Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-5 (B. Tech.)

Subject: Foundation Engineering – BETCV15321
Type of Course: Professional Elective Courses
Prerequisite: Knowledge of Geotechnical Engineering

Rationale: Loads of all civil engineering structures must be transmitted to the soil or rock through a foundation system that is safe and economical. The course on Foundation Engineering provides the necessary technical knowledge to select, analyze and design various types of foundation systems under different loads with full understanding on soil investigation, its requirements, interpretation of data and its application. Various types of foundations and their analytical solution help students to design suitable foundation with respect to soil and site condition and type of structure.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					
				Theory Marks		Practical Marks		CA	Total Marks
CI	T	P	C	ESE	MSE	V	P	ALA	
2	0	2	3	60	30	10	20	30	150

Legends: CI-Class Room 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	**Foundation Classification:** Types of foundation, Factors affecting the selection of type of foundations, steps in choosing types of foundation based on soil condition, Types of shallow foundation, Types of Deep foundation.	04	25
2	**Shallow Foundation** Introduction, significant depth, design criteria, modes of shear failures. Detail study of bearing capacity theories (Prandtl, Meyerhoff, Terzaghi, Skempton, Vesic etc), bearing capacity determination using IS Code (IS 6403), Presumptive bearing capacity. Settlements: components of settlement & its estimation (IS 8009), permissible settlement, Proportioning of footing for equal settlement, Allowable bearing pressure. Bearing capacity from in-situ tests (SPT, SCPT, PLT, DCPT), Factors affecting bearing capacity. Bearing capacity of raft/mat foundation as per codal provisions, Floating foundation.	10	25
3	**Deep Foundation** Introduction, load transfer mechanism, factors influencing, selection of pile, their method of installation and their load carrying characteristics for cohesive and granular soils, piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), penetration test data & Pile load test (IS 2911). Pile group: Carrying capacity, Group Efficiency and settlement. Negative skin friction, Foundations on problematic, soil Significant characteristics of expansive soil, Under-reamed pile foundation-its concept, design & field installation.	10	25
4	**Soil Retaining structure and soil inspection:** Types (types of flexible and rigid earth retention systems: counter fort, gravity, diaphragm walls, sheet pile walls etc.), Analysis of retaining and diaphragm walls. Objectives and planning of exploration program, methods of exploration-depth of boring, Soil samples and samplers-Methods of sampling, Introduction to geophysical methods, Bore log and report writing and Data interpretation, Introduction to geo synthetics-types and uses.	06	25

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Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1	**Field Visit to Foundation Construction Site:** Faculty will suggest to student an industrial visit regarding active construction site with ongoing foundation works. Students take notes on pile driving, soil compaction, and foundation pouring processes. Follow-up discussion on site challenges and mitigation strategies. Main objective is Observe real-life foundation construction techniques. Student will prepare the report and upload it on GMIU Web Portal.	10
2	**Role-Playing Activity – Geotechnical Consultant Meeting:** Faculty Assign to student different roles like civil engineers, geotechnical engineers, clients, and contractors. The "client" presents a construction problem (e.g., foundation cracks, excessive settlement). The "engineers" propose solutions based on technical knowledge. The class evaluates and critiques the proposed solutions. Main objective of this activity is Develop communication and decision-making skills. Student will prepare the Discussion point report and upload it on GMIU Web Portal.	10
3	**Soil Exploration and Site Investigation Activity:** Divide students into small groups and assign them a simulated construction site. Provide soil profiles, borehole logs, and standard penetration test (SPT) data. Students analyze the given data and recommend suitable foundation types based on soil properties. Main Objective of this activity is Understand the importance of soil investigation before foundation design. Student will prepare the report and upload it 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 %	20%	40%	20%	20%	-	-

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	Select appropriate type of foundation as per codal guidelines.
CO2	Design appropriate Shallow foundation system for different structures, that satisfy the allowable bearing capacity and settlement requirements based on soil properties.
CO3	Design vertical piles and pile groups for various types of loading, soil conditions and settlement requirements.
CO4	Analyze retaining walls, sheet piles and diaphragm walls under static loads., suggest suitable type of geo synthetics for various foundation issues.

List of Practical

Sr. No.	Descriptions	Unit No	Hrs.
01	Bearing capacity computations using Box Shear Test.	02	02
02	Bearing capacity computations using Triaxial Test	02	04
03	Bearing capacity computations using Vane Shear test	02	02
04	Bearing capacity computations using SPT	02	04
05	Bearing capacity computations using SCPT	02	02
06	Bearing capacity computations using DCPT	02	02
07	Bearing capacity computations using Plate load test	03	04
08	Settlement computations using Consolidation test	03	04
09	Settlement calculations for layered soil and Soft Marine clay	03	04
10	Swell pressure and swell index test for expansive soils	04	02
TOTAL			**30**

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 the laboratory.

Reference Books:

[1] Foundation Engineering, Peck hanson & Thronburg (1974). John Wiley & Sons.
[2] Foundation Engineering Naryana S Naik (2012), Dhanphat Rai publishers, New Delhi
[3] Foundation Analysis and Design, 5th Edition, McGraw Hill, New York, 1995.
[4] Analysis & Design of Foundations & Retaining Structures", Swami Saran, Gopal Ranjan, Sarita Prakashan.
[5] Pile foundation analysis and design, John Wiley and Sons, New York, 1980.