Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-1

Subject: Analysis and Design of Foundation – METSE11507

Type of course: Minor Stream

Prerequisite: Soil Mechanics, Foundation Engineering and relevant IS codes

Rationale: The foundation system plays a critical role in civil engineering structures, serving as a crucial component for transmitting structural loads from buildings, bridges, towers, and other projects to the underlying soil or rock safely. The selection of an appropriate foundation system is pivotal in ensuring serviceability, stability against various forces, and overall project economy. The course on Analysis and Design of Foundation Systems equips students with essential design knowledge, incorporating the latest field practices and adherence to codal provisions. This knowledge empowers students to analyze and design suitable foundation systems capable of withstanding different loads and soil conditions effectively.

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-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.

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Design of Shallow Foundations** Students will be given a set of design parameters (e.g., loadings, soil properties) and will design a shallow foundation system. They will perform structural design calculations for rectangular and trapezoidal spread footings and strap beams, considering factors such as load distribution, soil pressure, and reinforcement requirements. Students will prepare detailed design drawings and calculations, and submit them on the GMIU Web Portal.	10

2	**Soil-Structure Interaction and Flexible Foundation Design** Students will study the principles of soil-structure interaction and the Winkler foundation model. They will apply this model to design a flexible foundation system for a given structure. The analysis should include the effects of soil-structure interaction on foundation performance and stability. Students will submit a detailed report including design calculations, interaction analysis, and model validation on the GMIU Web Portal.	10
3	**Structural Design of Piles and Pile Caps** Students will design various pile foundations for a given load scenario, including pile caps, under-reamed piles, battered piles, piers, and caissons. They will perform calculations for pile capacity, pile cap design, and overall foundation stability. Students will document their design process, calculations, and results, and submit them in a report on the GMIU Web Portal.	10
Total		**30**

Course Content:

Sr. No	Course content	Hrs	% Weightage
1	Introduction to Limit State Design of reinforced concrete in foundations; Bearing capacity of Foundations, Settlement computations of various foundation types and their related IS Codal provisions.	9	15
2	Design of Shallow foundations: Structural design of reinforced concrete spread footings, rectangular, trapezoidal and strap beam;	9	15
3	Soil pressure for structural design; Conventional structural design of continuous footings, individual footings, combined footings and rafts of various types subjected to vertical and lateral loads and moments; Design of circular rafts;	12	25
4	Soil structure interaction and 'flexible' approach to the design of foundations; Winkler foundation	10	20
5	Structural design of piles including pile caps, under reamed piles, battered piles, piers and caissons;	8	10
6	Structural design of retaining walls; Cantilever and counter fort earth retaining walls with Structural and foundation stability computations	8	10
7	Sheet Pile Walls, Cantilever and Anchored sheet pile walls, Introduction to shell foundations;	4	5
	Total	**60**	**100**

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	NA	NA	NA	NA	NA	NA

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	Apply various design approaches, selection of proper foundation system as per sub-soil conditions based on codal provisions and theoretical practice followed.
CO2	Analyze and design rigid and flexible foundation systems using elastic theories based on numerical and analytical approaches through software including soil structure interaction effect.
CO3	Design temporary and permanent soil retaining structures, excavation supports, foundations in water bodies and high embankments.
CO4	Apply conceptual knowledge of special foundations such as batter piles, shell foundations and sheet pile walls for various applications such as resisting high lateral loads.

List of Practical

Tutorial work shall consist of presentations / problems / preparation of learning material based on above topics. Apart from above assignments a group of students has to undertake one open ended design problem based on engineering application of Thin plates & shells.

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 the 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] "Foundation Analysis & Design", Joseph E Bowles, McGraw Hill, 1996
[2] Analysis and Design of Foundation and Retaining Structures, Shamsher Prakash et.al, Sarita Prakashan
[3] Foundation Manual for Practicing Engineers, Nayak N.V., Dhanpatrai Publications
[4] Pratical Found. Engg, Handbook, Robert W Brown, McGraw Hill Pub,1996
[5] Principles of Found Engg, Das B.N., 4th ed,PWS Pub.Co.,1999