ARAB ACADEMY FOR SCIENCE, TECHNOLOGY
AND MARITIME TRANSPORT

COLLEGE OF ENGINEERING
AND TECHNOLOGY

(GRADUATE STUDIES)

Master of Science Programs

STATUS REPORT

ALEXANDRIA

2012

MARINE ENGINEERING

M.SC. PROGRAMS

M.Sc. in Marine Engineering

OVERVIEW

Marine and offshore engineers play a major role in ship design, operation, inspection and maintenance as well as offshore oil and gas platform design, operation, inspection and maintenance.

The department qualifies the students in areas such as drilling technology, oil and gas production, offshore oil and gas pipelines, underwater technology, safety and reliability of ships and offshore structures.

Graduates of the department often find careers in the shipping and offshore petroleum industries either as designer inspectors or operating engineers.

Many marine engineers pursue positions in management, while others prefer a career along technical and professional lines.

Program Detailed Structure

M.SC. PROGRAMS

M.Sc. in Marine Engineering

CORE COURSES:

Course Code	Course Title	Credit Hours
ME 755	Advanced Computational Methods	3
MM 740	Advanced Structural Analysis	3
MM 744	Advanced Marine Hydrodynamics 1	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

MARINE ENGINEERING DIVISION

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
MM 711	Vibration and Noise Control	3
MM 713	Advanced Marine Engineering	3
MM 721	Marine Propulsion Systems	3
MM 723	Marine Renewable Energy	3
MM 741	Ship Outfitting	3
MM 745	Ship Maintenance and Repair	3
MM 746	Ship Production Technology	3
MM 750	Dynamics of Marine Vehicles	3
MM 751	Advanced Marine Hydrodynamics 2	3
MM 752	Advanced Marine Materials	3
MM 753	Advanced Marine Vehicles	3
MM 754	Advanced Underwater Technology	3
MM 755	Marine Pollution: Prevention and Control	3
MM 756	Marine Statutory Regulations	3
MM 777	Marine and Offshore Safety	3
MM 778	Marine Operations	3
Subtotal	**5 Courses * 3 Credit Hours**	**15**

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OFFSHORE ENGINEERING DIVISION

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
MM 711	Vibration and Noise Control	3
MM 713	Advanced Marine Engineering	3
MM 723	Marine Renewable Energy	3
MM 751	Advanced Marine Hydrodynamics 2	3
MM 752	Advanced Marine Materials	3
MM 754	Advanced Underwater Technology	3
MM 755	Marine Pollution: Prevention and Control	3
MM 756	Marine Statutory Regulations	3
MM 757	Production of Offshore Structures	3
MM 771	Hydromechanics of Offshore Structures	3
MM 772	Structural Design of Offshore Structures	3
MM 773	Offshore Drilling Technology	3
MM 774	Maintenance of Offshore Structures	3
MM 775	Subsea Pipelines	3
MM 776	Oil and Gas Production Technology	3
MM 777	Marine and Offshore Safety	3
MM 778	Marine Operations	3
Subtotal	**5 Courses * 3 Credit Hours**	**15**

RESEARCH THESIS:

Course Code	Course Title	Credit Hours
MM 701	Master's Research Thesis (Part 1)	6
MM 702	Master's Research Thesis (Part 2)	6
Subtotal	**2 Parts * 6 Credit Hours**	**12**

Total	**36**

Courses

DETAILED STRUCTURE

Course Code : **ME 755**

Course Title : **Advanced Computational Methods**

Credit Hours : **3**

Course Description

Error analysis. Solution of non-linear algebraic equations. Curve fitting. Numerical integration. Numerical solution of ordinary differential equations (odes) for the initial value problem. Solution of systems of odes. The stiff odes. The solution of the boundary value problem using the linear shooting, finite difference, and non-linear shooting methods. Applications to Mechanical, and Marine system design. The finite difference approximation. Numerical solution of partial differential equations (PDEs) using the finite difference method. Applications on elliptic, parabolic, and hyperbolic PDEs. Direct and iterative methods of solution. Solution of PDEs using the finite element method. Applications to problems in fluid mechanics, elastic deformation of solid elements, and stress analysis. Case studies using the MATLAB programming and available software and modules.

Course Objectives

The student should be able to master the approximation techniques used in numerical solutions and types of errors and achieve hands on experience to successfully implement numerical methods in engineering.

