•MLO1. Apply knowledge and understanding of scientific principles and methodology related to solving w

Northumbria University Programme Framework for Northumbria Awards - Module Specification

Faculty	Engineering and Environment	**Department**		BEng (Hons) Mechanical Engineering (Manufacturing Systems and Design)	**Subject**		**Module Tutor**	Nak-Kyun Cho			
Module Title	Fundamentals of Engineering Design and Integrity Assessment						**Module Code**	MSDE 215			
Module Type* *(see key below)*	Choose an item.										
Module size credits	**Level 3:**		**Level 4:**	**10**	**Level 5:**		**Level 6:**		**Level 7:**		
Home programme/s for which the module is designed				BEng (Hons) Mechanical Engineering (Manufacturing Systems and Design)				**Code/s**			
Additional Programme/s other than that/those for which the module for specifically designed								**Code/s**			
Delivery Pattern (Please tick)		**Semester based** *(please specify)*		Sem 1 ☐ Sem 2 ☒	**Year Long**	☐	**Full-time** **Part-time** **Distance Learning**		☒ ☐ ☐		
Location(s) of delivery: If delivered at EPWO partners please give partner name and location											

KEY:

APL	*Accreditation for prior learning*	*P/F*	*Pass/fail module*	*PLIN*	*Placement - Industrial*
CORE	*PNVQ core skills module*	*P/F_DS*	*Pass/fail dissertation module*	*PRAC*	*Practical*
DISS	*Dissertation*	*P/F_PJ*	*Pass/fail project module*	*PROJ*	*Project*
FLDW	*Fieldwork*	*P/F_PL*	*Pass/fail placement module*	*STAN*	*Standard module*
INDS	*Independent study*	*PLAY*	*Placement – academic study abroad FT*	*WKBS*	*Work base study*
MAFOUN	*MA foundation modules - ASS*	*PLCL*	*Placement – Clinical*	*WORK*	*Workshop*

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Module Overview (Max 250 words per section) (This section is aimed at providing a prospective or current student with a brief overview of the module in answer to the specific questions and will form an element of the module handbook)

What will I learn on this module? (SRS 0001) Please give a brief indication of the content of the module including the main topic / subject areas studied
This module provides students with a comprehensive understanding of the mechanical behaviour of engineering materials. It explores the principles governing how materials respond to various mechanical loads and environments, enabling students to make informed decisions in material selection and design. Through a combination of theoretical concepts and practical applications, students will gain insights into the deformation, strength, and failure mechanisms of engineering materials.
How will I learn on this module? (SRS 0002) Please provide a brief overview the learning and teaching approaches the student can expect to experience.
This module will be delivered through regular lectures and tutorial sessions. During the lectures, students will acquire knowledge about the basic principles of structural mechanics and the mechanical behaviour of engineering materials. In tutorial sessions, students will engage in tensile and compression testing to obtain material characteristics. Additionally, they will learn to incorporate the design and construction of engineering structures using lightweight materials. Learning sessions will be used to present you with new material and assist you in exploring fundamental concepts and topics within the module. Sessions will involve a combination of content delivery and practical learning exercises to enable you to apply your learning to well-defined, authentic management problems. Learning activities will enable students to work collaboratively through the development of teamwork and communication skills, and the encouragement of creative thinking to solve problems issued from project management.
How will I be supported academically on this module? (SRS 0003) Please provide a brief overview of the academic support available to students, including any support that may be accessed outside formal scheduled teaching.
During your active learning sessions, academic support will be available to facilitate your exploration of the problem-solving activities. Formative feedback will be provided by the module team, including answering student queries and providing guidance concerning the module such as assessments and your academic progress. The electronic learning platform (e-class) provides a comprehensive resource for integrated learning incorporating learning materials and reading lists that will facilitate directed and self-directed learning. Contact with academic tutors and your peers outside formal teaching hours is encouraged through dedicated 'office hours', discussion boards, and messaging systems within the e-class.
What will I be expected to read on this module? (SRS 0004) All modules at Seoul Tech include a range of reading materials that students are expected to engage with. The reading list for this module can be found from MSDE Module Descriptor – https://msde.seoultech.ac.kr/curriculum_/syllabus_/

Northumbria University Library Reading List Service (please confirm the following)	**Please give date added**
A draft reading list has been created and on the university Library Reading List Service	Click here to enter a date.
Reading material has been acquired and digitised (following approval)	Click here to enter a date.
Reading list has been published to students (for module delivery)	Click here to enter a date.

