Marine Renewable Energies Harnessing (MAERM)

The main objective of the Master's Degree MAERM is to provide the students a complete expertise on matters necessary for a proper and comprehensive immersion in every single management and technical discipline in the area; that includes the design, project development, construction, operation and maintenance of an offshore renewable power plant.

The scope of the Modules has been carefully designed after a complete assessment of the training needs based on major world-class companies already working in offshore renewable energy harnessing, an industry that demands engineers with multi-disciplinary background.

LIST OF LECTURES

The 60 credits at UPM are composed of:

- 46 ECTS lectures in 8 modules
- 14 ECTS Master Thesis

MODULE	SUBJECT NAME	CREDITS
01	Oceanology	2
02	Structural design	8
03	Generation and Export Technologies	5.5
04	Manufacturing and Maritime Operations	7
05	Project Operation and Management	8
06	Structural Analysis of Offshore Platforms	4
07	Development of the Electrical Network	4
08	Project Development of an Offshore Power Plant	7,5
TFM	Master Thesis	14

Title: **OCEANOLOGY (2 credits)**

Module 01
Prof : A. CRUCELAEGUI

➢ **Objectives**

- Understanding the offshore environmental conditions.
- To gain the ability of building the environmental loads in order to properly model and design the structures.
- Energy resource, characterization: waves, currents, wind-wave joint probability, long term descriptions.

➢ **Contents**

- Offshore environmental conditions
  - Wind condition assessment: wind theories and profiles, wind-wave correlation
  - Metocean condition assessment: wave theories (shallow and deep waters), current theories and profiles, tidal conditions
  - Discussion on marine growth and impact on design of structures
  - Discussion on ice and icing

- Environmental resources
  - Ocean energy resource: wind
  - Ocean energy resource: wave, tidal, thermal

➢ **Academic staff**

Antonio Crucelaegui Corvinos, Module coordinator
Vicente Negro Valdecantos / José Santos López Gutiérrez / Dolores Esteban Pérez

➢ **Bibliography**

- Shore Protection Manual. Coastal Engineering Research Center. Vickburg. U.S.A. 1.984.
- Random Seas and design of maritime Structures. Yoshimi Goda. University of Yokohama. Tokio Press. 1.985.
- Water wave mechanics for engineers and scientists. Robert G. Dean and Robert A. Dalrymple. Advanced series on Ocean Engineering. 1.992.
- Nearshore dynamics and coastal processes. Theory, measurement and predictive Models. Horikawa, K. University of Tokyo Press. 1.988.
- Coastal Engineering Manual. Part II. Coastal Hydrodynamics. 2006

- **Learning outcomes of the Module**

Understanding the offshore environmental conditions
Energy resource, characterization: Waves, currents, wind-waves joint probability, long term descriptions

Title: **STRUCTURAL DESIGN (8 credits)**

Module 02
Prof : V. NEGRO

➢ **Objectives**

- Understanding site assessment, including dynamics of floating offshore structures, their mooring and their analysis.
- Understanding the design of foundations of fixed OWT, including the comprehension of the structural design principles, integrated design, material technologies, cathodic protection principles and the Certification Process.
- Gaining the knowledge about new technologies: floating support structures, and marine energy converters

➢ **Contents**

- Site Assestment
  - Offshore dynamics
  - Geotechnical engineering

- Design
  - Foundations: fixed structures
  - Structural design principles (FEA)
  - Integrated design
  - Material technologies
  - Cathodic protection systems
  - Certification process

- New technologies. Floating wind turbines
  - Floating wind turbines
  - Design methodologies for floating wind turbines
  - Mooring systems
  - Engineering singularities of floating wind turbines
  - Marine energy converters: TECs, WECs, and OTECs

Exam modules 1 and 2 (2 hours)

➢ **Academic staff**

Vicente Negro Valdecantos, Module coordinator
José Santos López Gutiérrez / Dolores Esteban Pérez / Mario de Vicente / Juan Carlos Suárez Bermejo / Paz Pinilla Cea / Rodrigo Pérez Fernández / Pedro Soria Ruiz / Luis Pérez Rojas / Ignacio González Tejada / Antonio Souto Iglesias

➢ **Bibliography**

- Technical standards and recommendations: BSH, DNVGL, IEC, Puertos del Estado,
- Burton, T., Sharpe, D., Jenkins, N., Bossanyi, E., 2001. Wind energy handbook. Technical book. Ed. Wiley.
- Cruz, J., 2008. Ocean wave energy, current status and future perspectives. Technical book. Ed. Springer.
- Kaiser, M.J., Snyder, B.F., 2012. Offshore wind energy cost modeling, Installation and decommissioning. Technical book. Ed. Springer.
- OTEO, 2014. Offshore Renewable Energy current status-future perspectives for Portugal. Technical book. Ed. INEGI.