Course Topics

- Error analysis
- Solution of non-linear algebraic equations
- Curve fitting
- Numerical integration - Numerical solution of ODE's
- The solution of the boundary value problem using the linear shooting, finite difference, and non-linear shooting methods
- Applications to Mechanical, and Marine system design
- The finite difference approximation
- Direct and iterative methods of solution

References

- Anderson J. D. "*Computational Fluid Dynamics: The Basics with Applications*", McGraw Hill, 1995
- Nakamura S. "*Numerical Analysis and Graphic Visualization with MATLAB*", Prentice Hall, 1996
- Burden F. "*Numerical Methods*", PWS Pub. Co., 1997
- Ferziger J. H., "*Numerical Methods for Engineering Applications*", John Wiley
- Coombes K. R., "*Differential Equations with MATLAB*", John Wiley, 2000

Course Code : MM 711

Course Title : Vibration and Noise Control

Credit Hours : 3

Course Description

Introduction. Free vibration of single-degree of freedom systems. Harmonic excitation of single degree of freedom systems. Response of non harmonic excitation. Continuous systems. Multi-degree of freedom systems. Applications to ships and marine structures. Typical vibration problems and remedies. Vibration control. Acoustic concepts. Noise control. Machinery noise.

Course Objectives

The student should be able to:

- Present a comprehensive coverage of the fundamental principles of vibration theory, with emphasis on the application of theses principles to practical engineering problems
- Develop the ability of the student to estimate the frequencies of marine structures using advanced and approximate methods and to study means of noise control
- Facilitate the comparison of theoretical and experimental results and to help carrying out further studies to control noise and vibration

Course Topics

- Introduction
- Free vibration of single-degree of freedom systems
- Harmonic excitation of single degree of freedom systems
- Response of non harmonic excitation
- Continuous systems
- Multi-degree of freedom systems
- Applications to ships and marine structures
- Typical vibration problems and remedies
- Vibration control
- Acoustic concepts
- Noise control

References

- Singiresu S. Rao, "*Mechanical Vibrations*", Addison Wesley, 1995.
- William T. Thomson, "*Theory of Vibration with Applications*", Prentice Hall, 1993.
- Eric Tupper, "*Introduction to Naval Architecture*", Butterworth, Heinemann.
- "*Ship Design and Construction*", Published by SNAME, 1980.
- "*Principles of Naval Architecture*" SNAME

Course Code : MM 713

Course Title : Advanced Marine Engineering

Credit Hours : 3

Course Description

Advanced technology for construction, operation and surveying of equipment and systems onboard ships. International regulations for Marine Engineering. Marine environment. Pollution. Ballast water, management, sea trials.

Course Objectives

The student should become acquainted with:

- Advanced technology of Marine Engineering equipment and engine room systems

Course Topics

- Advanced technology for construction, operation and surveying of equipment and systems onboard ships
- International regulations for Marine Engineering
- Marine environment
- Pollution
- Ballast water, management, sea trials

References

- Marine Institute publications.
- IMO regulations and publications.

Course Code : **MM 721**

Course Title : **Marine Propulsion Systems**

Credit Hours : **3**

Course Description

Early development of the screw propeller. Modern propulsion systems, The propeller environment, The wake field. Propeller performance characteristics. Theoretical methods. Propeller theory. Cavitations. Propeller noise. Propeller – ship interaction. Thrust augmentation devices. Transverse and azimuthing thrusters. Water jet propulsion. Propeller design. Operational problems.

Course Objectives

The student should become acquainted with:

- Different marine propulsion systems
- Modern propulsions
- Propulsion of advanced marine vehicles
- Use of thrusters in dynamic positioning systems

Course Topics

- Early development of the screw propeller
- Modern propulsion systems, The propeller environment, The wake field
- Propeller performance characteristics
- Theoretical methods
- Propeller theory
- Cavitations
- Propeller noise
- Propeller – ship interaction
- Thrust augmentation devices
- Transverse and azimuthing thrusters
- Water jet propulsion
- Operational problems

References

- J. S. Carlton, "*Marine propellers and Propulsion*", Butter worth- Heinmann Ltd 1994
- Taggart, "*Marine Propulsion: Principles and Evolution*", Gulf Publishing Company 1969
- *Principles of Naval Architecture*, SNAME

Course Code : MM 723

Course Title : Marine Renewable Energy

Credit Hours : 3

Course Description

New wind, wave and tidal technology, renewable energy systems, offshore wind characteristics, wind turbines types and performance predictions, offshore wind energy farms, wave energy systems, marine spatial planning, environmental protection, sustainable development, project management and integration, economics and viability, installation, maintenance and subsea operations, transport / lift vessels and associated support infrastructure, regulations, licensing and future directions for development.

Course Objectives

The student should be able to:

- Have appreciation for offshore renewable sources
- Have better understanding for environment energy related issues and the associated increasing global awareness
- Become exposed to some existing worldwide offshore renewable energy projects
- Design and study the performance of offshore energy project

Course Topics

- New wind, wave and tidal technology
- Renewable energy systems
- Offshore wind characteristics
- Wind turbines types and performance predictions
- Offshore wind energy farms
- Wave energy systems
- Marine spatial planning
- Environmental protection, sustainable development
- Project management and integration
- Economics and viability
- Installation, maintenance and subsea operations
- Regulations, licensing and future directions for development

References

- Lecture Notes

Course Code : **MM 740**

Course Title : **Advanced Structural Analysis**

Credit Hours : **3**

Course Description

Rationally based structural design. Basic aspects of structural design. Structural safety. Probabilistic design methods. Loads. Response. Limit states. Optimization techniques. Statistical and dynamic aspects of wave. Loads. Matrix stiffness analysis. Application to frames and grillages. Basic aspects of the finite element method. Plate bending. Small deflection theory. Large deflection theory. Buckling and ultimate strength of columns. Buckling and ultimate strength of plates. Applications using commercial software packages.

Course Objectives

The student should be able to:

- Cover the calculations of various loads acting on a ship during service as well as to calculate the stresses induced in ship's structure
- Design and calculate the scantlings of different structural elements in ship's structure to check its structural safety

Course Topics

- Rationally based structural design
- Basic aspects of structural design - Structural safety
- Probabilistic design methods
- Loads, Response, Limit states
- Optimization techniques
- Statistical and dynamic aspects of wave loads
- Matrix stiffness analysis
- Application to frames and grillages
- Basic aspects of the finite element method
- Plate bending
- Large deflection theory
- Buckling and ultimate strength of columns
- Buckling and ultimate strength of plates
- Applications using commercial software packages

References

- *Ship Structural Design – Rationally–based Approach*
- *Principle of Naval Architecture* (SNAME)
- Paik, J. K, Thayamballi, A. K. "*Ultimate Limit State Design of Steel-Plated Structure*".
- Offshore Technology Conference, *Proceedings*
- Lecture Notes

Course Code : **MM 741**

Course Title : **Ship Outfitting**

Credit Hours : **3**

Course Description

Outfitting systems. Shipboard piping systems. Mooring systems. Anchoring systems. Cargo- handling equipment. Steering systems. Accommodation. Pollution prevention. Classification societies requirements.

Course Objectives

The student should be able to:

- Explain the different outfitting systems onboard a ship and their functions
- Cover the design, construction and testing of such systems
- Choose, design and test different outfitting systems for a particular ship

Course Topics

- Outfitting systems
- Shipboard piping systems
- Mooring systems
- Anchoring systems
- Cargo- handling equipment
- Steering systems
- Accommodation
- Pollution prevention
- Classification societies requirements

References

- Jackson L. and Morton T.D., "*General Knowledge for Marine Engineers*"
- Taylor D.A., "*Introduction to Marine Engineers*"
- SNAME, "*Principles and Naval Architecture*", vol. III published.
- Eyres, D.J., "*Ship Construction, Heinemann Professional Publishing*", Ltd, 1988.

Course Code : **MM 744**

Course Title : **Advanced Marine Hydrodynamics 1**

Credit Hours : **3**

Course Description

Review of vector algebra. Derivations of basic flow equations. Potential flow. Viscous flows. Laminar and turbulent flows. Laminar and turbulent boundary layer theory. Marine Applications.

Course Objectives

The student should be able to:

- Apply basic flow governing equations to model and or solve problems pertaining to flow past floating and immersed bodies
- Use modern techniques and models to predict some real flow aspects

Course Topics

- Review of vector algebra
- Derivations of basic flow equations
- Potential flow
- Viscous flows
- Laminar and turbulent flows
- Laminar and turbulent boundary layer theory
- Marine applications

References

- Hermann Schlichting, "*Boundary Layer Theory*", 8th Edition, Springer Verlag, Berlin
- Frank M. White, "*Viscous Fluid Flow*", 3rd Edition, McGraw Hill, Science/ Engineering / Math, 2005
- J.A. Schetz, "*Boundary Layer Analysis*", Prentice Hall

Course Code : **MM 745**

Course Title : **Ship Maintenance and Repair**

Credit Hours : **3**

Course Description

Ship docking and types of docks. Repair of metal hulls. Repair of ships: methods, structure and machinery parts. Types of maintenance. Ship's surveys. Classification societies. Quality assurance. Strength after Repair.

