REM master basic syllabus

Title:
NM946 Inspection and Survey

Credit value:
5 ECTS

Mandatory/Optional:
Compulsory

Semester:
1

Lecturer/s:
Julia Race

University:
University of Strathclyde

Department:
Naval Architecture, Ocean and Marine Engineering

Rationale:

This module aims to provide understanding of threats to offshore structures, the effect of defects and appropriate methods for detection. The majority of the course assesses the threat of corrosion in a marine environment and describes measures for the control of corrosion. In addition, t is also critical to understand the basics of fatigue analysis and fracture mechanics approaches to defect assessment. These aspects are provided in this module along an appreciation of how material properties and assumptions about properties affect the life cycle and inspection of marine structures and how to assess 'fitness for purpose'.

Objectives:

1. *To provide students with an insight into 'marine' materials, their properties, failure and protection and an understanding of how their degradation affects the life-cycle of marine and offshore structures.*
2. *To engender an understanding of the role of inspection and the assessment of inspection results.*
3. *To provide knowledge of the major threats to marine asset integrity including corrosion and its control for equipment constructed in a wide range of materials, fatigue and fracture of steels.*

Skills: *(according to the list of skills provided)*

Subject skills	**REM Master Skills**						
	L2.1	**L2.2**	**L2.3**	**L2.4**	**L2.5**	**L2.6**	**L2.7**
L3.1. Have gained a basic understanding of threats to offshore structures, the effect of defects and appropriate methods for detection	X	X	X			X	X
L3.2. Understand the basics of fatigue analysis and fracture mechanics approaches to defect assessment.	X	X				X	X
L3.3. Appreciate how material properties and assumptions about properties affect the life cycle and inspection of marine structures and how to assess 'fitness for purpose'.	X	X	X			X	X
L3.4. Recognise the various way in which the marine environment can induce serious deterioration of structures by different corrosion processes	X	X				X	X
L3.5. Understand the basics of electro-chemical	X	X				X	X

corrosion of metals							
L3.6. Have a critical appreciation of the techniques of control of corrosion in marine engineering equipment	X	X				X	X

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Teaching and learning methods:

The teaching method is based on a series of lectures where the lecturer explains the main concepts through power point presentations and worked out examples on the board. The students are also presented with a variety of issues of practical nature during the lectures. To support the learning process part of the modules covers tutorial-like sessions where the students are put to the challenge of working together and addressing problems of slight higher technical complexity

Allocation of student time:

	Attendance (classroom, lab,…)	**Non attendance (lecture preparation, self study…)**
Lectures	16 hours	16 hours
Tutorial	4 hours	4 hours
Assignment	30 hours	30 hours
Private study		20 hours

Assessment:

The written examination tests acquisition of a clear general knowledge and understanding of the subject plus the ability to think and analyse a problem quickly, to select from and to apply both the general and detailed knowledge of aspects of the subject. The exam also assesses problem solving skills, the ability to work unaided and to communicate clearly and concisely in writing.

The tutorial calculations relevant to the assessment of fracture and fatigue consolidates the students' knowledge and understanding half way through the semester and enables them to obtain feedback. Feedback will also be provided through example calculations on MyPlace

The tutorial sessions are supervised activities in which the students apply the knowledge that they gain during formal lectures and private study to conduct the calculations outlined in the syllabus. During the tutorial sessions students are able to interact with the lecturer and obtain feedback on their calculations.

Assessment Matrix:

Subject skills	**Assessment method**					
	Exam	**Presentation**	**Home work**	**Report**	**…**	**…**
L3.1.	100%					
L3.2.	100%					
L3.3.	100%					
L3.4.	100%					
L3.5.	100%					
L3.6.	100%					

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Programme:

Lesson 1	***Course introduction – Fracture*** • Introduction to the module • Fracture mechanics and crack growth • Failure Assessment Diagrams *Distribution (2 h theory)*
Lesson 2	***Marine corrosion*** • Basic aspects of corrosion relevant to the marine environment • Features of aqueous corrosion • Factors determining corrosion rates *Distribution (2 h theory + 1 h tutorial)*

Lesson 3	***Aspects of seawater characteristics relevant to corrosion***
	
	• Seawater characteristic s including
	  ○ pH
	  ○ Dissolved gases
	  ○ Organic material
	  ○ Water depth
	
	Distribution (2 h theory)

Lesson 4	***General surface corrosion*** • Anodic and cathodic reactions and influencing factors • Corrosion in ships • Corrosion in oil and gas production systems *Distribution (2 h theory + 1 h tutorial)*

Lesson 5	***Fatigue***
	
	• Fatigue analysis
	  ○ Cycle counting
	  ○ S-N fatigue assessment
	
	Distribution (2 h theory)

Lesson 6	***Localised corrosion***
	
	• Localised corrosion mechanisms including:
	  ○ Galvanic corrosion
	  ○ Crevice corrosion
	  ○ Intergranular corrosion
	  ○ Microbiologically influenced corrosion
	  ○ Stray current corrosion
	  ○ Erosion/corrosion and cavitation
	  ○ SCC and hydrogen embrittlement
	
	Distribution (5 h theory)

Lesson 7	***Inspection methodologies***

	• Introduction to weld defects • Inspection techniques for different defects *Distribution (3 h theory)*
Lesson 8	***Tutorial session*** *Distribution (2 h tutorial)*

Resources:

Classrooms, Blackboard, laptop, projector, audio, computer room, laboratory, security issues,…

A classroom, equipped with a blackboard and audio-visual resources (laptop/computer with Matlab/Simulink installed and Internet connection + projector), for the lectures. A blackboard and a projector may be sufficient if the lecturer uses her/his own laptop.

Bibliography:

Basic textbooks, deepening bibliography, Internet addresses of interest, specific journals, etc…

Literature package is provided in Myplace.

Further comments: