Structural Integrity

Academic Year: (2024 / 2025) **Review date: 24-01-2025**

Department assigned to the subject: Continuum Mechanics and Structural Analysis Department

Coordinating teacher: VAZ-ROMERO SANTERO, ALVARO

Type: Electives ECTS Credits : 3.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Elasticity
Strength of Materials.

SKILLS AND LEARNING OUTCOMES

RA1.2: An systematic understanding of the key aspects and concepts of their branch of engineering.
RA1.3: Coherent knowledge of their branch of engineering including some at the forefront of the branch.
RA2.1: The ability to apply their knowledge and understanding to identify, formulate and solve engineering problems using established methods.
RA2.3: The ability to select and apply relevant analytic and modelling methods.
RA3.2: An understanding of design methodologies, and an ability to use them.
RA4.2: Rhe ability to design and conduct appropriate experiments, interpret the data and draw conclusions.
RA5.2: The ability to combine theory and practice to solve engineering problems.
RA5.3: An understanding of applicable techniques and methods, and of their limitations.
RA5.4: An awareness of the non-technical implications of engineering practice.
RA6.3: Demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environmental context, and commit to professional ethics, responsibilities and norms of engineering practice.
CB1: Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2: Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CG1: Ability to resolve problems with initiative, creativity decision-making and critical reasoning skills, and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering area.
CG3: Capacity to design a system, component or process in the area of mechanical engineering in compliance with required specifications.
CG4: Knowledge and capacity to apply current legislation as well as mandatory specifications, requirements and norms in the area of mechanical engineering.
CG9: Knowledge and capacity to apply computational and experimental tools for analysis and quantification of mechanical engineering problems.
CE5: Knowledge and capacity to construct and design industrial structures and buildings.

OBJECTIVES

By the end of this course, students will be able to have:
1. A systematic understanding of the key concepts and aspects for the analysis and assurance of the structural integrity of mechanical components and structures.
2. The ability to apply their knowledge and understanding to identify, formulate and solve structural integrity problems using established methods.
3. The ability to select and apply analytical methods and modeling of fracture mechanics

applicable to structural integrity problems.
4. An understanding of the different calculation methods to analyze structural integrity problems.
5. The ability to design and carry out experiments for the analysis of the structural integrity of mechanical components and structures, interpret the data and draw conclusions.
6. The ability to combine theory and practice to solve structural integrity problems
7. An understanding of the different applicable methods and techniques and their limitations for the analysis of the structural integrity problems
8. An awareness of the implications of engineering practice in the evaluation of the structural integrity issues.

DESCRIPTION OF CONTENTS: PROGRAMME

Basic concepts on Fracture Mechanics

1. Stress and strain fields in linear elastic cracked solids.
2. Fracture criteria in linear elastic cracked solids.

Fatigue behavior

3. Fatigue crack propagation.
4. Fatigue life calculation of structural elements.
5. Basic concepts on numerical techniques in fracture mechanics.

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6. Design against fracture and fatigue.
7. Standards in fracture and fatigue.

LEARNING ACTIVITIES AND METHODOLOGY

Lecture sessions (master class) and practical sessions will be taught.
The first are geared to the acquisition of theoretical knowledge, and the second to the acquisition of practical skills related to corresponding theoretical concepts.

ASSESSMENT SYSTEM

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

Final exam (obligatory): 40%

Continuum evaluation: 60%
- Laboratory: 20%
- Evaluation controls: 40%

In order to pass the course, attendance and successful completion of the laboratory practices foreseen in the weekly planning are mandatory. The weighting of the laboratory practice mark in the continuous assessment corresponds to what it is established in the course, in accordance with the regulations of the university. In this course, the weighting of the laboratory practices takes the value of 20% of the continuous assessment grade.

BASIC BIBLIOGRAPHY

- Anderson, T.L. Fracture mechanics: Fundamentals and applications , CRC Press, 1995

- Broek, David Elementary engineering fracture mechanics , Kluwer Academic, 1991

- Broek, David Elementary engineering fracture mechanics , Kluwer Academic, 1991

ADDITIONAL BIBLIOGRAPHY

- K. Ravi-Chandar Fracture mechanics, Springer, 1998

- Kanninen, Melvin F. Advanced fracture mechanics, Oxford University Press, 1985