Course Syllabus
Gyanmanjari Institute of Technology
Semester-4

Subject: Geotechnical Engineering - BETCV14308

Type of course: Major core

Prerequisite: Knowledge of Basic Science

Rationale:

The study of geotechnical engineering is essential for determining different soil properties both empirically and conceptually using the laws of mechanics. Any civil engineering construction needs a solid foundation, which is dependent on knowing the characteristics and behaviour of the soil as well as identifying soil strains and settlements, among other things. A solid foundation system design for any kind of infrastructure project requires a full understanding of geotechnical engineering and its ramifications. Understanding geotechnical engineering will help students transition into numerous other civil engineering programs by enabling them to engage with this subject in multidisciplinary contexts.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-ClassRoom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	**Type of Soils, Index Properties, Inter-relationships and Soil Characterization** Types of soil and soil formation, Geological cycle, Phase diagrams, Basic terms, Functional relationships based on index properties, Physical characterization of soil-Dry and Wet sieve analysis, Atterberg's Indices, Soil Structures, Soil Water and its types, Standard nomenclature & IS Soil Classification, Numericals. Problems/Numericals/Codes/Lab and Field Tests.	10	15%
2	**Permeability and Seepage & Compaction** Darcy's law and its validity, Factors affecting permeability, Laboratory permeability tests, Permeability of stratified soil masses, Seepage pressure, Quick condition, Flow nets. Definitions, Differentiate between compaction and consolidation, Compaction mechanism and proctor tests, field compactions methods, factors affecting compaction, Consolidation mechanism through spring analogy, fundamental definitions, Terzaghi's one dimensional consolidation theory (only formula), Time factor, preconsolidation pressure, consolidation settlement, Numericals	14	25%
3	**Stress Distribution & Shear Strength of Soil** Causes of stresses in soil, Boussinesq and Westergard's equation, Pressure Bulb, Stress distribution on horizontal and vertical planes, Stresses due to different shapes of footings, New-mark's influence chart, Numericals Mohr's strength theory, Mohr-coulomb's strength theory, Modified Mohr coulomb's theory, shears parameters through lab and field tests based on drainage conditions, Numericals	14	25%
4	**Earth Pressure & Stability of Slopes** Types of lateral earth pressure, Rankine's and Coulomb's earth pressure, Rebhann's/Culmann's Graphical methods, Infinite and finite slopes, Factor of safety, Type of slope failure, Limit equilibrium method, C-analysis-method of slices, Taylor's stability number, Numericals	12	20%
5	**Introduction to Foundations and Bearing Capacity** Shallow Foundations; Types, Basic terms, SBC computation using IS and Terzaghi methods. Deep Foundations; Pile and Pile capacity, Numericals.	10	15%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Prepare The Model** Faculty will assign students to create models demonstrating soil compaction and consolidation, and students will document the process with photographs taken over four days and upload them on GMIU Web Portal.	10
2	**Prepare Map** Faculty will assign a project where students will study different types of soil in the local region and prepare a corresponding map and will upload it on GMIU Web Portal.	10
3	**Poster Presentation** Students will prepare a poster that explains stress distribution for different types of soil, focusing on theoretical concepts and practical applications. The students will have to upload the prepared poster on GMIU Web Portal	10
	Total	30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	10%	30%	30%	30%	-	-

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

Course Outcome:

After learning the course, the students should be able to:	
CO1	Classify the soil and compute Soil Index parameters.
CO2	Interpret soil behaviour through learning soil compaction, consolidation, analyze various theories and calculate parameters needed in design.
CO3	Compute earth pressure, stress distributions and FOS for slopes using various graphical and analytical tools for various engineering projects
CO4	Differentiate, compare, formulate, and evaluate soil parameters through performing various tests as per site conditions or project needs
CO5	Suggest suitable type of foundation as per soil type, estimate bearing capacity and demonstrate its socio-economic feasibility.

List of Practicals: -

Sr.No.	Descriptions	Unit No.	Hrs
1.	Determine moisture content of soil by oven drying method	01	04
2.	Compute the particle size distribution of a material using sieve analysis.	01	04
3.	Conduct Unconfined Compression Test to measure the mechanical properties of soil samples.	01	04
4.	Determine the critical moisture content of fine-grained soils using Atterberg's Limit Test.	02	06
5.	Determine the optimal moisture content and maximum dry density of a soil type using Proctor Compaction Test.	03	04
6.	Conduct triaxial compression test to measure the shear strength of soil.	04	04
7	Conduct standard penetration test to measure the penetration resistance of soil.	05	04

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] B.C. Punamiya; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., New Delhi.
[2] Alam Singh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi
[3] Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.
[4] Gopal Ranjan, Rao A.S.R.; Basic and applied soil mechanics; New age int. (p) ltd
[5] Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi
[6] Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai