

CIPE3002 GROUND IMPROVEMENT (3-0-0)

Course Objectives :

The course aims to familiarize students with various ground improvement techniques essential for enhancing soil properties in challenging geotechnical conditions. It covers mechanical, chemical, hydraulic, thermal modifications, and the use of geosynthetics for soil reinforcement. Students will gain knowledge to analyze, evaluate, and design ground improvement solutions for real-world applications.

Module-I: (08 Hrs)

Introduction: situations where ground improvement becomes necessary, Mechanical modification: dynamic compaction, impact loading, compaction by blasting, vibro-compaction; pre-compression, stone columns;

Module-II: (06 Hrs)

Chemical modification; modification by admixtures, stabilization using industrial wastes, grouting

Module-III: (06 Hrs)

Hydraulic modification: dewatering systems, preloading and vertical drains, electro-kinetic dewatering, Thermal modification: ground freezing and thawing

Module-IV: (10 Hrs)

Soil reinforcement and Application of soil reinforcement: Reinforced earth, basic mechanism, type of reinforcements, selection of stabilization/improvement of ground using Geotextiles, Geogrid, geomembranes, geocells, geonets, and soil nails. shallow foundations on reinforced earth, design of reinforced earth retaining walls, reinforced earth embankments structures, wall with reinforced backfill, analysis and design of shallow foundations on reinforced earth, road designs with geosynthetics

Course Outcomes (CO):

- CO1: Explain the necessity for ground improvement and describe the basic principles of various mechanical ground modification techniques such as dynamic compaction, vibro-compaction, and stone columns.
- CO2: Apply appropriate chemical and hydraulic ground improvement methods, such as grouting and dewatering, to solve practical geotechnical problems.
- CO3: Analyze ground behavior under thermal and electro-kinetic modification techniques and assess their feasibility for specific site conditions.
- CO4: Evaluate and compare different soil reinforcement techniques using geosynthetics and determine the most suitable method for stabilization in varying geotechnical scenarios.
- CO5: Design reinforced earth structures including embankments, retaining walls, and shallow foundations by integrating appropriate ground improvement and reinforcement methods.

Books:

- Hausmann, M.R., Engineering Principles of Ground Modification, McGraw-Hill International Editions, 1990.
- Yonekura, R., Terashi, M. and Shibasaki, M. (Eds.), Grouting and Deep Mixing, A.A. Balkema, 1966.
- Moseley, M.P., Ground Improvement, Blackie Academic & Professional, 1993.
- Xanthakos, P.P., Abramson, L.W. and Bruce, D.A., Ground Control and Improvement, John Wiley & Sons, 1994.
- Koerner, R. M., Designing with Geosynthetics, Prentice Hall Inc. 1998.
- Shukla, S.K., Yin, Jian-Hua, —Fundamentals of Geosynthetic EngineeringII, Taylor & Francis.