GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL (GEOTECHNICAL ENGINEERING) (43)

ELEMENTARY MACHINE FOUNDATIONS

SUBJECT CODE: 2724307

SEMESTER: II

Type of course: Open Elective

Pre-requisites: 1. Soil Mechanics (Geotechnical Engineering I). 2. Foundation Engg (Geotechnical Engineering II), Earthquake Engg.

Rationale: Foundation type for any structure mainly depends on soil characteristics or in other words engineering properties of soil and its resemblance, magnitude of load, type of load and economic factors. Design of machine foundation is also an essential part of RCC design and needs through knowledge of dynamic soil behaviour. Various dynamic soil properties, its proper evaluation and interpretation needs to be proper addressed for proper selection of foundation for structures subjected to dynamic loads or vibration. Geotechnical significance of machine foundations becomes more significant when large machines having range of frequencies are to be installed and run for a longer period of time. The course on *Elementary Machine Foundations* provides the students necessary knowledge on dynamic soil parameters, its selection, design considerations for type of machines and various remediation techniques to mitigate vibrations for foundations. This will help them to cultivate their knowledge in design of machine foundations and its interaction with soil dynamics.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Topics	Total hours	Module Weightage
1	Introduction -nature of dynamics loads -free vibrations of spring mass systems -forced vibrations -viscous damping -principles of vibration measuring equipments	09	20
2	Dynamic stress -deformation and strength of soils -dynamic bearing capacity and earth pressure -Effect of transient and pulsating loads -resonant column apparatus -field tests -typical values of soil constants	08	20
3	Liquefaction of soils -factors influencing -liquefaction potential – analysis from standard penetration data	08	15
4	Machine foundations -design criteria -degrees of freedom -foundations for reciprocating machines -block foundations -elastic half space theory lumped parameter analog model- foundations for high speed machinery dynamic soil structure interaction	10	25

5	Vibration isolation -passive and active isolation -use of springs and damping materials -construction aspects of machine foundations	07	20

Reference Books:

1. Das B M, "Fundamental of Soil Dynamics", Elsevier Scientific Publishing Co., New York, 1983
2. Barkan D D, "Dynamics of Bases of Foundations", McGraw Hill Book Co. Inc., New York
3. Srinivashulu P & Vaidyanathan C V, Handbook of "Machine Foundation", McGraw Hill, 1986
4. Prakash S & Puri V K, "Foundations for Machines", McGraw Hill, 1987
5. Bykhovsky I, "Fundamentals of vibration engineering "
6. Winterkorn Hans, Fang Hsai Yang, "Foundation Engg Handbook ", Galgottia Publications
7. Vaidya & Srinivasan, Handbook of Machine Foundations, 1970.
8. Kameshwar Rao, Vibration Analysis and Found. Dynamics, Wheeler Pub. Co., 1998.

Course Outcome:

After learning the course the students should be able to:

- The course would help in developing a good background on principles of dynamic loading and response of soil under dynamic stresses.
- The course would help in estimation of the dynamic soil properties and evaluation of performance of the foundation system under different types of dynamic loadings including earthquake loading.
- It would also provide good background for designing effective vibration isolation or damping systems for various applications.

List of Experiments/Tutorials:

Following experiments should be performed in the laboratory for determination of various dynamic soil parameters:

i. Cyclic triaxial compression test
ii. Cyclic simple shear test
iii. Resonant column test
iv. Block vibration test
v. Cyclic plate load test
vi. Standard penetration test
vii. Geophysical tests

A. Design problem for reciprocating machines and impact machine/high speed machines as per IS codal provisions. No of problems equal to 5.
B. Design problem supported with case study for determination of liquefaction potential for any machine foundation. No of problems equal to 5.
C. Preparation of design charts /values with various co-relations developed by research workers on dynamic soil parameters, soil-machine interaction and liquefaction zoning.

Open Ended Problems:

Apart from above tutorials/experiments a group of students has to undertake one open ended problem/design problem using sub-soil profile of their local city or have a visit of any industrial site. Few examples of the same are given below:

1) Design problem for reciprocating machines as per IS code and determining its liquefaction potential.
2) Design problem for high speed machines as per IS code and determining its liquefaction potential.

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