- F., 2015. Gravity based support structures for offshore wind turbine generators: Review of the installation process. Ocean Engineering, 110-A, 281-291.
- Negro, V., López-Gutiérrez, J.S., Esteban, M.D., Alberdi, P., Imaz, M., Serraclara, J.M., 2017. Monopiles in offshore wind: preliminary estimate of main dimensions. Ocean Engineering, 133, 253-261
- USACE. Coastal Engineering Manual.
- USACE. Shore Protection Manual.
- Chella, M.A., Tørum, A., Myrhaug, D., 2012. An Overview of Wave Impact Forces on Offshore Wind Turbine Substructures. Energy Procedia 20, 217-226.

- **Learning outcomes of the Module**
  - To get the ability to select the foundation typology that fit best for the purpose
  - To outline the structural design process
  - To be capable of developing a structural model and run the different analysis that can be required during the design of an offshore structure
  - To be capable of defining the material that suits best for any situation
  - To properly assess the corrosion impact for the full design life of the structure and define the cathodic protection system
  - To state the significance of a correct and consistent definition of the framework from the start of the project
  - To be capable of defining the different methods for building the soil pile interaction models that can be accessed in technical literature and design standards.

Title: **ELECTRIC GENERATION AND EXPORT TECHNOLOGIES (5.5 credits)**

Module 03
Prof : E. TREMPS

➢ **Objectives**

- To have a global vision of different Power Take Off (PTO) types
- To identify the basic model for blades power conversion
- To understand the complete WTG's design process. This part will cover from the aero-servo-hidroelastic calculations for obtaining the load assessment to the dimensioning parameters for the main WTG components
- To present a general model of annual energy estimation
- To understand the operation and behavior of different types of generators and their connection to grid
- To understand of operation aspects related to active and reactive power control
- Knowledge about typologies and technologies of array and export cables
- To analyze the diverse possibilities of using the hydrogen produced from marine renewables

➢ **Contents**

- Offshore energy converters
  - Status of development, technologies, trends.
  - Fluid Mechanics of Blades. Design methodologies.
  - Structural aspects of Blades. Analysis models.
  - Gear Box, Brakes and Supports.
  - Generators (mechanical aspects)
  - Control Actuators (mechanical)
  - Wave Converters PTO's
  - Wind and TEC PTO's
  - Control and Dynamic Behaviour
  - Produced Energy

- Grid Technology

  - PTO electrical components and Elements
  - Offshore substations
  - Offshore Converters
  - Operation aspects
  - Array Cables
  - Export Cables
  - Grid connection to Shore

- Advanced storage offshore technologies
  - Hydrogen generation offshore
  - Uses of stored hydrogen
  - Floating Photovoltaic Systems

Exam module 3 (2 hours)

➢ **Academic staff**

Enrique Tremps Guerra, Module coordinator

Juan de Dios López Leiva / Pedro Soria / José Andrés Somolinos / Alfonso Martínez / Juan Miguel Pérez de Andrés / Sergio Martínez / Rosa María de Castro / Teresa Leo Mena / Jorge Barredo López

