GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Geotechnical Engineering

Subject Code: ME02076031

Subject Name: Offshore Geotechnical Engineering

w.e.f.Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Courses

Prerequisite:	Advanced Soil Mechanics, Foundation Engineering and Fluid Mechanics.
Rationale:	Off Shore structures are typical structures which require 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.

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes
01	Student will be able to justify marine environmental conditions for offshore structures and specify suitable type of remedial measures for marine deposits.
02	Students can execute investigation program for marine soil deposits and select necessary design parameters.
03	Student will be able to differentiate and analyse wind and wave forces required for design as per location and standards.
04	Student will be able to develop numerical models for response of offshore foundation under various conditions
05	Student will be able to Design suitable offshore foundation as per project requirement

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	ESE (E)	PA/ CA (M)	PA/CA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No.of Hours	% of 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	6	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	9	25
4.	Foundations for Offshore Gravity Structures: construction, installation, instrumentation of gravity platforms, stability analysis, deformation analysis based on elastic theory, piping and erosion. Design of suction piles for offshore structure.	9	20
5.	Offshore Pile Foundations: types of offshore piles, temporary support of piled structures, dynamic analysis of pile driving, axial load capacity, axial deformation analysis, Lateral loading, and dynamic response.	11	15
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**25**	**25**	**10**	**10**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(asperRevisedBloom'sTaxonomy)

References/Suggested Learning Resources:

(a) 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.
7. Marine Geotechnics – H.G. Poulos (1988), Prentice Hall Inc.
8. Construction of marine and offshore structures – Ben C Gerwick, jr., CRC Press, Taylor and Francis Group (2012)
9. Seabed Reconnaissance and Offshore Soil Mechanics (for the installation of petroleum structures) – Pierre LE Tirant (1979), Gulf Publishing Company, Houston, Texas.
10. Randolph M and Gourvene S, Offshore Geotechnical Engineering, CRC Press,2017.

(b) Open source software and website:

1. https://nptel.ac.in/courses/
2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/

List of Experiments/ Tutorials:

1. Tutorial on marine soil classification, investigation and codal guidelines.
2. Tutorial on Design of foundation for offshore structures and study its stability.
3. Tutorial on Design of piles for offshore structures

. **Suggested Project List:** ---

Apart from above tutorials/experiments a group of students has to undertake one open ended problem/design problem. Few examples of the same are given below:

1. Modelling of wave mechanics and its simulation

2. Design parameters (geotechnical) require for design of offshore structures

3. Design of gravity platforms – real life problem/case-studies.

Suggested Activities for Students: --- Visit to any offshore structures or onshore structures (coastal belt of Gujarat/Kandla port)

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