COURSE HANDOUT

Geotechnical Engineering (CE-502)

CIVIL-5th SEMESTER

ACADEMIC YEAR (2024-25)

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
CE-502	Geotechnical Engineering	Core	4	3	1	0	50	100	150

COURSE OUTCOMES

At the end of the course the student will be able to:	
CO1	Develop stress path diagrams and estimate shear strength for different load Conditions.
CO2	Analyze the active and passive earth pressure and their in-situ applications for slope failure.
CO3	Analyze bearing capacity and settlement of foundations.
CO4	Apply geosynthetics systems to solve contemporary geotechnical problems.
CO5	Select specific method of tunnel driving for a given ground condition.

Unit-I

Stresses in soils*:* Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation and Westergaard's theories, Newmark's influence chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory.Shear strength: Mohr and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, Shear Strength tests for Different Drainage condition.

(12 Hours)

Unit-II

Lateral Earth Pressure: Earth pressure at rest, Rankine's Theories, Active and passive earth pressure of cohesion & cohesion less soil. Stability of Slopes- Introduction, types of slopes and their failure mechanisms, analysis of finite and infinite slopes. friction circle method. Soil Exploration: Scope, Sampling, Methods of soil exploration, Standard penetration and cone penetration tests.

(12 Hours)

Unit-III

Foundation classification: Choices, Necessity, IS code method and Terzaghi's theory for finding Bearing Capacity. Pile Foundations: Classification and Uses, Field test and Bearing Capacity for piles. Well Foundations: Caissons – Types, advantages and disadvantages, Shapes and component parts, Grip length, bearing capacity and settlement, Forces acting, Sinking of wells, Rectification of Tilts and Shifts

(12 Hours)

Unit- lV

Geosynthetics: An overview on the development and applications of various geosynthetics - the geotextiles, geogrids, geonets, geomembranes and geocomposites

(08 Hours)

Unit-V

Tunneling: Benefits of tunneling, Tunnels for different purposes, Site investigation and geophysical methods adopted for tunneling purposes, Rock rating and classification, Instrumentation on tunnels Tunneling methods: Drill and blast method, Tunnel boring machine, NATM, Application of Geosynthetics in tunneling

(08 Hours)

Textbooks

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Soil Mechanics & Foundation Engineering	KR Arora	Standard Publishers	8 th (2020)
2	Geotechnical Engineering	P. Purshotama Raj	Tata Mcgraw Hill	4 th (2016)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Soil Mechanics & Foundation Engineering	V.N.S.Murthy	CBS Publishers	5th, (2018)

COURSE PLAN		
Unit-I Stresses and shear strength of soil		
S.No	**Topics**	**Recommended Books**
1	Introduction, stresses due to point load.	Book 1, Ch.1
2	Stresses due to, line load, strip load.	Book 1, Ch.3
3	Stresses due to uniformly loaded circular area, rectangular loaded area.	Book 2, Ch 13
4	Influence factors, Isobars, Boussinesq's equation and Westergaard's theories.	Book 2, Ch 13
5	Contact pressure under rigid and flexible area, computation of displacements from elastic theory.	Book 2, Ch 13
6	Mohr and its characteristics.	Book 1, Ch 1
7	Principal planes, relation between major and minor principal stresses.	Book 2, Ch.17
8	Mohr-Coulomb theory.	Book 2, Ch 13
9	Direct shear test.	Book 2, Ch 13
10	Triaxial shear test.	Book 2, Ch 13
11	Unconfined compression shear test.	Book 2, Ch 13
12	Different drainage conditions of tests.	Book 2, Ch 13
Unit-II Earth pressure of soil		
3	Lateral Earth Pressure: Earth pressure at rest.	Book 2, Ch.17
4	Rankine's Theories.	Book 2, Ch.17
15	Active and passive earth pressure of cohesion & cohesion less soil.	Book 2, Ch.17
16	Introduction to stability of slopes.	Book 1, Ch.3
17	Types of slopes and their failure mechanisms.	Book 2, Ch 13
18	Analysis of finite and infinite slopes.	Book 2, Ch 13
19	Friction circle method.	Book 1, Ch.3
20	Soil Exploration: Scope, Sampling.	Book 2, Ch.3
21	Methods of soil exploration.	Book 2, Ch 13
22	Cone penetration test	Book 2, Ch 13
23	Standard penetration tests	Book 2, Ch 13
24	Types of Samplers	Book 2, Ch 13

Unit-III Foundation		
25	Foundation classification of foundation	Book 2, Ch.17
26	Choices and Necessity of foundation	Book 2, Ch.17
27	IS code method and Terzaghi's theory for finding Bearing Capacity.	Book 2, Ch.17
28	Pile Foundations: Classification and uses.	Book 2, Ch.17
29	Field test and Bearing Capacity for piles.	Book 2, Ch.17
30	Well Foundations and its component parts	Book 2, Ch.17
31	Cautions and its component parts.	Book 2, Ch.17
32	Grip length, bearing capacity and settlement.	Book 2, Ch.17
33	Forces acting, Sinking of wells.	Book 2, Ch.17
34	Rectification of Tilts and Shifts.	Book 2, Ch.17
35	Types of causion foundation	Book 2, Ch.17
36	Shapes of different types of foundation.	Book 2, Ch.17
Unit-IV Geosynthetics		
37	Introduction to geosynthetics.	Book 2, Ch.5
38	Development of various geosynthetics.	Book 2, Ch.5
39	Applications of various geosynthetics.	Book 2, Ch.3
40	Geotextiles and their uses.	Book 2, Ch.3
41	Geogrids and their uses	Book 2, Ch.3
42	Geonets and its uses.	Book1, Ch. 20
43	Geomembranes and its uses	Book 2, Ch.9
44	Geocomposites and its uses	Book 2, Ch.9
Unit-V Tunnelling Methods		
45	Tunneling: Benefits of tunneling.	Book 2, Ch.5
46	Tunnels for different purposes.	Book 2, Ch.5
47	Site investigation and geophysical methods adopted for tunneling purposes.	Book 2, Ch.3
48	Rock rating and classification.	Book 2, Ch.3
49	Instrumentation on tunnels.	Book 2, Ch.3
50	Methods of Tunnelling.	Book1, Ch. 20
51	TBM and NATM method of tunnelling.	Book 2, Ch.9
52	Application of Geosynthetics in tunneling.	Book 2, Ch.9

ADDITIONAL WEB RESOURCES

1.	**MOOC:** Geotechnical engineering from IIT Madras https://www.google.com/search?q=mooc+on+geotech+engineering&rlz=1C1GCEU_en__973__973&oq=mooc+on+geotech+engineering&gs_lcrp=EgZjaHJvbWUyBggAEEUYOdIBCjEzOTQ4ajBqMTWoAgiwAgE&sourceid=chrome&ie=UTF-8
2.	**NPTEL:** Video lectures on Geotechnical engineering Lecture series by Prof. Avolika Agrawal Departmentof Civil Engineering, IIT Bombay. https://onlinecourses.nptel.ac.in/noc20_ce25/preview

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks
- **Assignment**: 20 marks

- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**

  Friday (12:05 PM - 12:55 PM)

- **Contact Information**

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