NB – for PFNA alignment process only, module authors should complete either the University Library e-Reading List, or Appendix 1.

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Module Learning Outcomes (MLOs) *(Max of five in total*, for standard 20-credit modules)*

**this can increase to a maximum of 10, for modules with more than 20 credits*

What will I be expected to achieve? (SRS 0005)	**How will I be assessed?** (SRS 0006) *Please give details of all formative and summative assessment process indicating which MLOs will be addressed and how feedback will be provided.*	**Programme (Level) Learning Outcomes that this module contributes to:** *[Please insert PLO number as listed on the programme specification]*
• C2: Analyse complex problems to reach substantiated conclusions using first principles of mathematics, statistics, natural science and engineering principles • C3: Select and apply appropriate computational and analytical techniques to model complex problems, recognising the limitations of the techniques employed • C12: Use practical laboratory and workshop skills to investigate complex problems • C13: Communicate effectively on complex engineering matters with technical and non-technical audiences	**Formative Assessment** Academic staff on the module will assess you in a formative manner to help build your confidence and highlight any misunderstandings you may have of the theoretical and professional concepts presented in the module. Your formative feedback will be given to you either verbally by academic staff on the module during formally scheduled teaching sessions. Your formative feedback aims to help you learn and prepare for the submission of your summative assessment. **Summative Assessment** Academic staff on the module will assess you in a summative manner by three pieces of assessment: Component 1. Mid-term exam assess your knowledge and understanding of basic principles of structural mechanics and mechanical behaviours of engineering materials. (C2). Component 2, The final group project assesses understanding of engineering design and interpretation of stress analysis	**Knowledge & Understanding:** • KU1: Demonstrate basic knowledge of the scientific and mathematical foundations of engineering to solve basic problems. • KU2. Perform simple analysis of familiar engineering systems. • KU3. Identify and utilise basic methodologies to create solutions to specific engineering problems. **Intellectual / Professional skills & abilities:** • IPSA1. Demonstrate the use of fundamental approaches to solving readily defined engineering problems. • IPSA2. Communicate established engineering concepts to expert and non-expert audiences using standard formats and media. • IPSA4. Illustrate solutions to basic engineering problems. **Personal Values Attributes** (Global / Cultural awareness, Ethics, Curiosity) (PVA): • PVA2. Demonstrate creativity in discussing solutions to standard problems.

	results obtained from finite element software. In addition, critical discussion between simulation results and hand-made structure (C3, C12, C13)	

Pre-requisite(s) (SRS 0007) Any module which must already have been taken, or any stipulated level of prior knowledge required in order to study this module, (co-requisite core models need not be listed	Mechanics of Material, CAD
Co-requisite(s) (SRS 0008) Modules at this level which must be taken with this module	n/a

Module abstract (SRS 0009)

Please provide a brief a brief abstract of the module (150 words max). This section acts as the 'shop window' for the module, therefore it needs to engage and inspire the student. This is the first thing that the student will read about this module, so it must immediately grab their attention. The main aim is to encourage the student to read on, however the summary should be written in such a way that if the student reads nothing else this section will convey all key messages and benefits that the module will offer. Start by explaining the module title where necessary. Then highlight any selling points relating to the four pillars: Research-Rich Learning; Technology Enhanced Learning; Assessment and Feedback; Employability and Entrepreneurship. Examples may include student satisfaction rates, learning environment, state-of-the-art facilities etc. Finally indicate benefits of the module such as the key skills that the students will gain for future employment and career paths that are open to them.
In this module, students will gain an understanding of the fundamental principles of structural mechanics and the mechanical response of engineering materials. Building upon this knowledge, students will design an engineering structure using the commercial 3D CAD software SolidWorks. Mechanical testing, involving tension and compression tests, will be conducted to determine material properties. Additionally, stress analysis will be performed to identify weak points in the structure through finite element analysis. The course will include hands-on practice in which students will construct the designed engineering structure based on the simulation results. This practical experience will also provide an opportunity to discuss the causes of discrepancies between the simulation results and the structural collapse test.

