GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL (STRUCTURAL ENGINEERING)
ADVANCED FOUNDATION ENGINEERING
SUBJECT CODE: 2712009
SEMESTER: I

Type of course: Elective

Prerequisite: Geotechnical Engineering

Rationale: Foundation is an important component of any civil engineering structure. 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 *Advanced Foundation Engineering* provides the students necessary geotechnical engineering skills to analyze and design shallow and deep foundation systems under different loading and soil conditions.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	20	0	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	General requirements, bearing capacity computations, settlement computations, use of field tests like SPT as per relevant IS code	05	10
2	Shallow foundations: different types, proportioning of footings for equal contact pressures, eccentrically loaded footings, soil design of combined footings, strap footing, C.P under rigid and Flexible footing	05	10
3	Rafts: different types, bearing capacity and settlement computations of raft on different soil deposits, determination of contact pressure under raft; concept of floating foundation buoyancy raft, Modulus of subgrade reaction	05	10
4	Pile foundation: vertical and lateral load capacity of a pile, settlement analysis of pile group, under reamed piles, IS code provisions, pile load test, Piled raft foundation and analysis	10	25
5	Well foundations: different types, stability analysis and basic concepts	01	05
6	Dynamic analysis of foundations: dynamic soil properties, natural frequency of machine foundation-soil system, different types of machine foundations, static and dynamic criteria for soil-foundation system, design of block foundations per IS code.	10	25
7	Foundations on expansive soils, waffle slab/raft, concept of CNS layer, chemical stabilization etc.	02	05
8	Liquefaction : Types, Factors and mitigation methods	02	05
9	Introduction to soil-structural interaction	02	05

Reference Books:

1. Kaniraj SR,"Design Aids in Soil Mech. And Foundation Engg. ", Tata McGraw Hill.
2. Swami Saran, Gopal Ranjan, "Analysis & Design of Foundaions & Retaining Structures", Sarita Prakashan.
3. Nainan P Kurian, " Design of Foundation Systems", Narose Pub. House.
4. J. E. Bowles, "Foundation Analysis and Design", McGraw Hill .
5. Analysis and design of foundation - J. Bowles
6. Foundation design -Teng
7. Principles of foundation Engg. - Braj Das
8. Pile foundation - M.J. Tomlinson
9. Handbook of foundation Engg. - Fang & Winker Korn

Course Outcome:

After learning the course the students should be able to:

(a) Select appropriate foundation system for different structures,
(b) Design shallow foundations that satisfy the allowable bearing capacity and settlement requirements based on soil properties,
(c) Design deep foundation satisfying bearing capacity and settlement requirements,
(d) Design of machine foundation under static and dynamic loads,
(e) Evaluate the liquefaction potential of soil deposits

List of Experiments/Tutorials:

At least 15 problems based on above topic.

Open Ended Problems:
Apart from above tutorials/experiments a group of students has to undertake one open ended problem/design problem. Few examples of the same are given below:

1. Development of spread sheets/computer programmes for the design of shallow, raft, pile and well foundation.
2. Design of machine foundation for a problem preferably selected from industry.
3. Design of foundation of real-life structure using open-source/commercial software.

List of Open Source Software/learning website:
http://nptel.ac.in/

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