Course Objectives

The student should be able to:

- Schedule and assess the maintenance planning programs of ships
- Meet the standards of Classification Societies
- Be aware of quality assurance concepts

Course Topics

- Ship docking and types of docks
- Repair of metal hulls
- Repair of ships: methods, structure and machinery parts
- Types of maintenance
- Ship's surveys
- Classification societies
- Quality assurance
- Strength after repair

References

- S. Shields, "*Ship Maintenance: A Quantitative Approach*".
- Oleg Leizerson, "*Ship Repair Practice*", Mir Publishers.
- *Safety and Health in Shipbuilding and Ship Repairing*, International Labor Office Geneva.
- Jackson, L. and T.D. Morton "*General Knowledge for Marine Engineers*".
- Thomas Walton, "*Steel Ships, their Construction and Maintenance*".

Course Code : **MM 746**

Course Title : **Ship Production Technology**

Credit Hours : **3**

Course Description

Ship's order. Ship building processes. Advanced welding techniques. Berth. Dry and floating docks. Operation systems. Quay and sea trials. Ship delivery. Classification Societies. Quality assurance in shipbuilding. Ship's Building Contract. Shipyard Site and arrangement.

Course Objectives

The student should become acquainted with:

- Various shipbuilding processes and the new trends
- Production and operation techniques
- Standards of Classification Societies
- Quality assurance concepts

Course Topics

- Ship's order
- Ship building processes
- Advanced welding techniques
- Berth
- Dry and floating docks
- Operation systems
- Quay and sea trials
- Ship delivery
- Classification societies
- Quality assurance in shipbuilding
- Ship's Building Contract

References

- Eyres, D.J. "*Ship Construction*" Heinemann Professional Publishing. 1988.
- Walton, T. "*Steel Ships*", Griffin, London.
- "*Merchant Ship Design*".

Course Code : MM 750

Course Title : Dynamics of Marine Vehicles

Credit Hours : 3

Course Description

Introduction, simple harmonic motion, sinusoidal water waves, uncoupled heaving, pitching, and rolling motions, irregular seaway, motions in irregular seaway, Dynamic effects, motions in three dimensional irregular seaway, coupled heaving, and pitching motions, nonlinear rolling motions (uncoupled), powering in a seaway, loads due to motion, wave loads, motion stabilization, model tests, full scale trials, and scale effects, seakeeping considerations in design, seakeeping of advanced marine vehicles

Course Objectives

The student should become acquainted with:

- Different ship motions and the associated couplings
- Ship motion in regular and irregular seaway
- Seakeeping qualities of marine vehicles

Course Topics

- Introduction
- Simple harmonic motion
- Sinusoidal water waves
- Uncoupled heaving, pitching, and rolling motions
- Irregular seaway, motions in irregular seaway
- Dynamic effects
- Motions in three dimensional irregular seaway
- Coupled heaving and pitching motions
- Nonlinear rolling motions (uncoupled)
- Powering in a seaway
- Loads due to motion
- Model tests, full scale trials, and scale effects
- Seakeeping considerations in design
- Seakeeping of advanced marine vehicles

References

- A. Lloyd "*Seakeeping, Ship Behavior in Rough Weather*"
- R. Bhattacharyya "*Dynamics of Marine Vehicles*".
- "*Principles of Naval Architecture*", SNAME, vol. III

Course Code : **MM 751**

Course Title : **Advanced Marine Hydrodynamics 2**

Credit Hours : **3**

Course Description

Ship resistance. Dimensional analysis. Frictional resistance. Residuary resistance, Wave making resistance, Form resistance, Two and three dimensional resistance formulations. Methodical Series of data. Shallow water effects. Relation of hull form to resistance, Advanced Marine vehicles. Theory of aerofoil sections. Powering of ships, Theory of propeller action. Law of similitude for propellers, Interaction between hull and propeller. Geometry of screw propellers. Cavitation. Propeller design

