280813 - Diseño de Plataformas y Artefactos Oceánicos

Unidad responsable: 280 - FNB - Facultad de Náutica de Barcelona
Unidad que imparte: 742 - CEN - Departamento de Ciencia e Ingeniería Náuticas
Curso: 2019
Titulación: MÁSTER UNIVERSITARIO EN INGENIERÍA NAVAL Y OCEÁNICA (Plan 2017). (Unidad docente Obligatoria)
Créditos ECTS: 5 Idiomas docencia: Inglés

Profesorado

Responsable: ALEIX CUBELLS BARCELÓ

Competencias de la titulación a las cuales contribuye la asignatura

Básicas:

CB6. Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
CB7. Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio.
CB8. Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios.
CB9. Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades.
CB10. Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

Específicas:

CE9. (CAST) Capacidad para organizar y dirigir la construcción de plataformas y artefactos oceánicos.

CE7. (CAST) Capacidad para proyectar plataformas y artefactos oceánicos.

CE1. (CAST) Capacidad para proyectar buques adecuados a las necesidades del transporte marítimo de personas y mercancías, y a las de la defensa y seguridad marítimas.
CTFM. (CAST) Capacidad para la realización, presentación y defensa de un ejercicio original realizado individualmente ante un tribunal universitario, consistente en un proyecto integral de Ingeniería Naval y Oceánica de naturaleza profesional en el que se sinteticen las competencias adquiridas en las enseñanzas.
CEE2-8. (CAST) Capacidad de proyecto de distintos sistemas de fondeo de estructuras offshore.

CEE2-1. (CAST) Capacidad de análisis hidrodinámico, estabilidad y comportamiento en la mar de plataformas y otras estructuras offshore.

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Metodologías docentes

The lecture will be structured in three parts. Each part will have a specific goal and will be presented and evaluated independently. Students will have different roles on each part depending on the content and the expected learnings.

During the three parts of the lecture, there will be presentations, exercises in class and home-tasks. In addition, there will be workshops related with specific software that is of common use in the offshore industry.

1. Offshore Industry Overview: In this first part of the lecture, there will be a presentation of what is the offshore industry, the history of how it started and how it has transformed to date. What have been the challenges, either technical, economical, and other aspects that have impacted the feasibility of the offshore projects. Types of project (EPCI vs Reimbursable). Cicle of life of a structure (FEED, Detail Design, Procurement, Fabrication, Transport, Installation, Operation, Decomissioning)

2. Basics of structural design: In the second part, students will learn the basics of the structural design. Types of structural elements that form a structure. How they are calculated as individual items or as a complex configuration. The standards and codes that apply for the offshore structures. The typical standards that major operators include in the project specifications. Design approach WSD vs LRFD. Design for Elastic and Plastic limits of material. General calculations that are to be included in design (CoG, Lift, Transport, Corrosion, etc). Common software that is used in industry for the solution of the complex calculations (FEA).

3. Development of a Project – Study Case: In the third part, students will be asked to carry out a complete offshore project. This will cover the whole part of Engineering, Procurement, Construction and Installation (EPCI). The project will run along a study case of a subsea structure project, the SLOR design for a ultra deep water project in the Atlantic Ocean. Students will carry out the project in groups. In each class, there will be a theory presentation based on the study case, and it will serve as a base to progress with the project that students will develop.

Activities will be carried out so that the students know how to apply their knowledge to their work or vocation in a professional way and possess the necessary skills through the elaboration and defense of arguments and problem solving within their area of study, aiming at acquiring the following capabilities:

1. Being responsible for self-learning, and being able to learn independently and continuously, being self-demanding and knowing how to define achievable goals.
2. Be able to analyze the current state of a discipline.
3. Develop critical and self-critical skills.
4. Acquire habits and skills to work responsibly in a team, possess negotiation and leadership skills, and be able to propose constructive solutions to potential conflicts.
5. Be able to weigh and manage information effectively, and know how to apply information and communication technologies to your management and analysis.
6. To be fluent in oral and written communication.

Objetivos de aprendizaje de la asignatura

The main learning objectives of the course are:

1. Understanding the functions of each type of offshore structures
2. Understanding and application of basic principles for the design of offshore structures
3. Becoming familiar with the standards and codes of common use in the industry
4. Understanding the design spiral for offshore structures
5. Becoming familiar with the use of key design tools offshore engineering
6. Understanding the key issues and trade-off principles

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7. Understanding issues for detail design, considering fabrication, transportation and installation
8. Becoming familiar with general procedures and issues in fabrication, manufacture, and installation
9. Developing effective communication and presentation skills for the final report

Horas totales de dedicación del estudiantado

Dedicación total: 45h	Horas grupo grande:	45h	100.00%

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Contenidos

Part 1. Offshore Industry Overview

Dedicación: 5h

Grupo grande/Teoría: 5h
Grupo mediano/Prácticas: 0h
Grupo pequeño/Laboratorio: 0h
Actividades dirigidas: 0h

Descripción:
Lecture will cover the following topics: Offshore industry overview – upstream vs downstream. Cycle of Exploration, Appraisal, Development, Production, and abandonment. History of the offshore, Technical and economical challenges. Offshore industry outlook – future prospects. Types of structure depending function and configuration. Types of project (EPCI vs Reimbursable). Cicle of life of a structure (FEED, Detail Design - Engineering, Procurement, Fabrication, Transport, Installation, Operation, Decommissioning). Supply chain in the industry – Economic ecosystem map. Professional career for offshore engineers, depending on knowledge, skills and capacities. Offshore projects on Shallow water vs ultradeepwater.

