

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE464	REINFORCED SOIL STRUCTURES AND GEO - - SYNTHETICS	3-0-0-3	2016

**Prerequisite : CE305 Geotechnical Engineering - II**

**Course objectives:**

- To understand the history and mechanism of reinforced soil
- To know the various types of geosynthetics, their functions and applications.
- To enable the design of reinforced soil retaining structures.

**Syllabus :**

Introduction- Functions of geosynthetics. Reinforcement action – Mechanism of reinforced soil. Component materials and their properties – fill, various types of reinforcements with advantages, disadvantages, facings. - Factors affecting the performance and behaviour of reinforced soil. Design and analysis of reinforced soil retaining walls-General aspects - External stability of vertically faced reinforced soil retaining wall. Internal stability – Tie back wedge analysis or coherent gravity analysis or reinforced soil retaining walls with metallic strip and continuous geosynthetic reinforcements. Assumptions and problems. Construction methods of reinforced retaining walls. Bearing capacity improvement using soil reinforcement – Binquet and Lee’s analysis - Simple problems in bearing capacity of reinforced soil foundation. Concept of Geocells, encased stone columns, prefabricated vertical drains, geocomposites, soil nailing, geotubes, geobags (only basic concepts). Natural geotextiles using coir and jute with relative advantages and disadvantages, application areas.

**Expected Outcomes:**

The students will

- i. Understand the history and mechanism of reinforced soil
- ii. Become aware about situations where geosynthetics can be used.
- iii. Know about various types of geosynthetics and their functions
- iv. Be able to do dimple design of reinforced soil retaining walls and reinforced earth beds.

**Text Books / References:**

1. Jones, C.J.F.P. (1985). Earth reinforcement and soil structures. Butterworth, London.
2. Koerner, R.M. (1999). Designing with Geosynthetics, Prentice Hall, New Jersey, USA, 4th edition.
3. Rao, G.V. (2007). Geosynthetics – An Introduction. Sai Master Geoenvironmental Services Pvt. Ltd., Hyderabad
4. Rao, G.V., Kumar, S. J. and Raju, G.V.S.S. (Eds.). Earth Reinforcement – Design and Construction. Publication No. 314, Central Board of Irrigation and Power, New Delhi, 2012.
5. Sivakumar Babu, G.L. (2006). An introduction to Soil reinforcement and geosynthetics. United Press (India) Pvt. Ltd.

**COURSE PLAN**

Module	Contents	Hours	Sem. Exam Marks %
I	Introduction -history –ancient and modern structures- Types of geosynthetics, advantages, disadvantages. Functions of geosynthetics and application areas where these functions are	5	15

	utilized such as in retaining walls, slopes, embankments, railway tracks, pavements etc. (general overview)		
<b>II</b>	Raw materials used for geosynthetics, manufacturing process of woven and non woven geotextiles, geomembranes, geogrids. Properties of geosynthetics. Creep and long term performance. Reinforced soil - Advantages and disadvantages. Fills, Types of facings, Factors affecting the performance of reinforced soil.	7	15
<b>FIRST INTERNAL EXAMINATION</b>			
<b>III</b>	Mechanism of reinforcement action - Equivalent Confining Stress Concept, Pseudo Cohesion Concept, Concept of Expanding soil mass. – Simple problems.	7	15
<b>IV</b>	Design and analysis of vertically faced reinforced soil retaining walls- External stability and Internal stability – Tie back wedge analysis and coherent gravity analysis. Assumptions, limitations and numerical problems. Construction methods of reinforced retaining walls. Geosynthetics in pavements, function and benefits.	7	15
<b>SECOND INTERNAL EXAMINATION</b>			
<b>V</b>	Bearing capacity improvement using soil reinforcement – Binquet and Lee’s analysis – Assumptions, failure mechanisms. Simple problems in bearing capacity. Geosynthetics for short term stability of embankments on soft soils. Natural geotextiles, Advantages and disadvantages, functions, erosion control- types of erosion control products, installation methods.	9	20
<b>VI</b>	Prefabricated vertical drains along with design principles and installation method Concept of Geocells, Gabion Walls, encased stone columns, geocomposites, soil nailing, geotubes, geobags (only basic concepts), application in landfills.	7	20
<b>END SEMESTER EXAMINATION</b>			

### QUESTION PAPER PATTERN (End semester examination)

**Maximum Marks :100**

**Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

**Note :** 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a, b, c, d)