

# GUJARAT TECHNOLOGICAL UNIVERSITY

## CIVIL (GEOTECHNICAL ENGINEERING) (43)

### ANALYSIS AND DESIGN OF FOUNDATION SYSTEMS

SUBJECT CODE: 2724302

SEMESTER: II

**Type of course:** Core

**Pre-requisites:** 1. Soil Mechanics (Geotechnical Engineering I). 2. Foundation Engg (Geotechnical Engineering II) including knowledge of IS codes on foundation.

**Rationale:** Foundation system is an important component of any civil engineering structure. Its proper selection will ultimately lead to its full utility and proper stability against various forces. The structural loads of buildings, bridges, towers, and other civil engineering works must be transmitted to the underlying natural soil or rock material using a foundation system that is safe, stable, and economical. The course on *Analysis and Design of Foundation Systems* provides the students necessary design knowledge acquainted with latest field practices and codal provisions. This will help them to analyze and design suitable foundation systems under different load and soil conditions.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	30	0	10	10	150

**Content:**

Sr. No.	Topics	Total hours	Module 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	04	05
2	Design of Shallow foundations: Structural design of reinforced concrete spread footings, rectangular, trapezoidal and strap beam;	06	10
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;	08	20
4	Soil structure interaction and 'flexible' approach to the design of foundations; Winkler foundation	05	15
5	Structural design of piles including pile caps, under reamed piles, battered piles, piers and caissons;	07	20
6	Structural design of retaining walls; Cantilever and counter fort earth	06	15

	retaining walls with Structural and foundation stability computations		
7	Sheet Pile Walls, Cantilever and Anchored sheet pile walls, Introduction to shell foundations;	06	15

### Reference Books:

1. Joseph E Bowles, "Foundation Analysis & Design", McGraw Hill, 1996
2. ShamsheerPrakash et.al, Analysis and Design of Foundation and Retaining Structures, SaritaPrakashan
3. Nayak N.V., Foundation Manual for Practising Engineers, Dhanpatrai Publications
4. Robert W Brown, Practical Found. Engg, Handbook, McGraw Hill Pub, 1996
5. Das B.N., Principles of Found Engg, 4th ed, PWS Pub.Co., 1999
6. S.P. Brahma, Foundation Engg, Tata McGraw Hill, 1985
7. Zeevert, Found. Engg for Difficult Sub Soil Condition, Van Nostrand Publin., 1975
8. Fang and Winterkorn, Found. Engg, Handbook, Van Nostrand Publn., 1975
9. Selvadurai, A. P. S. "Elastic Analysis of Soil Foundation Interaction.", ELSEVIER SCIENTIFIC PUBLISHING COMPANY, NEW YORK  
Selvadurai, A. P. S. "Elastic Analysis of Soil Foundation Interaction.", ELSEVIER SCIENTIFIC PUBLISHING COMPANY, NEW YORK

### Course Outcome:

After learning the course the students should be able to:

- Selection of proper foundation system as per sub-soil conditions based on codal provisions and theoretical practice. It will provide good understanding of design of shallow and deep foundation systems for various civil engineering structures.
- Analyse and design both rigid and flexible foundation systems and provides insight into codal provisions with respect to foundation design. This will be based on both analytical and numerical approach i.e. using software's.
- Distinguish between temporary and permanent soil retaining structures and the knowledge can be applied for design of excavation supports, foundations in water bodies and high embankments.
- Design special foundations such as batter piles and shell foundations for applications such as resisting high lateral loads.
- Understand a role of geotechnical engineer as structural design engineer and its implication for proper execution of any project.

### List of Tutorials:

Design problem for each foundation type and supported by at least two case studies. Maximum no of problems may be equal to 15-20.

### List of Open Source Software/learning website:

<http://nptel.ac.in/>

<http://ocw.mit.edu/courses/civil-and-environmental-engineering/>

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website