Actividades vinculadas:

Part 2. Basics of Design

Dedicación: 10h

Grupo grande/Teoría: 5h
Grupo mediano/Prácticas: 0h
Grupo pequeño/Laboratorio: 0h
Actividades dirigidas: 5h

Descripción:
Lecture will cover the following topics: General concepts for structural Design. Calculation of tubular and plate capacity. Approach of Allowable Stresses based on WSD and LRFD. Review on API, AISC, ASME, DNV for design in offshore environment, welding design, special design considerations, Lift loads, padeye design, rigging design, transporation forces, barge and seastate, stability of barges, grillage and seafastening. Tubular Joint Connections. Elastic design vs Plastic Design. Codes for Plastic Desgin. Review on FEA packages used for design Offshore. Review of Pipeline Design.

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Part 3. Development of Detail Design Project	Dedicación: 30h Grupo grande/Teoría: 5h Grupo mediano/Prácticas: 20h Grupo pequeño/Laboratorio: 0h Actividades dirigidas: 5h

Descripción:

Students will carry out the design of a subsea structure. For this project, a framework will be provided with regards to functional requirements from the “client”, the standards and codes that apply to the project, the requirements for construction, the functional limitations for transport and installation, and the restrains of cost and time from the “project manager”. Study case will be presented alongside with the development of the project, and challenges will be posed to students while the design is being progressed.

Design Premise, Pressure Piping, T&I, Strength, Weight calculation, Cathodic protection, Drawings, Fabrication, Flexible Jumper Connection, Miscellaneous Items, Structural Frame, Bend Stiffener, Subsea Connector, Top Assembly, Bottom Assembly

Sistema de calificación

Final mark will be the summation of the following parts:

Nfinal = 0.0•N_Part 1 + 0.3•N_Part 2 + 0.4•N_Part 3_GR + 0.3•N_Part 3_IN

N_Part 1: Do not account for final mark
N_Part 2: Mark from Examn on Part 2
N_Part 3_GR: Mark from Project part 3 as group (continuous evaluation)
N_Part 3_IN: Mark from Project part 3 as individual (continuous evaluation)

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Normas de realización de las actividades

Theory classes
These classes will cover an overview and outlook of the offshore industry, and the theoretical concepts on the design of offshore structures. The main objective of these classes is to provide a general understanding of the industry, and to understand the structural concepts and will be necessary for the students to deal with the development of the project in groups.

Directed Activities
During the classes there will be resolution of typical engineering problems related with the design of offshore structures. Students will have to learn them so to be able to resolve as practical exercises during the exam.

FEA tools workshop
Industry software provider will give a session about FEA tools used in the industry for the design of offshore structures. Software provider will hand out attendance certificates to the attendees. This session will be necessary for the students to be able to progress with the development of the project of the third part of the structure.

Development of a Detail Design Project
Students will be asked to carry out the detail design of an offshore structure. For that, they will be working in groups. The project will have to be developed based on specific functional requirements from the “client”, the standards and codes that apply to the project, the requirements for construction, the functional limitations for transport and installation, and the restrains of cost and time from the “project manager”. For the project, students will be asked to do hand calculations, as well as use software tools such as spreadsheets and FEA packages.

Tutorials
The tutorial action will be carried out offering availability through e-mail.

Exams
There will be an exam, in the middle of the quartermaster, that will cover the second part of the course (Basics of Structural Design). Students that don´t pass the exam will have the opportunity to repeat the exam during the exam period at the end of the quartermaster. Those who do not attend any of the two exams, will be classified as not presented

Bibliografía

Básica:

Gerwick, Ben C. Construction of marine and offshore sructures. 3rd. Boca Raton: CRC Press, 2007. ISBN 9780849330520.

Chakrabarti, Subrata K. Handbook of offshore engineering [en línea]. Amsterdam [etc.]: Elsevier, cop. 2005 [Consulta: 21/09/2018]. Disponible a: <https://www.sciencedirect.com/science/book/9780080443812>. ISBN 0080443818.

API. Recommended practice 2A-WSD : planning, designing and constructing fixed offshore platforms : working stress design. 22nd. Washington: American Petroleum Institute, 2014.

Cobb, Fiona. Structural engineer's pocket book. 2nd. Oxford: Elsevier/Butterworth-Heinemann, 2009. ISBN 9780750686860.

Otros recursos:

Standards:

Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design API, 21st Edition , 2000, American Petroleum Institute
Specification for Structural Steel Buildings AWD and Plastic Design, 1989 American National Standard
Specification for Structural Steel Buildings ANSI/AISC 360-10, 2010 American National Standard