ m} \times 1.05 \text{ m}$ at a depth of 1.5 m yielded an ultimate value of 141.0 kN . Unconfined compression test on the soft saturated clay yielded a strength of 0.03 N/mm^2 . If the unit weight of the soil is 1.6 g/cc , how much does the test value differ from that obtained using Terzaghi's bearing capacity equation?

(6)

B. Derive the expression of passive pressure of purely sandy soil for a smooth retaining wall. Give neat sketch. (4)

C. What is the use of depth factor & ground penetrating radar? (2)

2. A. Explain the effect of presence of tension crack in slip surface on the stability of slope. (2)

B. A retaining wall (figure 1) 10 m high has sandy backfill with $e = 0.65$, $\phi = 30^\circ$ and $G = 2.65$. The water table is at a depth of 3 m from the ground surface. Draw the active earth pressure diagram and determine the magnitude and point of application of the total active earth pressure. (10)

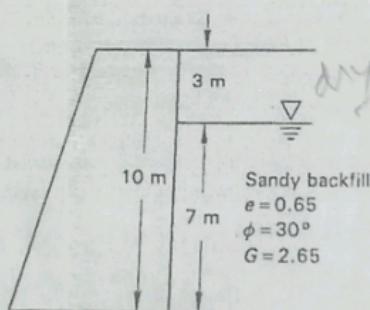


Figure 1.

3. A. Show various forces acting on the slice abcd (see figure 2) as per Bishop method. The slope is fully submerged condition. (5)

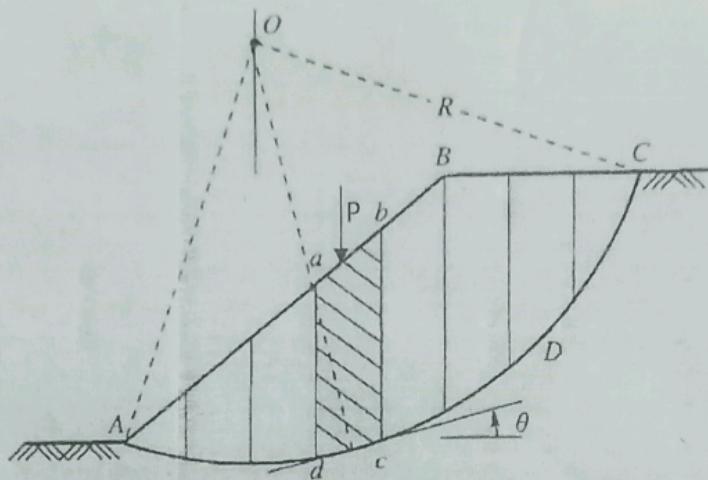


Figure 2.

- B. A concrete pile, 30 cm diameter, is driven into a medium dense sand ($\phi = 35^\circ, \gamma = 21 \text{ kN/m}^3, K=1, \tan \delta = 0.70$) for a depth of 8m, Estimate the safe load, taking a factor safety of 2.5. For $\phi = 35^\circ, D_c/B \approx 12.0, N_q = 60$. (7)

4. A. Explain the procedure for determination of active earth pressure of rough retaining wall for sandy soil. Give neat sketch. (4)
 B. Explain the use of sand pile & fender pile (3)
 C. You have used plate load test & Equation of compression index for determination of settlement of shallow foundation on purely clay soil. Which will test give the best result? Explain the reason also. (3)
 4. What will be the maximum slope angle of an infinite slope for sandy soil? Describe the reason also. (2)

5. A. Determine the factor of safety of slope (see figure 2). AC is the slip surface. (6)

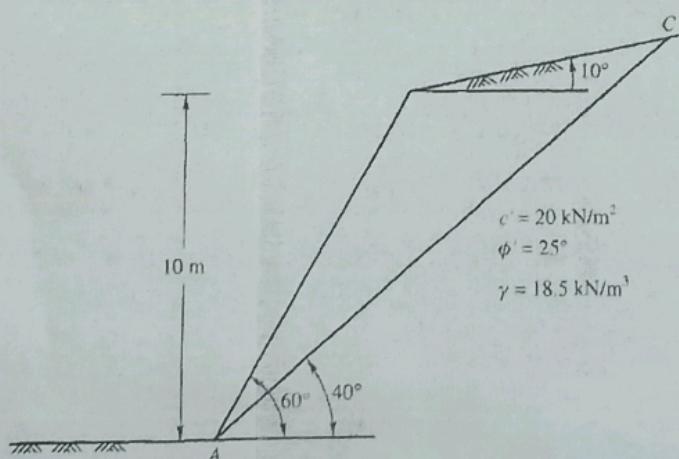


Figure 2.