Course Objectives

The student should be able to:

- Perform resistance and powering calculations for different types of ships
- Carry out calculations for the design of propellers

Course Topics

- Ship resistance
- Dimensional analysis
- Frictional resistance
- Residuary resistance, Wave making resistance, Form resistance, Two and three dimensional resistance formulations
- Methodical Series of data
- Shallow water effects
- Relation of hull form to resistance, Advanced Marine vehicles
- Theory of aerofoil sections
- Powering of ships, Theory of propeller action
- Law of similitude for propellers, Interaction between hull and propeller
- Geometry of screw propellers
- Propeller design

References

- "*Principles of Naval Architecture*", SNAME, vol. III
- J.S. Carlton Butter Worth, "*Marine Propellers and Propulsion*", Heinemann, Lid,19
- K.J. Rowsan and E.C. Tupper, "*Basic Ship Theory*".
- G. Kuiper, "*The Wageningen Propeller Series*", Marine Publication 1992

Course Code : MM 752

Course Title : Advanced Marine Materials

Credit Hours : 3

Course Description

Introduction to materials. Ferrous materials. Phase diagrams. Carbon steels. Alloy steels. Nonferrous alloys. Properties of Marine materials: Mechanicals, chemical, thermal, electrical and magnetic. Toughness. Creep. Corrosion. Fatigue. Marine Materials selection and substitution. Future trends in marine materials usage. Environmental issues. Fracture, weld ability and the influence of welding on mechanical properties. Crystal structure, a review. Diffusion in metals. Solidification of metals. Equilibrium diagrams. Heat treatment alloys. Defects on materials. Strengthening of materials. Corrosion resistant materials. Cathodic Protection. Marine coating. Material inspection.

Course Objectives

The student should be able to:

- Develop and enhance the knowledge and skill of the student in order to select the most suitable materials for marine structures applications
- Provide the students with the latest developments in material technology and applications of new advanced materials
- Relate fracture, corrosion and welding behavior to particular alloy specifications

Course Topics

- Introduction to materials
- Ferrous materials
- Phase diagrams - Alloys
- Properties of Marine materials:
- Marine Materials selection and substitution –
- Future trends in marine materials usage - Environmental issues
- Fracture, weld ability and the influence of welding on mechanical properties
- Crystal structure, Diffusion in metals, Solidification of metals and Equilibrium diagrams
- Heat treatment alloys, Defects on materials
- Corrosion resistant materials, Cathodic Protection, Marine coating
- Material inspection

References

- William F. Smith, "Foundation of Materials Science and Engineering".
- Flinn and Trojan, "Engineering Materials and Their Applications"
- F. Shackelford, "Introduction to Materials and Their Applications"
- M. Farag. "Materials Selection for Engineering Design"
- SNAME and RINA Publications

Course Code : MM 753

Course Title : Advanced Marine Vehicles

Credit Hours : 3

Course Description

Hydrodynamics of small high-speed craft including planning hulls, air cushion vehicles, surface effect ships, and Wing in Ground Effect. Theoretical and empirical methods for resistance propulsion and attitude prediction. Nonlinear dynamics and stability of high-speed marine vehicles. Effect of hull form on resistance and dynamic performance. Structural design considerations including bottom plating strength and frame loading. Discussion of various types of framing. Material choices.

Course Objectives

The student should be able to:

- Understand the differences between conventional and advanced marine vehicles geometrical, hydrodynamic, and structural aspects
- Apply new codes pertaining to high speed and advanced marine vehicles

Course Topics

- Hydrodynamics of small high-speed craft including planning hulls
- Air cushion vehicles
- Surface effect ships, and Wing in Ground Effect
- Theoretical and empirical methods for resistance propulsion and attitude prediction
- Nonlinear dynamics and stability of high-speed marine vehicles
- Effect of hull form on resistance and dynamic performance
- Structural design considerations including bottom plating strength and frame loading
- Discussion of various types of framing
- Material choices

References

- Odd M. Faltinsen, “Hydrodynamics of High-Speed Marine Vehicles”, Cambridge University Press, NY, 2005
- B. R. Clayton, “Mechanics of Marine Vehicles”, Gulf Pub Co 1982
- Lecture Notes

Course Code : MM 754

Course Title : Advance Underwater Technology

Credit Hours : 3

Course Description

Underwater equipment. Underwater cutting. Underwater welding. Underwater inspection. Underwater repair operations.

