



DEPARTMENT OF CIVIL ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech. (Geotechnical Engineering)		
Course Title	Dynamics of Soils and Foundations		
Course Code	CE806	No. of Credits	3
Course Code of Pre-requisite subject(s)	Nil		
Session	January 2021	Section (if, applicable)	Nil
Name of Faculty	Dr.S.Jayalekshmi	Department	Civil Engineering
Official Email		Telephone No.	9487575715
Name of Course Coordinator(s) (if, applicable)	-		
Official E-mail	jaya@nitt.edu	Telephone No.	+91 431 2503164
Course Type (please tick appropriately)	<input checked="" type="checkbox"/> Core course — <input type="checkbox"/> Elective course		

**Syllabus (approved in BoS)**

- Introduction – Nature of Dynamic Loads – free vibrations of spring-mass systems-forced vibrations-viscous damping-principles of vibration measuring equipment
- Dynamic stress – deformation and strength of soils – Dynamic bearing capacity and earth pressure – Effect of Transient and Pulsating Loads – Resonant Column Apparatus – Field Test – Typical values of soil constants- Liquefaction of soils – Factors Influencing -Liquefaction potential – vibration table studies – Field Tests-Analysis -from standard penetration data.
- Engineering problems involving soil dynamics; Role of inertia; Theory of Vibrations: Single and two degree freedom systems, vibration measuring instruments, Vibration isolation, Wave propagation in elastic media-General nature of soil behaviour under cyclic/dynamic loading; Field and Laboratory tests for measurement of small strain and large strain, dynamic properties of soils- Design criteria for machine foundations, elastic homogeneous, half space solutions, lumped parameter solutions – Codal Provisions.
- Response of SDOF systems: Free vibration, Experimental determination of natural frequency and damping, Response of system to exciting forces and ground motions ranging from simple pulse like excitation to harmonic and complex histories, Transmissibility, Vibration Measuring Instruments, Response of 2 DOF and Multi degree of freedom systems. Propagation of seismic waves in soil deposits- Attenuation of stress waves, Stress-strain behaviour of cyclically loaded soils, strength of cyclically loaded soils.



### References

1. Shamsheer Prakash, V.K. Puri, "Foundations for Machines: Analysis and Design", John Wiley & Sons, 1988
2. Swami Saran, "Soil Dynamics and Machine Foundation", Galgotia Publications Pvt. Ltd., New Delhi 1999.
3. K.G. Bhatia, "Foundations for Industrial Machines: Handbook for Practising Engineers", CRC Press, London, 2009.
4. Krammer S.L., "Geotechnical Earthquake Engineering", Prentice Hall, International Series, Pearson Education(Singapore) Pvt. Ltd., 2004.
5. Kameswara Rao,"Vibration Analysis and Foundation Dynamics", Wheeler Publishing, New Delhi, 1998.

### COURSE OBJECTIVES

1. To interpret the concept of dynamics in Geotechnical Engineering
2. To predict liquefaction and suggest mitigation
3. To recognize the significance of soil structure interaction
4. To apply the principles of dynamics for the design of machine foundation

### PROGRAMME OUTCOMES (POs)

Graduates of the Geotechnical Engineering Programme will be able:

1. To acquire in-depth knowledge of Geotechnical Engineering, with an ability to understand, evaluate and analyse existing techniques and establish new techniques and integrate them for the betterment of the field.
2. To analyse Geotechnical Problems critically and apply independent judgment to come up with advanced and reliable solutions.
3. To develop original and unique concepts to solve Geotechnical Engineering issues and evaluate and compare existing concepts in order to provide solutions that are economically and technically feasible with highest standards of professionalism.
4. To conduct thorough literature survey on trending problems of Geotechnical Engineering and adopt appropriate research methodology to conduct experiments and analyse the obtained results and apply it to develop technical knowledge and publish in the corresponding domains of Geotechnical Engineering
5. To use computer based modelling and numerical analysis of Geotechnical engineering problems in various platforms based on Finite element methods and understand the significance of such modelling techniques and their applicability in real – time scenarios.
6. To possess knowledge and understanding of group dynamics, recognise opportunities and contribute positively to collaborative – multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and to further the learning of themselves as well as others.
7. To demonstrate knowledge and understanding of Geotechnical Engineering and Management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently after consideration of economic and financial factors.
8. To communicate with the Engineering community, and with society at large, regarding complex Geotechnical engineering activities confidently and effectively, such as being able to comprehend and write effective reports and design



documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
9. To recognise the need for, and have the preparation and ability to engage in life long learning, with a high level of enthusiasm and commitment to improve knowledge and competence continuously
10 To acquire professional and intellectual integrity, professional ethics and code of conduct, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the society for sustainable development.
11 To observe and examine critically the outcomes of one's actions in addressing Geotechnical Engineering problems and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

**MAPPING OF COs with POs**

<b>Course Outcomes</b> Upon completion of this course, the students will be able to	<b>Programme Outcomes (PO)</b> (Enter Numbers only)
1. Interpret the principles of dynamics in Geotechnical Engineering	1-11
2. Predict Liquefaction and suggest measures for its mitigation	1-11
3. Reason the response of any soil-structure system	1-11
4. Apply the principles of soil Dynamics	1-11

**COURSE PLAN – PART II**

**COURSE OVERVIEW**

This course is essential to get an overview of dynamic concepts especially in seismic conditions and machine foundations. It aids in the design and in Understanding soil structure interactions. The course is application oriented

**COURSE TEACHING AND LEARNING ACTIVITIES**

The pace of the lecture and the number of classes will be based on the needs of the class taught and the teaching-learning process, which is an evolving one.