B. What are the refusal conditions of SPT test? (2)

C. Describe wash boring with neat sketch. (4)

6. A square pile group consisting of 16 piles of 40 cm diameter passes through two layers of compressible soils as shown in Figure 3. The thicknesses of the layers are : $L_1 = 2.5$ m and $L_2 = 3$ m. The piles are spaced at 100 cm center to center. The properties of the fill material are: top fill $c_u = 25$ kN/m²; the bottom fill (peat), $c_u = 30$ kN/m². Assume $\gamma = 14$ kN/m³ for both the fill materials. Compute the negative frictional load on the pile group. (7)

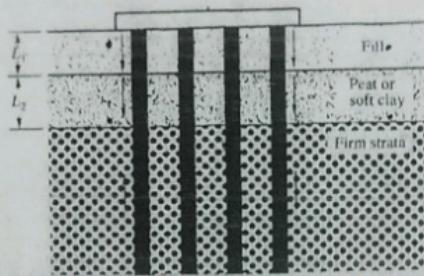


Figure 3.

7. B. Derive the expression of crossover distance for seismic refraction survey. Give neat sketch. (5)

7. A. A rigid retaining wall of 6 m height (Figure 4) has two layers of backfill. The top layer to a depth of 1.5 m is sandy clay having $\phi = 20^\circ$, $c = 12.15$ kN/m² and $\gamma = 16.4$ kN/m³. The bottom layer is sand having $\phi = 30^\circ$, $c = 0$, and $\gamma = 17.25$ kN/m³. Determine the total active earth pressure acting on the wall and draw the pressure distribution diagram. (6)

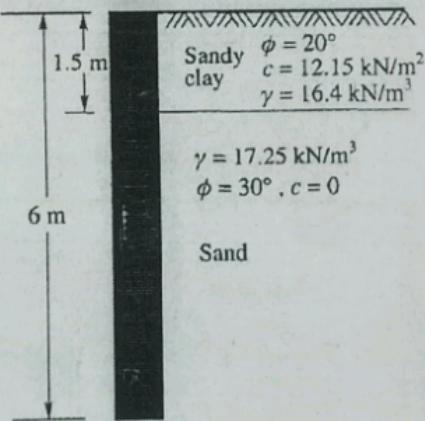


Figure 4.

- B. The side of a canal is shown in Figure 5. The soil properties are: saturated unit weight = 20 kN/m², $c = 25$ kN/m² and $\phi = 0$, for the trial slip circle shown in the figure. Find the factor of safety of the slope. (3)

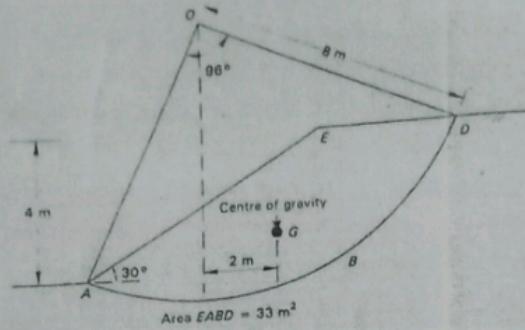
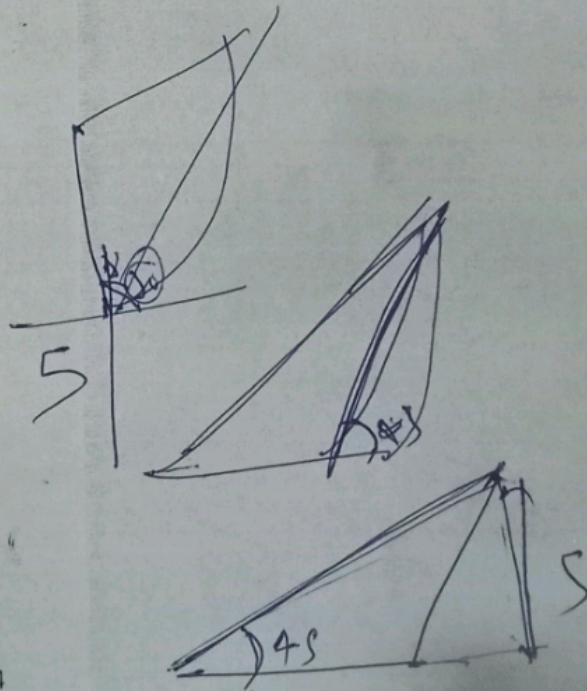