Course Objectives

The student should become acquainted with:

- Different methodologies and techniques for under water operations as related to marine structures

Course Topics

- Underwater equipment
- Underwater cutting
- Underwater welding
- Underwater inspection
- Underwater repair operations

References

- Handouts and Lecture Notes

Course Code : MM 755

Course Title : Marine Pollution: Prevention and Control

Credit Hours : 3

Course Description

Sources of marine pollution. Hazards of marine pollution. Statutory regulations and international conventions to prevent marine pollution. Methods and measures of controlling marine pollution. Ballast water management.

Course Objectives

The student should be able to:

- Identify sources of marine pollution
- Assess the conformity of marine system with local and international environmental regulations
- Assess environmental impacts of marine system operations

Course Topics

- Sources of marine pollution
- Hazards of marine pollution
- Statutory regulations and international conventions to prevent marine pollution
- Methods and measures of controlling marine pollution
- Ballast water management

References

- Lecture Notes

Course Code : MM 756

Course Title : Marine Statutory Regulations

Credit Hours : 3

Course Description

Government administration. International Maritime Organization (IMO). SOLAS. Surveys and certification. Subdivision and stability. Machinery and electric installations. Fire protection. Fire detection and fire extinction. Life saving appliances. Radiotelegraphy and radiotelephony. Safety of navigation. Carriage of grain. Carriage of dangerous goods. Nuclear ships, port State Control.

Course Objectives

The student should become:

- Aware of recent marine regulations
- Knowledgeable of national and international conventions in the marine fields
- Familiar with recommendations and guidelines of marine and offshore bodies

Course Topics

- Government administration
- International Maritime Organization (IMO)
- SOLAS
- Surveys and certification
- Subdivision and stability
- Machinery and electric installations
- Fire protection
- Fire detection and fire extinction
- Life saving appliances
- Radiotelegraphy and radiotelephony
- Safety of navigation
- Carriage of dangerous goods
- Nuclear ships, port State Control

References

- Lecture Notes

Course Code : MM 757

Course Title : Production of Offshore Structures

Credit Hours : 3

Course Description

Material in the ocean. Construction of ocean structures. Impact of the ocean environment on structural design. Structural assembly. Outfitting. Preservation of ocean structures. Cost and contracts.

Course Objectives

The student should be able to:

- Identify the ocean characteristics and their impacts on the offshore structure
- Assess the building and assembly approaches to offshore structures
- Study different protection and preservation methods of ocean structures -

Course Topics

- Material in the ocean
- Construction of ocean structures
- Impact of the ocean environment on structural design
- Structural assembly
- Outfitting
- Preservation of ocean structures
- Cost and contracts

References

- Handouts and Lecture Notes

Course Code : MM 771

Course Title : Hydromechanics of Offshore Structures

Credit Hours : 3

Course Description

Hydromechanics of offshore structures, Features of offshore structures, Selected basics of hydromechanics (Continuity, Laplace, Euler, Bernoulli, Navier-Stokes Equations), Non Dimensional Characteristic numbers, 2D potential flow of incompressible fluids, 3D potential flow of incompressible fluids, Wave theories (Linear wave theory, Stokes finite amplitude theory), Hydrostatic analysis (Pressure and buoyancy, Stability of floating offshore structures, stability of compliant offshore structures), Hydrodynamic analysis (Wave forces on hydrodynamically transparent structures, Motion of hydrodynamically transparent structures in a seaway, Forces and motions of hydrodynamically compact structures in a seaway, wave drift forces

Course Objectives

The student should be able to:

- Estimate the fluid loading accurately in order to perform the structural design of offshore platforms

Course Topics

- Hydromechanics of offshore structures
- Features of offshore structures
- Selected basics of hydromechanics (continuity, Laplace, Euler, Bernoulli, Navier-Stokes equations)
- Non-dimensional characteristic numbers
- 2D and 3D potential flow of incompressible fluids
- Wave theories (linear wave theory, Stokes finite amplitude theory)
- Hydrostatic analysis
- Hydrodynamic analysis
- Forces and motions of hydrodynamically compact structures in a seaway
- Wave drift forces

References

- Barltrop, N. P., Mitchell, G. M. and Atkins J.B. “Fluid Loading on Fixed Offshore Structure”.
- Gunther Clauss, Eike Lehmann, and Carsten Ostergaard, “Offshore structures Vol. I Conceptual Design and Hydromechanics”, Springler Verlag
- Offshore Technology Conference Proceedings
- Sarpkaya, T. and Isaacson M., “Mechanics of Wave Forces on Offshore Structures”.
- Lecture Notes

