Seoul National University of
Science & Technology
232 Gongneung-ro,Nowon-gu,
Seoul 01811 Korea

MSDE Module Descriptor

Module Title MEMS/Nanotechnology	**Module Code** MSDE 440	**Semester (Sem 1 / Sem 2)** Sem 1
Credits 10	**Level** 4	**Professor and email** Jihwan An Jihwanan@seoultech.ac.kr
Delivery Method Lecture/Project	**Delivery Location** SeoulTech, Mugung Hall	

Module Synopsis

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. Laboratory work with advanced atomic force microscopy is conducted for students to achieve experience and nanoindentation. nanoscratch and scanning probe lithography. Assessment is through a group presentation and individual report of experimental results in addition to the examination at the end of the course.

Outline Syllabus

Overview of MEMS
Microfabrication: Lithography, Deposition, Etching

Overview of nanotechnology
Impact and classification of nanotechnology. Lessons from nature. Current development and future of nanotechnology.

MEMS Processes
Lithography, Etching, Depositino

Basics of surface physics
Element of surface physics. Surface properties. Surface forces and surface water affinity

Nanomaterials and nanofilms
Carbon nanotubes. nanowires and nanorods. Nanostructured materials.

Nanofabrication
Top-down and bottom-up approach. Scanning probe lithography. Focused ion beam. Atomic layer deposition.
Testing materials and identifying their nanomechanical properties.

Indicative Reading

1) Handbook of Nanotechnology, Ed. B. Bhushan, Springer, Berlin, Germany, 2004.

2) Introduction to Nanoscience, S.M. Lindsay, Oxford Univ. Press, Oxford, England, 2010.

3) Nanoscale Science and Technology, Eds. R. Kelsall, I. Hamley , M. Geoghegan, John Wiley & Sons, Ltd., West Sussex, England, 2005.

4) MEMS – a practical guide to design, analysis and application, Han G. Korvink and Oliver Paul (Edt.), 2006, Springer.

NOTIONAL STUDENT WORKLOAD	**Hours**
MODE OF DELIVERY (FT / PT / DL)	FT
Lectures	45
Seminars	5
Tutorials	
Laboratories/studios/practical	
Directed learning	20
Independent Learning	30
Work experience/fieldwork	
Other: eg formal presentation	
Total Workload 100 hours for a 10 credit module 200 hours for a 20 credit module	100

Module Learning Outcomes	
KU1,2,5,6	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
IPSA1,2,3,5	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
PVA2	PVA2. Critically analyse advanced solutions to complex engineering problems.

Assessments	Assessment Type	Weighting %	Mid-Term/interim/final
Coursework			
Project			
Quiz			
Test			
Laboratory			
Exam	Problem solving	50%	Midterm
Presentation	Oral presentation by team	50%	Final