



**NATIONAL INSTITUTE OF TECHNOLOGY,
TIRUCHIRAPPALLI**

DEPARTMENT OF CIVIL ENGINEERING

| COURSE PLAN – PART I | | | |
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| Name of the programme and specialization | M.Tech. Geotechnical Engineering | | |
| Course Title | Ground Improvement Techniques | | |
| Course Code | CE 815 | No. of Credits | 3 |
| Course Code of Pre-requisite subject(s) | NIL | | |
| Session | I-Sem/July /2023 | 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 | | |
| Syllabus (approved in BoS) | | | |
| <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 & 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</p> | | | |



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and Developments. Control of Improvement – Field Instrumentation – design and analysis for bearing capacity and settlement of improved deposits.

COURSE OBJECTIVES

- To introduce the engineering properties of soft, weak and compressible deposits, principles of treatment for soils
- To learn how to improve weak soils by modern ground improvement techniques
- To study the recent ground improvement techniques
- To study the role of soil reinforcement in soil stabilization
- To know the importance of geo-synthetics in ground improvement

MAPPING OF COs with POs

| Course Outcomes | Programme Outcomes (PO) (Enter Numbers only) |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| 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 |

COURSE PLAN – PART II

COURSE OVERVIEW

The course elaborates various ground improvement techniques along with principles, design issues and construction procedures.

COURSE TEACHING AND LEARNING ACTIVITIES

| S.No. | Week | Topic | Mode of Delivery |
|-------|--------|-----------------------------------------------------------------------------------------------------------------------|------------------|
| 1 | Week 1 | Introduction - Engineering properties of soft, weak and compressible deposits - problems associated with weak deposit | PPT & Chalk-talk |
| 2 | Week 2 | Requirements of ground improvements – introduction to engineering ground modification, need and objectives. | PPT & Chalk-talk |
| 3 | Week 3 | Science of soil stabilization – Mechanical modification – Hydraulic modification - Dewatering systems | PPT & Chalk-talk |



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| 4 | Week 4 | Chemical modification – Modification by admixtures – Grouting – Deep jet mixing methods | PPT & Chalk-talk |
| 5 | Week 5 | Assessment-1 | |
| 6 | Week 6 | Recent Ground improvement techniques: stabilization using industrial waste – modification by inclusion and confinement | PPT & Chalk-talk |
| 7 | Week 7 | Soil nailing – stone column – compaction piles – dynamic compaction – prefabricated vertical drains – preloading | PPT & Chalk-talk |
| 8 | Week 8 | Electro-osmosis – soil freezing vacuum consolidation – deep explosion – dry powdered polymers - enzymes | PPT & Chalk-talk |
| 9 | Week 9 | Soil reinforcement: Historical background, RCC – Vidalean concept of reinforced earth – Mechanisms – Types of reinforcements | PPT & Chalk-talk |
| 10 | Week 10 | Soil – Reinforcement: Interaction studies – Internal & External stability criteria | PPT & Chalk-talk |
| 11 | Week 11 | Design Principles of steep reinforced soil slopes – pavements – Embankments on soft soils | PPT & Chalk-talk |
| 12 | Week 12 | Assessment-2 | |
| 13 | Week 13 | Geo-synthetic clay liner – Construction details – Geo Synthetic Materials – Functions – Property characterization | PPT & Chalk-talk |
| 14 | Week 14 | Testing Methods for Geo – Synthetics – Recent research and Developments. | PPT & Chalk-talk |
| 15 | Week 15 | Control of Improvement – Field Instrumentation – Design and analysis for bearing capacity and settlement of improved deposits. | PPT & Chalk-talk |



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| 16 | Week 16 | Final Assessment |
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COURSE ASSESSMENT METHODS

| S.No. | Mode of Assessment | Week | Duration | % Weightage |
|-------|------------------------------|------------------------------------------|-------------|------------------|
| 1 | Assessment-I | 5 th Week | 1 hour | 20 marks |
| 2 | Assessment-II | 12 th Week | 1 hour | 20 marks |
| 3 | Assignment/Seminar | 10 th week | 1 week time | 10 marks |
| | CPA-Compensation Assessment* | 16 th week | 1 hour | 20 marks |
| 5 | Final Assessment * | 16 th / 17 th week | 3 hour | 50 marks |
| 6 | Total | | | 100 marks |

*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.

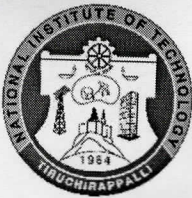
COURSE EXIT SURVEY

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)



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- 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 W. Palani CC- Chairperson P. Prabhakar S. Prasad
HOD