Liverpool John Moores University

Title:	ADVANCED STRUCTURAL INTEGRITY
Status:	Definitive
Code:	**7026MAR** (115970)
Version Start Date:	01-08-2011
Owning School/Faculty:	Engineering
Teaching School/Faculty:	Engineering

Team	Leader
Gareth Bradley	Y

Academic Level:	FHEQ7	**Credit Value:**	10.00	**Total Delivered Hours:**	43.00
Total Learning Hours:	100	**Private Study:**	57		

Delivery Options
Course typically offered: Runs Twice - S1 & S2

Component	Contact Hours
Lecture	24.000
Practical	4.000
Tutorial	12.000

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	AS1	Examination	70.0	3.00
Essay	AS2	Coursework - Fracture mechanics/fatigue laboratory.	15.0	
Essay	AS3	Coursework - Finite element analysis assignment.	15.0	

Aims

To have a thorough understanding of the causes and effects of structural integrity issues with respect to a range of structural engineering materials and their associated manufacturing processes.

Learning Outcomes

After completing the module the student should be able to:

1	Critically evaluate the main factors influencing fatigue in structural engineering (metals, polymers, ceramics and composites) materials.
2	Critically evaluate the affects of manufacturing processes, e.g. machining and welding, on the structural and surface integrity of materials.
3	Apply the concepts of damage tolerance and how to apply this with respect to design criteria.
4	Apply the concepts of stress and strain life analysis with respect to HCF and LCF and how to apply this with respect to design criteria.
5	Design against fatigue, fracture and creep.
6	Apply advanced fracture mechanics concepts to the determination of structural integrity.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

EXAM	1	2	3	4	5	6
CW	1	2	3			
CW	3	6				

Outline Syllabus

Overview of the module content.
Review of linear elastic fracture mechanics concepts.
Elastic-plastic fracture mechanics, J Integral, effects of constraint, testing of materials.
Finite element analysis of fracture, crack tip elements, determination of K and J.
Overview of the concept of fatigue crack growth including crack initiation, stable crack growth unstable crack growth.
High cycle fatigue and S-N testing and low cycle fatigue and ε-N testing.
Damage tolerance testing.
Fatigue properties of structural engineering materials (metals, plastics, ceramics and composites).
Designing against fatigue and fracture.
Creep of engineering materials (metals, ceramics and plastics) and testing methods
Creep of metal materials at higher temperatures, data interpretation and modelling

Learning Activities

A series of lectures supported by tutorials, seminars, practical work and group exercises.

References

Course Material	Book
Author	Crawford, RJ
Publishing Year	1998
Title	Plastics Engineering
Subtitle	
Edition	3rd Edition
Publisher	Butterworth-Heinemann
ISBN	9780750637640

Course Material	Book
Author	Green, DJ
Publishing Year	1998
Title	An introduction to the mechanical properties of ceramics
Subtitle	
Edition	
Publisher	Cambridge,
ISBN	0-521-59913-X

Course Material	Book
Author	Hull, D; Clyne, TW
Publishing Year	1996
Title	An Introduction to Composite Materials
Subtitle	
Edition	
Publisher	Cambridge
ISBN	0 521 38855 4

Course Material	Book
Author	Janssen, M; Zuidema, J; Wanhill, RJH
Publishing Year	2004
Title	Fracture Mechanics
Subtitle	
Edition	
Publisher	Taylor and Francis
ISBN	9780415346221

Course Material	Book
Author	Polmear, I
Publishing Year	2006
Title	Light Alloys
Subtitle	
Edition	4th Edition
Publisher	Butterworth-Heinemann,
ISBN	0 7506 6371 5

Course Material	Book
Author	Suresh, S
Publishing Year	0
Title	Fatigue of Materials
Subtitle	
Edition	2nd Edition
Publisher	Cambridge University Press
ISBN	9780521578479

Notes

This module builds on the knowledge gained from level 3 Materials and Structural Integrity module (or equivalent) and will deliver engineering students who have a in-depth understanding of structural integrity issues and can subsequently make informed choices with regards to material selection and design.