➢ **Bibliography**

- *Electricity from Wave and Tide. Paul A. Lynn. Wiley (2014)*
- *Wind Turbine Control Systems. Fernando D. Bianchi, Hernán De Battista and Ricardo J. Mantz. Springer (2007)*
- *Onshore and Offshore Wind Energy*. Paul A. Lynn. Wiley (2012)
- *Biblioteca sobre Ingeniería Energética*. Pedro Fernández Díez. http://es.pfernandezdiez.es/
- *Modelado Energético de Convertidores Primarios para el Aprovechamiento de las Energías Renovables Marinas*. Amable López P. et al. Revista Iberoamericana de Automática e Informática industrial Vol.2 2014. www.elsevier.es/RIAI.
- *Methodologies for Tidal Energy Converters Evaluation Early Project Phases*. L.R. Núñez et al. 1st International Conference on Renewable Energies Offshore RENEW'14. Lisbon 2014
- T. Burton, N. Jenkins, D. Sharpe, E. Bossanyi. *Wind Energy Handbook*
- IEC 61400-1 Ed3. *Design Requirements*
- IEC 61400-3, Ed1. *Design Requirements for Offshore Wind Turbines*
- DNV-OS-J101. *Design of Offshore Wind Turbines*
- GL2010. *Guideline for the Certification of Wind Turbines*
- *Electric Machinery Fundamentals*. Stephen J. Chapman. McGraw Hill (2012)
- *Induction Machines Design Handbook*. Ion Boldea, Syed A. Nasar. CRC Press (2010)
- *Synchronous Generators*. Ion Boldea. CRC Press (2016)
- Stolten D (editor), Samsun R C (editor), Garland N (editor), *Fuel Cells: Data, Facts and Figures,*
- Wiley, 2016.
- Godula-Jopek A (editor), *Hydrogen Production: by Electrolysis*, Wiley-VCH, 2015.

➢ **Learning outcomes of the Module**

- To be capable to make a basic design of rotor and PTO, related with the site characteristics obtaining the energy produced and optimizing the main parameters
- To be capable of developing a structural model and run the different analysis that can be required during the design of the rotor of a OWT
- To be capable of defining the material that suits best for any situation
- To know the similarities and differences of OWT devices with that harness energy from sea waves and currents.
- To know the possibilities of using the hydrogen as energy vector, for storage or transport

Title: **MANUFACTURING AND MARINE OPERATIONS (7 credits)**

Module 04
Prof : J. DOMÍNGUEZ

➢ **Objectives**

- Understanding the offshore fabrication techniques, relevance of interfaces and all activities for sail away.
- Knowledge of marine vessels and ability to select the most appropriate offshore vessels set. Ability to define the most suitable transport and installation strategies.
- Understanding the figures involved in granting permits for marine operations and decision-making procedures under HES criteria.
- Understanding of the construction phases happening offshore

➢ **Contents**

- Fabrication
  - Manufacturing strategies
  - Load-Out
  - Marine vessel deployment
  - Vessel typologies spectrum
  - Transport and installation operational requirements
- Marine operations
  - Marine warranty surveyor
  - Harbour logistics
  - Transport operations
  - Installation operations
  - Complementary installation strategies
  - Submarine cable laying
  - Commissioning
  - Offshore logistics
  - Health & safety
  - Environment
- Operation and Maintenance
  - Maintenance
  - Marine logistics for O&M
  - Assets operation. Operational tools

Exam module 4 (2 hours)

➢ **Academic staff**

Jaime Domínguez Soto, Module coordinator
Pablo Gómez Alonso / Vicente Negro Valdecantos / José Santos López Gutiérrez / Dolores Esteban Pérez / Enrique de Faragó Botella / Jose Manuel García Muniña / Jonay Cruz Fernández / Manuel Aguinaga Arena / Juan Luis Paredes

➢ **Bibliography**

- Construction of Marine and Offshore Structures - Ben C. Gerwick
- API Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – API RP 2A
- DNVGL-OS-C401 Fabrication and Testing of Offshore Structures
- DNVGL-ST-N001 Marine operations and marine warranty
- DNVGL RP-J301 Subsea Power Cables in Shallow Water Renewable Energy Applications

➢ **Learning outcomes of the Module**

- Understanding the load-out operation from the impact on design and fabrication to the load-out sequence and the benefits of feedback engineering-fabrication
- Understanding of the operation requirements for marine operations to define the vessels for best selection for each marine operation and for the future for the renewable business
- Understanding the certification process that rules the marine operation authorization
- Understanding the characteristics of the marine transportation to select the most suitable transport means and port selection
- Understanding the different phases involved in the installation process and new challenges ahead accounting for deeper and heavier structures
- Knowledge on the characteristics of the logistics required to support the offshore commissioning activities and personnel offshore
- Understanding of the paramount importance of the H&S concept, specific training and countries regulations to reduce risks during execution and operation of the platforms
- Understanding of the environmental impact and mitigation measures of the installation and maintenance works
- Understanding of the different maintenance strategies and the resources to be mobilized in the different maintenance typologies. Risk attenuation, insurances
- Understanding of the mutual influence between the ship design and the selected maintenance strategy

