EE6615: NANOTECHNOLOGY FOR DEVICES AND MICROSYSTEMS

Effective Term
Semester A 2026/27

Part I Course Overview

Course Title
Nanotechnology for Devices and Microsystems

Subject Code
EE - Electrical Engineering
Course Number
6615

Academic Unit
Electrical Engineering (EE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
EE8404 Nanotechnology for Devices & Microsystems

Exclusive Courses
Nil

Part II Course Details

Abstract

The aim of the course is to provide students with theoretical knowledge and analytical skills necessary for an in-depth understanding of the chemistry and physics of nanofabrication technologies used in microelectronics and microsystems. Highlighted topics include patterning, interconnects, and packaging technology for nanostructures, devices, and microsystems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the principles of nanofabrication technology.		x	x	
2	Apply nanotechnology to nanostructures, devices and microsystems fabrication.		x	x	
3	Design nanotechnology for specific nanostructures, devices and microsystems.		x	x	x
4	Recognize limits of nanotechnology for different applications.		x	x	
5	Perform independent studies to identify future developments of nanotechnology in nanostructures, nanodevices, and microsystems.		x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Knowledge of the general concepts in nanotechnology and its applications.	1, 2, 3, 4	3 hrs/wk for 8 weeks
2	Laboratory	Hands on experience in cleanroom to practice nanotechnology.	2, 3, 4	3 hrs/wk for 3 weeks
3	Project	Research selected nanotechnology topics and provide independent evaluations.	1, 2, 3, 4, 5	3 hrs/wk for 2 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Tests (min.: 1)	1, 2, 3, 4	25	-	No
2	#Assignments (min.: 1)	1, 2, 3, 4, 5	15	-	Yes
3	Lab Exercises/ Reports	2, 3, 4	10	-	Yes

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

Remark: To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.
may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Achievements in CILOs

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal level

Assessment Task

Coursework (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Achievements in CILOs

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal level

Assessment Task
Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Achievements in CILOs

Excellent
(A+, A, A-) High

Good
(B+, B) Medium

Marginal
(B-, C+, C) Low

Failure
(F) Not even reaching marginal level

Assessment Task
Coursework (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Achievements in CILOs

Excellent
(A+, A, A-) High

Good
(B+, B) Medium

Marginal
(B-, C+, C) Low

Failure

(F) Not even reaching marginal level

Additional Information for AR

Constructive Alignment with Programme Outcomes

PILO 1, 2, 3, 4 Students are required to apply the fundamental theoretical knowledge and analytical skills for an in-depth understanding of nanotechnology for nanostructures, nanodevices and microsystems. The students have many opportunities to formulate and solve problems using the learnt knowledge and skills.

PILO 2, 3, 4, 5 Students are required to complete an independent research study on new developments of nanotechnology in nanodevices and microsystems.

PILO 6 Students are required to give an oral presentation of their independent research studies.

Part III Other Information

Keyword Syllabus

- Overview of nanotechnology
- Clean rooms facilities for nanofabrication
- Lithography technology for high-resolution patterning and mass production
- Dry and wet etching technologies for nanostructures, nanodevices, and microsystems
- Introduction of dopants to control conductivity and form shallow junctions
- Electrical contact formation and multiple level interconnects
- Nanophotonic devices for optical communications and biosensing applications
- Micro-Electro-Mechanical Systems (MEMS) and their applications
- Nanoimprint technology for three dimensional nanostructures and nanodevices
- Packaging technology for nanodevices and microsystems

Reading List

Compulsory Readings

	Title
1	Course notes provided by the instructor

Additional Readings

	Title
1	Silicon VLSI Technology - Fundamentals, Practice and Modeling, Plummer, Deal, and Griffin (Prentice Hall, 2000).
2	Fabrication Engineering at the Micro- and Nanoscale, Stephen A. Campbell (Oxford University Press, 2008).
3	Fundamentals of Microfabrication and Nanotechnology, Marc J. Madou, (CRC Press, 3rd Edition, 2011).
4	Nanotechnology and Functional Materials for Engineers, Yaser Dahman, Amsterdam; Cambridge, MA: Elsevier, 2017.
5	Emerging Applications of Nanoparticles and Architecture Nanostructures: Current Prospects and Future Trends, edited by Abdel Salam Hamdy Makhlouf, Ahmed Barhoum, Amsterdam; Cambridge, MA: Elsevier, 2018.
6	Introduction to Nanotechnology, Massimo F Bertino, Massimo F., New Jersey; Hong Kong: World Scientific, 2022.