

B. Tech. III Semester V

Subject Name : Applied Soil Mechanics

Subject Code:BTCL13501

Type of course : PCC

Prerequisite : Fundamentals of soil Mechanics (BTCL13402)

Rationale : This subject deals with determination of various soil parameters theoretically and experimentally based on laws of mechanics. For any civil engineering structure, a strong and stable foundation is required for which thorough understanding of soil behaviour, determination and interpretation of soil parameters is required. The course provides the knowledge on soil properties, testing procedures, suitability of test and analytical solutions necessary for design and behaviour of soil.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage %
1.	Consolidation: Introduction, Mass-spring analogy, Terzaghi's theory of one dimensional consolidation. Over consolidation ratio, Consolidation characteristics of soil, Laboratory one dimensional consolidation test, Characteristics of e-log(σ) curve, Determination of consolidation characteristics of soils compression index and coefficient of consolidation.	11	24
2.	Shear Strength of Soil: Concept of shear strength, Mohr-Coulomb Failure Criterion, Modified Mohr-Coulomb Criterion Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils. Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test,	10	22
3.	Stress Distribution of Soils: Causes of stress in soil, geostatic stress, Boussinesque's equation, stress distribution diagrams, Newmark's influence chart Westergard's analysis, contact pressure, stresses due to triangular and other loadings.	8	18
4.	Stability of slopes:	8	18

PCC: Professional Core Course

	Infinite and finite slopes, factor of safety, type of slope failure, stability of infinite slopes, finite slopes forms of slip surfaces, limit equilibrium method and critical stage instability analysis, effects of tension crack and submergence, C-analysis-method of slices, Taylor's stability no., use of Bishop's method.		
5.	Earth Pressure: Types of lateral earth pressure, Rankine's and Coulomb's earth pressure, theory and their application for determination of lateral earth pressure under different conditions, Rebhann's and Culmann's Graphical methods of determination of lateral earth pressures.	8	18

Suggested Specification table with Marks (Theory/Practical):

<p align="center">% Distribution of Marks</p>					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	30	15	10	5

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels (**Revised Bloom's Taxonomy**)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Soil mechanics and Foundations	Dr B.C. Punmia, Ashok Jain, Arun Jain	Laxmi Publications(P) Ltd, New Delhi ISBN-13: 978-8170087915 ISBN-10: 8170087910	2005	17 th
2	Basic Soil Mechanics & Foundations	Singh Alam,	CBS Publishers & Distributors, New Delhi. ISBN 10:8123901275 ISBN 13:9788123901275	2014	1 st
3	Soil Mechanics & Foundation Engineering	B.N.D. Narasinga Rao	John Wiley and Sons ISBN:978-81-265-3956-7 ISBN:978-81-265-8196-2	2015	1 st

4	Foundation Analysis and Design	Bowles JE	The McGraw-Hill Companies, Singapore ISBN-10:0079122477	1997	5 th
5	Craig's Soil Mechanics	Craig RF	Taylor and Francis, New York, USA ISBN:0-415-32702-4 ISBN:0-415-32703-2	2004	7 th

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Interpret soil behavior due to compaction, consolidation, and analyze various theories and calculate parameters needed in design. <i>(R,U,A, cognitive level)</i>	24
CO-2	Estimate the Shear strength of different soil types of soils and suggest the suitable method /tests for determination of shear strength parameters. <i>(R,U,A, cognitive level)</i>	22
CO-3	Compute stresses and their distribution in soil. <i>(R,U,A, cognitive level)</i>	18
CO-4	Compute earth pressure by various analytical as well as graphical methods <i>(R,U,A,N,E,C cognitive level)</i>	18
CO-5	Compute factor of safety for slopes using various graphical and analytical methods for various engineering projects/site. <i>(R,U,A, N,E,C cognitive level)</i>	18

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	2	2	-	1	1	1	1	2	2	1	2	3	1	1

CO-2	3	2	2	-	1	1	1	1	2	2	1	2	3	1	1
CO-3	3	2	2	-	1	1	1	1	2	2	1	2	3	1	1
CO-4	3	2	2	-	1	1	1	1	2	2	1	2	3	1	1
CO-5	3	2	2	-	1	1	1	1	2	2	1	2	3	1	1
Rationale *	15	10	10	-	5	5	5	5	10	10	5	10	15	5	5

Rationale: Majority of the COs are satisfying the well-defined POs and PSOs up to certain extent. Understanding of soil behaviour, determination and interpretation of soil parameters .

LIST OF PRACTICALS:

1. Free Swell Index Test
2. Swelling Pressure test
3. Consolidation Test
4. Triaxial Shear Test
5. Unconfined Compression Test
6. Direct Shear test
7. Vane Shear test
8. California Bearing Ratio test

Major Equipments:

1. Triaxial shear testing machine
2. Box shear testing machine
3. Laboratory vane shear testing equipment
4. CBR machine

List of Open Source/learning website:

- <https://nptel.ac.in/content/storage2/courses/105101001/downloads/L41.pdf>
 - Consolidation
- <https://nptel.ac.in/courses/105/103/105103097/>
 - Shear strength of Soil
- <https://nptel.ac.in/content/storage2/courses/105101001/downloads/L19.pdf>
 - Stability of slopes
- <https://nptel.ac.in/content/storage2/courses/105101083/download/lec10.pdf>
 - Theory of Earth pressure