Title: **PROJECT OPERATION AND MANAGEMENT (8 credits)**

Module 05
Prof : S. FERNÁNDEZ

➢ **Objectives**

- Sound knowledge of the political, economic and technological drivers guiding the development of the MRE (Marine Renewable Energy)
- Full comprehension of the different phases of a MRE Project and the specific characteristics of each one of them: Development, Permits, Construction and Operation and its financial inputs and outputs
- Knowledge of the different approaches to develop, build and operate a MRE project. Cost structure of the project and differences among the different possibilities.
- Sound knowledge of the building up of a MRE Project business case and the different possibilities for its financing.
- Robust knowledge of the different approaches to monetize risks. Contingency concept and valuation.
- Understanding of the main risks arising during the different development phases of a RME Project. Classification, evaluation and mitigation of these risks. Contingency management.

➢ **Contents**

- Financial Principles
  - Development phases of a Power Production Project. Specific case of an OWF. Development, Permits, Construction and O&M. FID Milestone.
  - Environmental & socio-economic impact of the MRE
  - Economic remuneration to the marine energy projects. Regulation in Germany, UK and France. Status in Spain.
  - Cost structure of a Renewable Marine Energy Project. Turn Key Projects vs. Package Split. Packages splitting levels and needs for owner's resources.
  - Valuation of an Energy Project. IRR/VNA/WACC. The business plan.
  - Project financing modalities. Non-recourse financing: "Project Finance".
  - Principles of risk assessment. Concept of contingency.

- Contract assessment
  - Detailed assessment of the business plan. Incomes and costs of he business plan of a OWF
  - Risk assessment. Contingency evaluation methodologies.
  - Cotract suites. FIDIC, LOGIC and others
  - Basic notions on insurances
  - Consolidation of the business plan to take the FID.

Exam module 5 (2 hours)

➢ **Academic staff**

Salvador Fernández Uranga, Module coordinator
Jose Ignacio González Iglesias / Laura Rol Rúa / Jose Luis Morán González / Ricardo Izquierdo Labella / Pedro Fernández Viñuelas / Julio de la Jara / Álvaro Martínez Palacio

➢ **Bibliography**

- FIDIC. A guide for practitioners. Axel-Volkmar Jaeger & Dr. Götz-Sebastian Hök. Springer-Verlag Berlin Heidelberg 2010
- Financing Large Projects: Using Project Finance Techniques and Practices M. Fouzul Kabir Khan y Robert J. Parra. Prentice Hall College Div 2007 Random
- East Anglia ONE Offshore Windfarm. 500MW – 600MW Project. Supply Chain Plan. Available in www.gov.uk
- Estimating Project Cost Contingency-A model and exploration of research questions. David Baccarini-2004
- A decision support tool for the Risk Management of offshore Wind Energy Projects-2013
- Project Definition Rating Index PDRI RR113-11 CII-1996
- Project Risk Analysis and Management. The association for Project Management
- A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fifth Edition
- Specification for Invitation to Tender No. 2011/S 126-208873 relating to offshore power generation wind installations in Metropolitan France. Available in French in www.cre.es
- Construction Contract 1st Ed (1999 Red Book), and Plant and Design-Built Contract 1st Ed (1999 Yellow Book). International Federation of Consulting Engineers.
- BIMCO Time Charter Party for Offshore Service Vessels. Baltic and International Maritime Council
- LOGIC. General Conditions of Contract (including Guidance Notes) for Services (On- and Off-shore)
- A review of regulatory framework for wind energy in European Union countries: Current state and expected development.
- Javier Serrano González, Roberto Lacal-Arántegui
- European Commission, Joint Research Centre, Institute for Energy and Transport, Westerduinweg 3, NL-1755 LE Petten, The Netherlands
- Available in http://ac.els-cdn.com/S1364032115013581/1-s2.0-S1364032115013581-main.pdf?_tid=51057716-67e9-11e7-ba13-00000aacb360&acdnat=1499963924_83fecf7eb89141221c9143ba5231d533
- Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources. Available in: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016PC0767R%2801%29

