

Faculty of Engineering

End Semester Examination May 2025

CE3CO27 Geotechnical Engineering -I

Programme	:	B.Tech.	Branch/Specialisation	:	CE
Duration	:	3 hours	Maximum Marks	:	60

Note: All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Section 1 (Answer all question(s))

Marks CO BL

- Q1.** The minimum water content at which the soil just begins to crumble when rolled into threads 3 mm in diameter, is known- 1 1 1
- Liquid limit Plastic limit Permeability limit
- Q2.** A soil has a bulk density of 22kN/m³ and water content 10%. The dry density of soil is- 1 1 3
- 18.6 20 23.2
- Q3.** Darcy's Law gives- 1 3 2
- Velocity of flow directly proportional to length Velocity of flow directly proportional to exit gradient None of these
- Q4.** Flow net is not used to find- 1 2 1
- Seepage Void ratio Hydrostatic pressure
- Q5.** Which of the following factors affects compacted density? 1 4 1
- Water content and Type of compaction Degree of saturation All of the mentioned
- Q6.** Time factor for a clay layer is- 1 3 1
- A dimensional parameter Directly proportional to permeability of soil Inversely proportional to drainage path Independent of thickness of clay layer
- Q7.** Which of the following is coulomb's strength equation? 1 3 1
- $S = c + \tan \phi$ $C = s + c \tan \phi$ $S = \tan \phi$
- Q8.** To conduct un-drained shear test, which of the following is used? 1 3 1
- Slope grids Perforated grids All of the mentioned
- Q9.** Factor of safety with respect to height is given by _____ equation. 1 4 1
- $FC = HC / H$ $FC = C / C_m$
 $FC = \tau f / \tau$ $FC = \tau C / \tau$

Q10. For an angle of internal friction of 30° , find the flow value $N\phi$ -

1 4 1

- 4
 3

- 10
 0

Section 2 (Answer all question(s))

Marks CO BL

Q11. The in-situ percentage voids of a sand deposit are 34%. For determining the density index, dried sand from the stratum was first filled loosely in a 1000 cc mould and was then vibrated to give a maximum density. The loose dry mass in the mould was 1610 gm and dense dry mass at maximum compaction was 1980 gm. Determine density index if the specific gravity of the sand particles is 2.67.

3 1 3

Rubric	Marks
3 marks for correct result	3

Q12. (a) What is shrinkage limit? Derive the formula for the same with diagram.

7 1 2

Rubric	Marks
Definition 2 marks, Derivation 4 marks, diagram 1 marks	7

(OR)

(b) Define permeability. Derive formula of effective stress of water flows from bottom to top with neat sketch.

Rubric	Marks
Definition 2 marks, Derivation 4 marks, diagram 1 marks	7

Section 3 (Answer all question(s))

Marks CO BL

Q13. What is Darcy's law?

2 1 1

Rubric	Marks
2 marks for correct definition	2

Q14. (a) What do we understand by critical hydraulic gradient? Find the expressions for determining the coefficient of permeability in case of flow parallel to planes of stratification and flow normal to the planes of stratification.

8 3 3

Rubric	Marks
Definition 2 marks, expressions for flow parallel to planes 3 marks, normal to the planes 3 marks	8

(OR)

(b) What do we understand by flow net? Write its properties and three applications of flow net with diagram.

Rubric	Marks
Definition 2 marks, 2nd part 6 marks (properties 2, applications 3, diagram 1)	8

Section 4 (Answer all question(s))

Marks CO BL

Q15. Explain zero air void line in brief with the help of diagram.

3 2 2

Rubric	Marks
definition 2 marks, diagram 1 marks	3

Q16. (a) Differentiate between compaction and consolidation. (Any 2). Explain standard proctor test with diagrams in detail.

7 3 3

Rubric	Marks
Differentiation 3 marks, Standard proctor test 4 marks	7

(OR)

(b) Derive the consolidation equation and coefficient of consolidation by Terzaghi's theory of one dimensional consolidation with diagrams.

Rubric	Marks
consolidation equation 4 marks, coefficient of consolidation 3 marks	7

Section 5 (Answer all question(s))

Marks CO BL

2 3 1

Q17. What do we understand by critical void ratio?

Rubric	Marks
2 marks for correct definition	2

Q18. (a) Explain the stress distribution theory beneath loaded area by Westergaard's in detail with neat sketch.

8 5 3

Rubric	Marks
8 marks	8

(OR)

(b) Explain in detail Mohr-Coulomb theory of shear failure of soil with neat sketches.

Marks CO BL

2 3 2

Q19. What do we understand by stability number?

Rubric	Marks
2 marks for correct explanation	2

Q20. (a) Explain any two types of slope failure in brief. Explain Coulomb's wedge theory in details with diagrams.

8 5 3

Rubric	Marks
1st part 3 marks, 2nd part 5 marks	8

(OR)

(b) What is active and passive earth pressure? Derive the earth pressure formula for earth pressure on retaining wall due to submerged backfill.

Rubric	Marks
1st part 3 marks, 2nd part 5 marks	8
