



DEPARTMENT OF CIVIL ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech. Transportation Engineering and Management		
Course Title	Ground Improvement Techniques		
Course Code	CE 622	No. of Credits	3
Course Code of Pre-requisite subject(s)	NIL		
Session	I-Sem/July/2020	Section (if, applicable)	
Name of Faculty	Dr. Deendayal	Department	Civil Engineering
Official Email	deendayal@nitt.edu	Telephone No.	0431-2053170
Name of Course Coordinator(s)	Dr. Deendayal		
Official E-mail	deendayal@nitt.edu	Telephone No.	
Course Type (please tick appropriately)	<input type="checkbox"/> Core course	<input checked="" type="checkbox"/> Elective course	
<b>Syllabus (approved in BoS)</b>			
<p>Introduction: Engineering properties of soft – weak and compressible deposits – problems associated with weak deposit – Requirements of ground improvements – introduction to engineering ground modification, need and objectives.</p> <p>Soil Stabilization: Science of soil stabilization – Mechanical modification – Hydraulic modification – Dewatering systems – Chemical modification – Modification by admixtures like lime, Cement, Bitumen etc. – Grouting – Deep jet mixing methods</p> <p>Recent Ground improvement techniques: stabilization using industrial waste – modification by inclusion and confinement – soil nailing – stone column – compaction piles – dynamic compaction – prefabricated vertical drains – preloading – electro – osmosis – soil freezing vacuum consolidation – deep explosion – dry powdered polymers - enzymes</p> <p>Soil reinforcement: Historical background, RCC – Vidalean concept of reinforced earth – Mechanisms – Types of reinforcements – Soil – Reinforcement – Interaction studies – Internal &amp; External stability criteria – Design Principles of steep reinforced soil slopes – pavements – Embankments on soft soils.</p> <p>Geo-Synthetics: Geo-synthetic clay liner – Construction details – Geo Synthetic Materials – Functions – Property characterization – Testing Methods for Geo – Synthetics – Recent research and Developments. Control of Improvement – Field Instrumentation – design and analysis for bearing capacity and settlement of improved deposits.</p>			



<b>COURSE OBJECTIVES</b>	
<ul style="list-style-type: none"> <li>To introduce the engineering properties of soft, weak and compressible deposits, principles of treatment for soils</li> <li>To learn how to improve weak soils by modern ground improvement techniques</li> <li>To study the recent ground improvement techniques</li> <li>To study the role of soil reinforcement in soil stabilization</li> <li>To know the importance of geo-synthetics in ground improvement</li> </ul>	
<b>MAPPING OF COs with POs</b>	
<b>Course Outcomes</b>	<b>Programme Outcomes (PO) (Enter Numbers only)</b>
1. understand the importance of ground improvement techniques in civil engineering construction activities	1,2,3,4,6,7,8
2. understand the properties of soft, weak and compressible deposits, principles of treatment for soils	4,5,6,7,8,11,12
3. do reinforced wall design using steel strip or geo-reinforcement	4,7
4. perform any modern ground improvement design including soil stabilization	2,3,4,7
5. understand the importance of geo-synthetics and their field applications	2,3,4,5,7

<b>COURSE PLAN – PART II</b>			
<b>COURSE OVERVIEW</b>			
The course elaborates various ground improvement techniques along with principles, design issues and construction procedures.			
<b>COURSE TEACHING AND LEARNING ACTIVITIES</b>			
<b>S.No.</b>	<b>Week</b>	<b>Topic</b>	<b>Mode of Delivery</b>
1	Week 1	Introduction - Engineering properties of soft, weak and compressible deposits - problems associated with weak deposit	PPT & Virtual Mode
2	Week 2	Requirements of ground improvements – introduction to engineering ground modification, need and objectives.	PPT & Virtual Mode
3	Week 3	Science of soil stabilization – Mechanical modification – Hydraulic modification - Dewatering systems	PPT & Virtual Mode
4	Week 4	Chemical modification – Modification by admixtures – Grouting – Deep jet mixing methods	PPT & Virtual Mode



5	Week 5	<b>Assessment-1</b>	
6	Week 6	Recent Ground improvement techniques: stabilization using industrial waste – modification by inclusion and confinement	PPT & Virtual Mode
7	Week 7	Soil nailing – stone column – compaction piles – dynamic compaction – prefabricated vertical drains – preloading	PPT & Virtual Mode
8	Week 8	Electro-osmosis – soil freezing vacuum consolidation – deep explosion – dry powdered polymers - enzymes	PPT & Virtual Mode
9	Week 9	Soil reinforcement: Historical background, RCC – Vidalean concept of reinforced earth – Mechanisms – Types of reinforcements	PPT & Virtual Mode
10	Week 10	Soil – Reinforcement: Interaction studies – Internal & External stability criteria	PPT & Virtual Mode
11	Week 11	Design Principles of steep reinforced soil slops – pavements – Embankments on soft soils	PPT & Virtual Mode
12	Week 12	<b>Assessment-2</b>	
13	Week 13	Geo-synthetic clay liner – Construction details – Geo Synthetic Materials – Functions – Property characterization	PPT & Virtual Mode
14	Week 14	Testing Methods for Geo – Synthetics – Recent research and Developments.	PPT & Virtual Mode
15	Week 15	Control of Improvement – Field Instrumentation – Design and analysis for bearing capacity and settlement of improved deposits.	PPT & Virtual Mode
16	Week 16	<b>Final Assessment</b>	



<b>COURSE ASSESSMENT METHODS</b>				
<b>S.No.</b>	<b>Mode of Assessment</b>	<b>Week</b>	<b>Duration</b>	<b>% Weightage</b>
1	Assessment-I	5 <sup>th</sup> Week	1 hour	20 marks
2	Assessment-II	12 <sup>th</sup> Week	1 hour	20 marks
3	Assignments/Mini projects/Seminars: 2 Nos.	3 <sup>rd</sup> and 10 <sup>th</sup> week	1 week time	30=15+15 marks
	CPA-Compensation Assessment*	16 <sup>th</sup> week	1 hour	20 marks
5	Final Assessment *	16 <sup>th</sup> / 17 <sup>th</sup> week	2.5 hour	30 marks
6	<b>Total</b>			<b>100 marks</b>

\*mandatory; refer to guidelines on page 6

**ESSENTIAL READINGS : Textbooks, reference books and journals.**

**References:**

1. Hausmann, M.R., *Engineering Principles of Ground Modification*, McGraw – Hill International Editions, 1990.
2. Purushotham Raj, *Ground Improvement Techniques*, Laxmi Publications, New Delhi.
3. Sharma.S.K., *Principles, Practice and Design of Highway Engineering*, S.Chand & Co. New Delhi, 1985.
4. Jones C. J. F. P, *Earth Reinforcement and Soil Structures*, Butterworths, London.

**COURSE EXIT SURVEY**

1. Class committee meetings.
2. Online - Feedback forms submission through MIS.

**COURSE POLICY (including compensation assessment to be specified)**

- Minimum 75% attendance is compulsory for attending the final examination.

**ATTENDANCE POLICY** (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.



**ACADEMIC DISHONESTY & PLAGIARISM**

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying 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**

The Course Coordinator's Room No. : 101 (Civil- Annex Building)  
Timings : 10 a.m. to 5 p.m.  
Email ID : deendayal@nitt.edu  
Telephone No. : 0431-250-3170

**FOR APPROVAL**

  
Course Faculty \_\_\_\_\_

  
CC- Chairperson \_\_\_\_\_

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



**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.