Figure 5.

C. A soil has $c = 40 \text{ kN/m}^2$, $\phi = 10^\circ$ and $\gamma = 16 \text{ kN/m}^3$. A cutting of 5 m depth is to be made in this soil. What is the factor of safety with respect to cohesion if the side slope of the cutting is 1:1? What will be the critical height of the slope in this soil? Given $N_s = 0.108$ for $\beta = 45^\circ$ and $\phi = 10^\circ$. (3)

FC



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$$= \frac{S_{nag}}{S_{c}} = \frac{5}{4}$$

$\therefore S_{nag} = \frac{5}{4} S_c$

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
 Department of Civil Engineering
 END SEMESTER EXAMINATION, 2024

Civil: Semester -VI

Course Name: Advance concrete Design

Maximum Time: 3 hours

Course Code: CE63118

Max. Marks: 60

Instruction:

1. Answer all questions.
2. Assume any suitable data, if necessary
3. Answer with neat sketches.
4. The marks, CO (Course Outcome) and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.
5. IS: 456-2000 & SP-16 are allowed

		Marks	CO	BL
1.	<p>Analyse & Design a G+2 frame for gravity load and horizontal load as shown below.</p> <p>Assume suitable LL/IL/SIDL Grade of concrete M-25. Grade of steel Fe500D Exposure – Moderate. Assume safe bearing capacity of soil = $100\text{KN}/\text{m}^2$ at 1.5m depth.</p>	60	1	1,2

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Civil Engineering

END SEMESTER EXAMINATION, Jan-Jun 2024

M. Tech: Semester-6

Course Name: Design of Steel Structures

Course Code: CE63116

Maximum Time: 3 hrs

Max. Marks: 60

Instruction: 1. Attempt **Three** questions. 2. Assume any suitable data, if necessary.
 3. Use of IS 800 and Steel Tables is allowed.
 4. Use structural steel having yield strength of 250 MPa and ultimate strength of 410 MPa
 5. The Marks, CO (Course Outcome) and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.

Q.N.	Question	Marks	CO	BL
1	Design a laterally supported beam of effective span 6 m. The beam carries a uniformly distributed factored load of 18 kN/m. Use bearing plates of 120 mm long at the below the supports. Design the beam and check for all the relevant effects.	20	CO4	IV
2	A singly laced column of 8 m high has both the ends fixed. The column carries an axial factored load of 800 kN. Design (i) suitable channels back to back with spacing between them and (ii).Design the lacing flat and its connections.	20	CO4	IV
3	Design a bolted Column splice to transfer an axial load of 400kN, a moment of 100 kN-m and a shear of 20 kN. Assume that the column ends are rough (uneven) for bearing. Use M20 bolts of grade 8.8. The columns of upper and lower stories are ISHB 225 @43.1 kg/m.	20	CO4	IV
4	A steel water tank has dimensions of 3 m x 3m x 2.5 m. When the tank is empty it weighs 45 kN. The tank is supported on columns of one angle section placed at each corner of the tank. The height of the columns is 8 m. All the columns are braced at their mid height. Take unit weight of water as 10 kN/m ³ . Design the angle column as strut.	20	CO3	V
5(a)	Design the base plate for a column base which rests on a concrete block of M25. The column carries a factored axial force of 800 kN.	10	CO3	V
(b)	Write short notes on (i) Section classification (ii) Laterally unsupported beam (iii) Methods of welding (iv) Shape factor of a section (v) Design procedure of an angle tension member	5@2 =10	CO4 CO2 CO3 CO4 CO2	IV II III V II