Northumbria University NEWCASTLE

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**	Hyungkook JEON		
Module Title	MEMS/Nanotechnology							**Module Code**	MSDE 440		
Module Type* *(see key below)*	**STAN**										
Module size credits	**Level 3:**		**Level 4:**		**Level 5:**		**Level 6:**	**10**	**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							Mugung Hall (Seoultech)				

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*

Version Dated 04/03/2024 06:44:00

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 consists of basic information on MEMS, nanomechanics and measurement technology at nanoscale. A brief introduction to general MEMS processes and nanotechnology will first be given. In the nanomechanics field, basic mechanics, physics and chemistry of materials at nanoscale are introduced to better understand nanomechanical behaviour of nanomaterials. and nanostructures. Various technologies measuring local mechanical properties of nanostructures are introduced in detail in nanoscale measurement technologies. Special attention is given to theory and practice of scanning probe microscopy.
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 by regular lectures. During the lectures, students will gain the essential knowledge about MEMS, nanomechanics and measurement technology at nanoscale. Students will have opportunities to apply their learnings to practical problems, gaining insight into how to apply their learning in real-world scenarios.
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, you'll have access to academic support to assist you in understanding knowledge about MEMS, nanomechanics and measurement technology at nanoscale. The module team will offer formative feedback, which includes addressing student inquiries and offering guidance on module-related matters like assessments and your academic progress. Lecture materials will be distributed in advance, allowing students the opportunity to prepare for class ahead of time. We encourage you to communicate with academic tutors and your peers outside of formal teaching hours through designated 'office hours,' discussion boards, and email. Our professional support staff will serve as your initial point of contact for a wide range of questions, including issues related to assessment submission, late submissions/extensions, and other administrative matters.
What will I be expected to read on this module? (SRS 0004) All modules at Northumbria include a range of reading materials that students are expected to engage with. The reading list for this module can be found at: http://readinglists.northumbria.ac.uk (Reading List service online guide for academic staff, this contains contact details for the Reading List team – http://library.northumbria.ac.uk/readinglists)

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.

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]*
• C3. Select and apply appropriate computational and analytical techniques to model complex problems, recognising the limitations of the techniques employed. • C4. Select and evaluate technical literature and other sources of information to address complex problems. • C6. Apply an integrated or systems approach to the solution of complex problems. • C16: Function effectively as an individual, and as a member or leader of a team.	**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 two pieces of assessment: Component 1, written examination (midterm and final exams), is to assess your knowledge and understanding about the MEMS system (C3, C4, and C6). Component 2, Group project (with presentation), is to assess your ability to analyse physical phenomena and present your analysis (C3, C6, and C16).	**Knowledge & Understanding:** • KU1. Evaluate and apply complex knowledge of the scientific and mathematical principles of engineering to solve Real-World problems. • KU2. Perform advanced analysis of unfamiliar engineering systems. • KU5. Understand how complex Design and Manufacturing methods and systems can be combined to create sophisticated products. • KU6. Understand the use of advanced and non-traditional manufacturing methods and components. **Intellectual / Professional skills & abilities:** • IPSA1. Apply advanced approaches to solving unfamiliar real world engineering problems. • IPSA2. Professionally communicate a broad range of engineering concepts to expert and non-expert audiences using a variety of advanced formats and media. • IPSA3. Derive solutions to complex health and safety, sustainability and environmental issues in the engineering sector. • IPSA5. Demonstrate the ability to solve advanced design problems and apply advanced manufacturing systems. **Personal Values Attributes** (Global / Cultural awareness, Ethics, Curiosity) (PVA): • PVA2. Critically analyse advanced solutions to complex engineering problems.

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	N/A
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.
This module consists of basic information on MEMS, nanomechanics and measurement technology at nanoscale. A brief introduction to general MEMS processes and nanotechnology will first be given. In the nanomechanics field, basic mechanics, physics and chemistry of materials at nanoscale are introduced to better understand nanomechanical behaviour of nanomaterials. and nanostructures. Various technologies measuring local mechanical properties of nanostructures are introduced in detail in nanoscale measurement technologies. Special attention is given to theory and practice of scanning probe microscopy.

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)
Students will actively engage in research/enquiry-based learning by exploring basic knowledge and applications of MEMS, nanomechanics and measurement technology at nanoscale. Through hands-on projects, case studies, and problem-solving activities, students will develop a deep appreciation for the practical relevance of their leanings. This approach empowers students to ask questions, gather data, and use mathematical techniques to derive solutions, fostering critical thinking and problem-solving skills.

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	50	Lecture		Scheduled	
Seminar				Seminar			
Tutorial				Tutorial			
Project Supervision				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	50	Tutor guided independent learning		Independent	
Student independent learning	50			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**			

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)	- Midterm: 50%	50%	☒	☐	☐	☒	☐	☒
002	PRE (Presentation)	- Final presentation: 50%	50%	☒	☐	☐	☒	☐	☒

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.	
		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) Liu, Chang - Foundations of MEMS
2) Sami Franssila - Introduction to Microfabrication