# GUJARAT TECHNOLOGICAL UNIVERSITY

**Master of Engineering**
**Subject Code 37243115**
**Semester – II**
**Subject Name: Earth Retaining Structures**

**Type of course: PE-IV**

**Prerequisite** Geotechnical Engineering, Applied Soil Mechanics, Foundation Engineering.

**Rationale:** To retain earth in an engineered way as per requirement is one of the major tasks for geotechnical engineers. As soil is heterogeneous material, it is very difficult to retain it under different situation. The course on *Earth Retaining Structures* provides the knowledge of various earth retaining structures, its field application and behavior under different conditions so; student can take proper engineering decisions in practical situations

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | ESE(E) | PA (M) | ESE (V) | PA(I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 30 | 20 | 150 |

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Earth pressure:** Types - at rest, active, passive; Rankine's theory; Backfill features - soil type, surface inclination, loads on surface, soil layers, water level; Coulomb's theory; Effects due to wall friction and wall inclination; Graphical methods; Earthquake effects. Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangement and its influence. | 11 |
| 2 | **Reinforced earth retaining wall:** Principles; concepts and mechanism of reinforced earth; design consideration of reinforced earth; materials used in reinforced earth- Geotextile, Geogrids, Metal strips, facing elements. | 09 |
| 3 | **Sheet pile wall:** Analysis of cantilevered and anchored sheet pile walls in granular & cohesive soils- fixed and free earth system | 07 |
| 4 | **Bulkheads:** bulkheads with free and fixed earth supports; equivalent beam method; anchorage of bulkheads and resistance of anchor walls; spacing between bulkheads and anchor walls; resistance of anchor plates | 07 |
| 5 | **Braced excavation:** Types; construction methods; pressure distribution in sands and clays; stability - bottom heave, seepage, ground deformation. | 08 |

**Reference Books:**

1. Das, BrajaM; *Principles of Foundation Engineering;* Cengage Learning.
2. Bowles. J.E (1997); *Foundation Analysis and Design;* McGraw-Hill International Edition, 5th Edn.
3. Donald P Coduto ; *Foundation Design Principles and Practices;* 2nd edition, Pearson India
4. Chris R.I. Clayton, Rick I. Woods, Andrew J. Bond, Jarbas Milititsky (2014); *Earth Pressure and Earth-Retaining Structures;* CRC Press
5. Koerner, R.M. (2012*); Designing with Geosynthetics;* 6 th edition, Vol-1 and 2, Xlibriscorp.ion
6. G.V. Rao, PK Banerjee, J.T. Shahu, G.V.Ramana (2004); *Geosynthetics - New Horizons;* Eds. Asian Books Private Ltd., New Delhi.

**Course Outcomes: Students will be able to**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Understand the earth pressure development mechanism and use of available theories | 15 |
| CO-2 | Apply graphical methods, lateral pressure computations and provisions of drainage facilities | 10 |
| CO-3 | Understand basic mechanism of reinforced earth wall and able to design RE wall. | 30 |
| CO-4 | Analyse and design various rigid and flexible retaining structures. | 30 |
| CO-5 | Analyise types of excavation, Design excavation both in sands and clays. | 15 |

**List of Experiments:**

Minimum 5 assignment questions from above topics.

**List of Open Source Software/learning website:**

1. NPTEL lecture series