➢ **Learning outcomes of the Module**

- Comprehension by the students of the phases of an ERM Project, with specific understanding of the main drivers in each stage.
- The student will acquire knowledge about the possible interactions with the environment and society during the processes of development, construction and operation of the plant and the measures taken to manage them.
- The student will have a wide comprehension of the different regulatory models applied to the RME in the European countries where these energies are being developed. Restrictions caused by the need of local content in the Supply Chain.
- The student will acquire knowledge about the costs in a RME Project. Both direct costs as the acquisition of the supplies and services needed for the construction and operation of the facility, as the indirect costs with a commercial or financial character, as insurances or financing.
- The student will acquire a sound knowledge of the concepts used in projects valuation and the final investment decision. Energy indicators and concept of business case, application to an OWF project.
- The way in which a project is financed has influence in all areas of the project, managerial, technical and economical. Therefore, the student has to have knowledge of the different possibilities to finance a project, especially the possibility to finance it without recourse to the shareholders. Differences with rest of possible financing models, effects on the final costs and financial results. Banking conditioning

Title: **STRUCTURAL ANALYSIS OF OFFSHORE PLATFORMS (4 credits)**

Module 06
Prof : M.A. HERREROS

➢ Objectives

- Preparation of a Finite Element model of a foundation and integration with tower & WTG models
- Preparing the analysis: site description, load case definition and creating the load environment in the FEM.
- Running the FEM analysis and assessment of results
- Sizing the model for the test on a basin.
- Selection of the load conditions and site constraints
- Being able to perform results comparison between numerical models and experiments

➢ Contents

- Full-Structural Design of a substructure for a WTG
  - Case study: jacket, monopile, by modelling with ANSYS.
  - Building the model and applying constraints
  - Definition of a specific site and building the design load cases
  - Sequential analysis: tower & WTG with foundation
- Testing an offshore foundation on basin
  - Definition of model for test basin
  - Preparing the model for testing and load conditions
  - Test result comparison test basin vs. Software modelling

➢ Academic staff

Miguel Ángel Herreros, Module coordinator
Mario de Vicente / Luis Pérez Rojas / Antonio Souto / Ricardo Zamora

➢ Bibliography

- E. Oñate: Cálculo de estructuras por el método de los elementos finitos. 1-análisis estático lineal, 2- análisis no lineal, CIMNE, 1992.
- Zienkiewicz O. O.: The finite element method, mcgraw-hill, 1989.
- Bathe, K. J.: Finite element procedures. 2nd ed. klaus-jürgen bathe, 2014.
- Offshore Structures: Design, Construction and Maintenance By Mohamed El-Reedy. Gulf Pub. Co., Book Division. ISBN: 978-0-12-385475-9
- Introduction to offshore structures: design, fabrication, installation. William J. Graff. Gulf Pub. Co., Book Division.
- Essentials of Offshore Structures: Framed and Gravity Platforms. D.V. Reddy, A. S. J. Swamidas. CRC Press.
- Offshore Wind Power. Edited by John Twidell and Gaetano Gaudiosi. Multi-Science.
- WEB resources. “Ocean Wave Interaction with Ships and Offshore Energy Systems” http://ocw.mit.edu/courses/mechanical-engineering/2-24-ocean-wave-interaction-with-ships-and-offshore-energy-systems-13-022-spring-2002/ at MIT-OPEN-COURSE-WARE®
- NREL – National Renewable energy Laboratory. NREL Publications Database
- /http://www.nrel.gov/publications/
- Chopra A.: Dynamics of structures. Theory and applications. Edited by Prentice Hall, 2000 ISBN: 0130869732

➢ **Learning outcomes of the Module**

- Ability to perform a numerical model analysis and sizing a WTG structure
- Ability to assess the equivalent model for test basin
- Ability to build the equivalent design load cases for test basin
- Understanding of differences between numerical modelling and testing on a basin, and obtaining conclusions

Title: **DEVELOPMENT OF THE ELECTRICAL NETWORK (4 credits)**

Module 07
Prof : S. MARTÍNEZ

➢ Objectives

- Concepts of ambient turbulence and wake turbulence
- IEC standard
- Use of a CFD code for wake calculations
- Components and types of substations
- Wind turbine substations
- AC and DC off-shore substations
- Transmission alternatives from the off-shore
- Models for wind farm elements and control strategies

➢ Contents

- Wind farm layout
  - Ambient turbulence and wake turbulence
  - Global turbulence. IEC standard
  - CFD for wake calculations
- Off-shore electrical substations
  - Components and types
  - Wind turbine substations
  - AC and DC off-shore substations
- Transmission of electrical energy to shore
  - Transmission alternatives
  - Case study
- Wind farm control and connection to the grid
  - Modelling and control of wind farms
  - Case study