Course Code : MM 772

Course Title : Structural Design of Offshore Structures

Credit Hours : 3

Course Description

General design procedure. Design loads and forces. Jacket structural design. Tubular joint design. Fatigue analysis. Design codes. Topside structures. Layout and design considerations. Design of plates. Design of beams and girders. Pile foundations. Axial and lateral pile capacities. Soil-pile interaction. Pile design. Dynamic analysis of jacket platforms. Time domain and frequency domain approaches.

Course Objectives

The student should be able to:

- Perform detailed design calculations for offshore jacket platforms

Course Topics

- General design procedure
- Design loads and forces
- Jacket structural design
- Tubular joint design
- Fatigue analysis
- Design codes
- Topside structures
- Layout and design considerations
- Design of plates
- Design of beams and girders
- Pile foundations
- Soil-pile interaction
- Pile design
- Dynamic analysis of jacket platforms
- Time domain and frequency domain approaches

References

- Barltrop and Adams “Dynamics of Fixed Marine Structure”
- Offshore Technology Conference - Proceedings.
- Lecture Notes

Course Code : MM 773

Course Title : Offshore Drilling Technology

Credit Hours : 3

Course Description

Petroleum geology. Types of rocks. Oil and gas traps. Well types. Offshore exploration methods. Offshore drilling platforms. Drilling equipment. Drilling derrick. Rotary system. Draw works. B.O.P. and well control equipment. Mud system. Mud classification. Mud testing. Mud pumps. Drilling and completion operations. Directional drilling. Drilling problems. Well design.

Course Objectives

The student should be able to:

- Enhance and develop the knowledge and experience of students in the field of marine drilling for oil and gas

Course Topics

- Petroleum geology
- Types of rocks
- Oil and gas traps
- Well types
- Offshore exploration methods
- Offshore drilling platforms
- Drilling equipment
- Drilling derrick
- Rotary system
- Draw works
- B.O.P. and well control equipment
- Drilling and completion operations
- Directional drilling
- Drilling problems
- Well design

References

- McLachlan, M. “An Introduction to Marine Drilling”.
- Applied Drilling Engineering (SPE)
- Offshore Technology Conference - Proceedings.
- Lecture Notes

Course Code : MM 774

Course Title : Maintenance of Offshore Structures

Credit Hours : 3

Course Description

Offshore structures. Fixed and floating structures. Subsea systems. Pipelines. Deterioration of offshore structures. Fabrication and installation stages. In-service stage. Maintenance strategies and types. Underwater work systems. Tools. Instruments. Divers. Underwater vehicles. Maintenance of jacket structures. Cleaning. Inspection. Maintenance of the topside structures. Steel structures. Topside facilities and equipment. Maintenance of subsea systems and pipelines. Reporting and documentation.

Course Objectives

The student should learn:

- Planning, performing and supervising maintenance programs for offshore structures and subsea systems

Course Topics

- Offshore structures
- Fixed and floating structures
- Subsea systems and Pipelines
- Deterioration of offshore structures
- Fabrication and installation stages
- In-service stage
- Maintenance strategies and types
- Underwater work systems
- Tools, Instruments, Divers - Underwater vehicles
- Maintenance of jacket structures
- Cleaning, Inspection
- Steel structures
- Topside facilities and equipment
- Maintenance of subsea systems and pipelines
- Reporting and documentation

References

- An Introduction to Offshore Maintenance (OPL)
- M. Bayliss “Underwater Inspection”
- Offshore Technology Conference Proceedings.
- Lecture Notes

Course Code : MM 775

Course Title : Subsea Pipelines

Credit Hours : 3

Course Description

Types of pipelines. Design of offshore pipelines. Forces and motions of offshore pipeline in seaway. Special design considerations. Stress analysis of offshore pipelines. Installation and laying of pipelines. Methods. Laying barges. Towing. Inspection and survey of pipelines. Inspection techniques. Classification Societies requirements. Maintenance and repair of pipelines.

