# GUJARAT TECHNOLOGICAL UNIVERSITY

**CIVIL (Geotechnical ENGINEERING) (43)**
**Master of Engineering**
**Subject Code: 3734306**
**Semester – III**
**Subject Name: Offshore Geotechnical Engineering**

**Type of course: Program Elective-V**

**Prerequisite:** Advanced **S**oil Mechanics, Foundation Engineering and Fluid Mechanics.

**Rationale:** Off Shore structures are typical structures which requires knowledge and understanding of behavior of the structure under tidal condition and continuous exposure to water currents. In developments near coastal region the knowledge of the subject is very necessary.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| L | T | P | C | Theory Marks | | Practical Marks | | |
| | | | | ESE(E) | PA (M) | ESE (V) | PA(I) | |
| 3 | 0 | 0 | 3 | 70 | 30 | 0 | 0 | 100 |

**Content:**

| Sr. No. | Content | Total Hrs | % Weightage |
|---|---|---|---|
| 1 | **Marine soil deposits:** Offshore environment, Offshore structures and foundations, Specific problems related to marine soil deposits, Physical and engineering properties of marine soils | 06 | 15 |
| 2 | **Wave and Wind Mechanics:** Wave generation process, small and finite amplitude wave theories, Wave forces on vertical, inclined cylinders, structures – current forces and use of Morison equation, Effect of wave loading on offshore foundations, Behavior of sands and clays under cyclic loading, Laboratory experiments including repeated loading, Cyclic behavior of soils based on fundamental theory of mechanics | 10 | 25 |
| 3 | **Geotechnical Investigation for Offshore foundations:** Challenges of site investigation in marine environment, Different site investigation techniques, sampling techniques, Geophysical methods, Recent advancements in site investigation and sampling used for marine soil deposits | 09 | 20 |
| 4 | **Numerical modeling of Offshore foundations subjected to wave loading:** Numerical modeling of cyclic behavior of soils, empirical models, elastic-plastic models, FEM analysis of marine foundations subjected to wave loading | 08 | 20 |
| 5 | **Offshore Foundations:** Different offshore and nearshore foundations, Gravity platforms, Jack-up rigs, pile foundations. cassions, spudcans | 09 | 20 |

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**Suggested Specification table with Marks (Theory):**

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| **5** | **15** | **20** | **15** | **10** | **5** |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

**Reference Books:**


1. Hydrodynamics of Offshore Structures - Chakrabarti, S.K. Computational Mechanics Publications, 1987.
2. Offshore Structural Engineering - Thomas H. Dawson, Prentice Hall Inc Englewood Cliffs, N.J. 1983
3. Recommended Practice for Planning, Designing - API, American Petroleum Institute and Constructing Fixed Offshore Platforms Dalls, Tex. Publication, RP2A,
4. Oceanographical Engineering - Wiegel, R.L., Prentice Hall Inc, Englewood Cliffs, N.J. 1964.
5. Dynamic Analysis of Offshore Structures, - Brebia, C.A.Walker, S., New-nes Butterworths, U.K. 1979.
6. Offshore Structures, Vol.1, - Reddy, D.V. and Arockiasamy, M.,Krieger Publishing Company, Malabar, Florida, 1991.


**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Student will be able to justify marine environmental conditions for offshore structures and specify suitable type of remedial measures for marine deposits. | 20 |
| CO-2 | Students can execute investigation program for marine soil deposits and select necessary design parameters. | 20 |
| CO-3 | Student will be able to differentiate and analyse wind and wave forces required for design as per location and standards. | 15 |
| CO-4 | Student will be able to develop numerical models for response of offshore foundation under various conditions | 25 |
| CO-5 | Student will be able to Design suitable offshore foundation as per project requirement | 20 |

**List of Experiments/Tutorial:**

Tutorial work shall consist of presentations / problems / preparation of learning material based on above topics. Apart from above assignments a group of students has to undertake one open ended design problem based on engineering application.

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

1. NPTEL lecture series
2. MIT open source material