S.No.	Week	Topic	Mode of Delivery
1	1-3	Introduction – Nature of Dynamic Loads – free vibrations of spring-mass systems-forced vibrations-viscous damping-principles of vibration measuring equipment	Online Interactive Lecture/ Powerpoint Presentation/ Whiteboard / Video Lectures/ Any suitable mode / Activity based
2	4-5	Dynamic stress – deformation and strength of soils – Dynamic bearing capacity and earth pressure – Effect of Transient and Pulsating Loads – Resonant	Online Lecture/ Power point Presentation/ Whiteboard / Any suitable mode / Activity based



		Column Apparatus – Field Test – Typical values of soil constants- Liquefaction of soils – Factors Influencing -Liquefaction potential – vibration table studies – Field Tests- Analysis -from standard penetration data.	
3.	6-8	Engineering problems involving soil dynamics; Role of inertia; Theory of Vibrations: Single and two degree freedom systems, vibration measuring instruments, Vibration isolation	Online Lecture/ Powerpoint Presentation/ Whiteboard / Any suitable mode / Activity based
4	9-10	Wave propagation in elastic media-General nature of soil behaviour under cyclic/dynamic loading; Field and Laboratory tests for measurement of small strain and large strain -	Online Lecture/ Powerpoint Presentation/ Whiteboard / Any suitable mode / Activity based
5	11-12	dynamic properties of soils- Design criteria for machine foundations, elastic homogeneous, half space solutions, lumped parameter solutions – Codal Provisions.	
6	13-14	Response of SDOF systems: Free vibration, Experimental determination of natural frequency and damping, Response of system to exciting forces and ground motions ranging from simple pulse like excitation to harmonic and complex histories, Transmissibility,	Online Lecture/ Powerpoint Presentation/ Whiteboard / Any suitable mode / Activity based
7.	15-16	Vibration Measuring Instruments, Response of 2 DOF and Multi degree of freedom systems. Propagation of seismic waves in soil deposits- Attenuation of stress waves, Stress-strain behaviour of cyclically loaded soils, strength of cyclically loaded soils.	Online Lecture/ Powerpoint Presentation/ Whiteboard / Any suitable mode / Activity based



<b>COURSE ASSESSMENT METHODS (shall range from 4 to 6)</b>				
<b>S.No.</b>	<b>Mode of Assessment</b>	<b>Week(Tentative)</b>	<b>Duration</b>	<b>% Weightage</b>
1	Assessment 1 (Assignment/Surprise Quiz/Activity/ Seminar)	-		20%
2	Assessment 2	March 2 <sup>nd</sup> week	1 hour	25%
3	Assessment 3	April 2 <sup>nd</sup> week	1 hour	25%
CPA	Compensation Assessment <sup>§</sup>	<b>April 4<sup>th</sup> week</b>	1 hour	<b>25%</b>
4	Final Assessment *	All Portions May 2 <sup>nd</sup> Week	2 hours	30%
<p><b>§ Only one compensation assessment(25% weightage) for those who missed due to genuine reasons,one or both assessments( Assessment 2 or Assessment 3 or both ) shall be provided.</b>  <b>*Final assessment is mandatory.</b></p>				
<p><b>COURSE EXIT SURVEY</b> (mention the ways in which the feedback about the course shall be assessed)</p>				
<p>In class Committee Meetings Feedbacks in class</p>				
<p><b>COURSE POLICY</b> (including compensation assessment to be specified)</p>				
<p><b><u>Compensation assessment is for genuine cases only</u></b>  <b><u>Mass absenteeism is discouraged and no compensation assessment shall be held.</u></b></p> <p>The passing minimum shall be as per the institute regulations</p>				
<p><b><u>ATTENDANCE POLICY</u></b> (A uniform attendance policy as specified below shall be followed)</p> <ul style="list-style-type: none"> <li>➤ At least 75% attendance in each course is mandatory.</li> <li>➤ A maximum of 10% shall be allowed under On Duty (OD) category.</li> <li>➤ Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.</li> </ul>				
<p><b><u>ACADEMIC DISHONESTY &amp; PLAGIARISM</u></b></p> <ul style="list-style-type: none"> <li>➤ Possessing a mobile phone, carrying bits of paper, talking to other students, copying</li> </ul>				



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from others during an assessment will be treated as punishable dishonesty.

- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

### ADDITIONAL INFORMATION, IF ANY

**Opportunities are provided for clarification.**

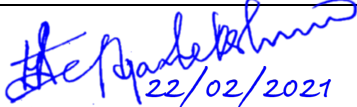
**The students must work diligently and are expected to inculcate readings habits on related topics.**

One compensation assessment (25% weightage) for absentees in assessment/assessments (other than final assessment) is provided. Only genuine cases of absence shall be considered.

### Contact Address

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### FOR APPROVAL

  
22/02/2021

Course Faculty \_\_\_\_\_  
**Dr.S.JAYALEKSHMI**

  
CC- Chairperson \_\_\_\_\_  
**Dr.MOSES SANTHAKUMAR**

  
HOD \_\_\_\_\_  
**Dr.G.SWAMINATHAN**

Head  
Department of Civil Engineering  
National Institute of Technology  
Tiruchirappalli - 620 015.



**Guidelines**

- a) The number of assessments for any theory course shall range from 4 to 6.
- b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.
- d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.