GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3174023
Semester – VII
Subject Name: Analysis and Design of Offshore Structures

Type of course: Professional Elective Course

Prerequisite: Structural analysis, Design of steel structures

Rationale: The need for qualified off-shore structural personnel are rapidly increasing as the oil industry moves into deeper water in the search for additional supplies of oil and gas, new technology is emerging at a rapid peace for the development of new concepts for off-shore platforms. It requires large scale planning, design and construction. It requires huge amount of investment. Precise engineering skill is required for the planning, design and construction and maintenance of off-shore structures. To develop understanding of off-shore structures, the subject covers the fundamental knowledge of various important elements like Fixed platforms, Compliant towers, Floating structures, their types, analysis, design, maintenance, etc.

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	1	0	4	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	Types of offshore structures and conceptual development (Offshore Structural systems – Jacket, gravity, tension leg etc)- Loads on Offshore Structures, Wind Loads; Wave and Current Loads; Calculation based on Maximum base Shear and Overturning Moments; Design Wave heights and Spectral Definition; Hydrodynamic Coefficients and Marine growth; Fatigue Load Definition and Joint Probability distribution; Seismic Loads.	10
2	Concepts of Fixed Platform Jacket and Deck Jacket concepts, redundant framing arrangement; Launch and Lift jackets; Simple Deck configurations for Lift and float-over installations; In-service and Pre-service Loads and analysis	8
3	Steel Tubular Member Design Principles of WSD and LRFD; Allowable stresses and Partial Safety Factors; Tubular Members, Slenderness effects; Column Buckling, Design for Hydrostatic pressure; Design for combined axial and bending stresses (API RP2A guidelines).	10
4	Tubular Joint Design for Static and Cyclic Loads Simple tubular joints, design using allowable loads; stress concentration factors; S-N curves and fatigue damage calculations. Offshore drilling Underwater welding.	6
5	Corrosion - Corrosion mechanism - Types of corrosion - Offshore structure corrosion zones – Biological corrosion - Preventive measures of Corrosion - Principles of cathode protection systems - Sacrificial anode method and impressed current method – Online	8

	corrosion monitoring - Corrosion fatigue.	
	Total	**42**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**25**	**20**	**20**	**10**	**10**

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. S.K. Chakrabarti, Hydrodynamics of Offshore Structures, Springer-Verlag
2. S.K. Chakrabarti, Handbook of Offshore Engineering, Elsevier, 2005.
3. B. Gou, S. Song, J. Chacko and A. Ghalambor, Offshore pipelines, GPP Publishers, 2006 Structural Stability
4. Faltinsen, O. M. *Sea Loads on Ships and Offshore Structures*. Cambridge, UK: Cambridge University Press, 1993. ISBN: 9780521458702.
5. Sarpkaya and Issacson - "Fluid loading on offshore structures "
6. DNV – Rules for design, construction and inspection of fixed offshore structures
7. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
8. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.
9. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.
10. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
11. Reddy, D. V & Arockiasamy, M., Offshore Structures Vol.1 & 2, Kreiger Publ. Co.1991.
12. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
13. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.
14. Lewis, E. V., ed. *Principles of Naval Architecture*. Jersey City, NJ: Society of Naval Architects and Marine Engineers, 1988. ISBN: 9789991181417.
15. Paik, Jeom Kee, and Anil Kumar. *Ship-shaped Offshore Installations: Design, Building, and Operation*. Cambridge University Press, 2007. ISBN: 9780521859219.

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Course Outcomes: After studying this subject, students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	List and understand the classification of offshore structures	30
CO-2	Develop the conceptual clarity in design of offshore structures	40
CO-3	Comprehend the hydrodynamic studies	10
CO-4	Know about corrosion mechanism and its monitoring.	20

List of Tutorials:

- Determination of Loads:
  - Gravity loads
  - Environmental loads
  - Load combination
- Design of Structural steel members
- Corrosion estimation
- Simulation
  - Geometry simulation
  - Foundation simulation
  - Load simulation
- Dynamic analysis
- Fatigue analysis
- Ship impact analysis

Major Equipment: Nil

List of Open Source Software/learning website:

http://www.dnv.com/software/systems/sesam/programModules.asp
http://www.wamit.com/
http://oceanworld.tamu.edu/resources/ocng_textbook/PDF_files/book.pdf.