➢ Academic staff

Sergio Martínez González, Module coordinator
Emilio Migoya / Carlos Platero / Luis Fernández

➢ Learning outcomes of the Module

- Understanding of ambient turbulence, wake turbulence and their combined effect
- Ability to classify wind turbines depending on the global turbulence
- Knowledge of components, types and basic schemes of substations
- Knowledge of characteristics, diagrams and cabinets of wind turbine substations
- Knowledge of characteristics, diagrams and equipment of off-shore substations
- Understanding of transmission alternatives and factors affecting selection
- Ability to use computational tools for analysis of alternatives
- Ability to model a wind farm grid and to understand control strategies
- Ability to use computational tools for modeling and control analysis

Title: **PROJECT DEVELOPMENT OF AN OFFSHORE POWER PLANT (7,5 credits)**

Module 08
Prof : D. PALACÍN

➢ **Objectives**

- Understanding of all national and international authorities involved, their applicable regulations and get an overview of the process in the most offshore wind supportive countries.
- Understanding the different approaches in terms of contracting strategies to follow, concepts of EPCI, BOP, multi-contract, etc.
- Understanding of what a Development Consent Order is, and its implications along the project execution.
- Understanding of the different phases of the project, (FEED, conceptual design, basic/detail design, design certification, procurement, construction (onshore+ offshore site installations), commissioning, O&M, de-comissioning).
- Understanding of the main stakeholders involved in an offshore contract and its role
- Understanding on how the interfaces have to be managed in conjunction with the contracting strategy
- Understanding of the typical claims associated to the offshore works.
- Understanding of the specific considerations related to the Grid connection assets, their ownership, the different build approaches and the process of transfer of ownership.

➢ **Contents**

- Offshore Wind Farm Projects Overview
  - OWF Project Engineering process
  - OWF Project Management
  - OWF Project Health and Safety Management

- Pre-FID (Final Investment Decision)
  - Pre-FID Activities
    - Consenting Process
    - Contracting strategies
    - Tender Process

- Post-FID
  - Preliminary activities
    - DCO
    - Resources
    - Programme
  - Project Management
    - Progress Indicators
    - Cost Control
    - Interface management
    - Risk Management during project execution
  - Contract Management
    - Particularities of an offshore contract and typical accepted figures
    - WDT
    - MWS
    - Soil risk

- LDs
- Liaison between Tier 1 Contractors
- Installation Windows
- Claims management

- Operations Management
  - Management of the Operation and maintenance site
  - Operational tools
  - Mid and long term O&M strategies

- Grid Connection considerations
  - Grid and OFTO Considerations in UK, Germany, etc.
  - OFTO Transfer process

- Offshore Wind Sector Overview
  - Offshore Main Stakeholders
  - Renewables share targets
  - Subsidies Regimes and Cost Reduction targets
  - Local content Policies

➢ **Academic staff**

Diego Palacín Sotillo, Module coordinator
Antonio Crucelaegui / Javier Osorio / Pedro Fernández / Manuel Aguinaga

➢ **Bibliography**

- FIDIC Yellow book model
- NEC3 contract model
- LOGIC Contract model
- Rest of bibliography to be delivered before the beginning of the module's lectures.

➢ **Learning outcomes of the Module**

- To understand the set of studies, data , surveys and reports which all integrated makes up the basis of main inputs for the for the Project Design Basis
- To understand the different design process of an OWF
- To understand the integration of the design activities within the rest of budgeting, financing and tendering activities.
- To understand the fundamentals of the management of a project form early dseign phase to construction and commisisoning.
- To understand the fundmentals of H&S in a project from hazard identification and risk assessment to risk management and mitigations.
- To understand the set of studies, data , surveys and reports which all integrated makes up the basis of main inputs for the Final Investment Decision.
- To understand the need of resources, the time and cost implication of these activities.
- To understand the mechanisms for Tender launching, feedback from/to Tenderers/Design Office, Bids Evaluation, homogeneization criteria, etc.
- To understand a Typical Org. Chart and the key positions.

- Know the tools for progress controls, input and output information
- To understand how the the overall project cost and specific pakages costs are controlled, OFO considerations
- To identify the cross-package policies to be applied on the differnet packages
- To have an overview of the typical claims and variations in an offshore project.
- To understand how the windows are determined, forecasted, cost and time implications.