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Programme Framework for Northumbria Awards Research Rich Learning Design Pillar (SRS 0090)

Embedding Research Rich Learning into the curriculum: Indicate how students will be actively engaged in research rich learning in this module through: research/enquiry based learning, research tutored learning, research led learning and/or research oriented learning, providing a brief overview of how this / these will feature within the delivery of the module (250 words max) **Note:** • **Research/enquiry Based:** L&T Based on student-centred enquiry and research activities (conducting research). • **Research Tutored**: L&T Emphasises learning focused on students actively discussing research, and critically engaging with research outputs • **Research Led**: T&L structured around subject content and that content is based on the research (learning about research) • **Research Orientated:** T&L Emphasises understanding of the knowledge production process, and methods of enquiry in the subject (learning how to research)
You will be introduced to both academic and practical engineering design process required to perform successfully in higher education and in your future career as a practicing engineer. This module will introduce you to research methodologies and the application of knowledge in materials and engineering design. You will be encouraged to investigate and gain confidence in research and inquisitive thinking through the application of appropriate knowledge and methodologies to tackle well-defined problems within the scope of engineering materials and methods of engineering design. In your first year, the underlying approach is focused on research-orientated learning, for example, you will appreciate how to characterise certain material properties and understand how this is used in research to manipulate the structural integrity of engineering structure.

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Notional Student Workload (NSW) for each mode of delivery

Complete for each delivery mode where the distribution of NSW **Full Time Mode of Delivery**				**Part Time Mode of Delivery**			
Activity type	**Hours**	KIS category	KIS category hours		**Hours**	KIS category	KIS category hours
Lecture	50	Scheduled	80	Lecture		Scheduled	
Seminar				Seminar			
Tutorial	15			Tutorial			
Project Supervision	15			Project Supervision			
Demonstration				Demonstration			
Practical classes and workshops				Practical classes and workshops			
Supervised time in studio/ workshop				Supervised time in studio/ workshop			
Fieldwork				Fieldwork			
External visits				External visits			
Tutor guided independent learning		Independent	20	Tutor guided independent learning		Independent	
Student independent learning	20			Student independent learning			
Placement		Placement		Placement		Placement	
Study abroad				Study abroad			
Work based learning				Work based learning			
Total workload *200 hours for 20 credit module*	*100*		*100*	**Total workload**			

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Summative Assessment

Sequence *001, 002 etc.*	**Activity type** *indicate **ONE** of the following types:*	**Brief description of assessment (max.120 characters)** *e.g. type/ length of exam, type/ word limit of coursework*	**Weighting** % or Pass/Fail (for grade only components) *Note: % weightings should add up to 100% for module overall*	**Final assessment**		**Anonymous submission**		**ESAF submission**	
				Yes	*No*	*Yes*	*No*	*Yes*	*No*
001	EXAM (Written examination)	Mid Term Exam (120 min)	50%	☐	☒	☐	☒	☐	☐
002	PRE (Presentation)	Final Project (4 weeks) Report & Presentation	50%	☒	☐	☐	☒	☐	☐
003	Choose an item.			☐	☐	☐	☐	☐	☐
004	Choose an item.			☐	☐	☐	☐	☐	☐
005	Choose an item.			☐	☐	☐	☐	☐	☐
006	Choose an item.			☐	☐	☐	☐	☐	☐
007	Choose an item.			☐	☐	☐	☐	☐	☐
008	Choose an item.			☐	☐	☐	☐	☐	☐
009	Choose an item.			☐	☐	☐	☐	☐	☐
010	Choose an item.			☐	☐	☐	☐	☐	☐
011	Choose an item.			☐	☐	☐	☐	☐	☐
012	Choose an item.			☐	☐	☐	☐	☐	☐

Reassessment (specify either synoptic or non-synoptic)

Synoptic reassessment *One form of reassessment that tests all module learning outcomes*	Yes	☒	No	☐
Non-synoptic reassessment *Where module referred overall, individual failed components of assessment are reassessed*	Yes	☐	No	☒

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Date of FPARSC Approval Click here to enter a date.

Date of entry onto SITS	Click here to enter a date.

LOG OF CHANGES POST-APPROVAL

Please indicate any changes to the approved module descriptor from 2012/13 onwards

Section No.	**Brief description of change**	**Date of Approval**	**Semester and year of first implementation**
		Click here to enter a date.	
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Appendix 1

Indicative Reading for PFNA alignment approval only *(to be completed only if e-reading list unavailable at point of alignment approval)*

N.B. This outline indicative reading list will be utilised for approval purposes only, and **a full e-reading list must be produced and available by the June of the academic year prior to the first delivery date of the module** (at which point the section of p.2 referring to University Library Reading Lists should be completed).

Please list below essential key text underpinning the module content and ultimately the learning outcomes:

1) Shigley's Mechanical Engineering Design, Richard G. Budynas and J. Keith Nisbett, 11th Edition, 2021
2) Machine Design An Integrated Approach, Robert Norton, Prentice Hall, 2008