Course Objectives

The student should be able to:

- Design and evaluate offshore pipeline with consideration to the production technology, environmental conditions, route characteristics, safety requirements and economical aspects

Course Topics

- Types of pipelines
- Design of offshore pipelines
- Forces and motions of offshore pipeline in seaway
- Special design considerations
- Stress analysis of offshore pipelines
- Installation and laying of pipelines
- Methods
- Laying barges
- Towing
- Inspection and survey of pipelines
- Inspection techniques
- Maintenance and repair of pipelines

References

- Subsea and Pipeline Engineering – Bentham Press
- Rules for Submarine Pipeline Systems – Det Norske Veritas
- Offshore Technology Conference Proceedings
- Lecture Notes

Course Code : MM 776

Course Title : Oil and Gas Production Technology

Credit Hours : 3

Course Description

Well completion. Bottom hole completion techniques. Types of production systems. Fixed platforms. Floating and compliant production systems. Subsea systems. Offshore pipelines. Oil and gas separation. Mechanisms of small particle collection. Piping systems. Pressure vessels. Layout and design of process plant. Gas production. Oil production. Oily water processing. Separation facilities and processing equipment. Oil drive mechanism. Enhanced oil recovery systems. Maintenance and safety aspects.

Course Objectives

The student should be able to:

- Evaluate and chose the proper production system for a given offshore field
- Evaluate, prepare the layout and design of oil and gas production trains
- Determine the main specifications of the required processing equipment

Course Topics

- Well completion
- Bottom hole completion techniques
- Types of production systems
- Fixed platforms
- Floating and compliant production systems
- Subsea systems and Offshore pipelines
- Oil and gas separation
- Mechanisms of small particle collection
- Piping systems, Pressure vessels
- Layout and design of process plant
- Gas production, Oil production
- Separation facilities and processing equipment
- Oil drive mechanism
- Enhanced oil recovery systems
- Maintenance and safety aspects

References

- Offshore Technology Conference Proceedings
- Production Facilities (SPE)
- Offshore Oil and Gas Process Engineering – Benthan Press
- Lecture Notes

Course Code : MM 777

Course Title : Marine and Offshore Safety

Credit Hours : 3

Course Description

Main risks. Classification and survey regulations. Safety case approach. Goal setting. Verification schemes. The Safety Management System. Offshore risk assessment. Quantitative risk assessment. Safety of topside structure. Safety considerations of topside facilities and equipment. Personnel safety considerations. Fire-fighting equipment. Active fire protection. Passive fire protection. Life-saving appliances. Emergency systems. Safety aspects of underwater structure and systems. Design stage. In-serve stage.

Course Objectives

The student should be able to:

- Identify and specify the main risks affecting marine and offshore structures and systems for both the under water structure and topside facilities
- Perform safety assessment using modern techniques and tools

Course Topics

- Main risks
- Classification and survey regulations
- Safety case approach
- Goal setting and Verification schemes
- The Safety Management System
- Offshore risk assessment
- Quantitative risk assessment
- Safety of topside structure
- Safety considerations of topside facilities and equipment
- Personnel safety considerations
- Fire-fighting equipment
- Life-saving appliances
- Emergency systems
- Safety aspects of underwater structure and systems
- Design stage and in-serve stage

References

- Offshore Technology Conference Proceedings
- Inspection, Assessment and Recertification of Offshore Platforms – Bentham Press
- Preparation and Evaluation of Safety Case – Bentham Press
- Lecture Notes

Course Code : MM 778

Course Title : Marine Operations

Credit Hours : 3

Course Description

Review of basic ship definitions. Stability of floating units. Stability criteria. Ballasting and free surfaces. Trim. Resistance and powering estimation. Types of propulsion systems. Propellers. Types of propellers. Rig - moves. Towage. Approaching the location. Anchor types. Anchor handing. Dynamic positioning systems.

Course Objectives

The student should be able to:

- Perform the various calculations needed during jacket and topside structure transportation including stability evaluation
- Determine the power and specifications of the tug boots used for towing operations

Course Topics

- Review of basic ship definitions
- Stability of floating units
- Stability criteria
- Ballasting and free surfaces
- Trim resistance and powering estimation
- Types of propulsion systems
- Propellers
- Types of propellers
- Rig - moves
- Towage
- Approaching the location
- Anchor handing
- Dynamic positioning systems

References

- Offshore Technology Conference Proceedings
- Muckle, W. “Muckle’s Naval Architecture”.
- Rawson. K.J., Tupper, E.C., “Basic Ship Theory”
- Carlton, J. S., “Marine Propellers and Propulsion”
- Lecture Notes