EE3801: MICROSYSTEMS AND NANOTECHNOLOGY

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Microsystems and Nanotechnology

Subject Code
EE - Electrical Engineering
Course Number
3801

Academic Unit
Electrical Engineering (EE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
EE2005 Electronic Devices and Circuits

Precursors
EE2800 Semiconductor Physics for Engineers

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

The aim of the course is to provide students with the basic theoretical knowledge, analytical skills and laboratory experience for understanding the nanofabrication technologies for producing microelectronic circuits and microsystems. Highlighted topics include patterning, etching, deposition and doping technologies 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 individual nanofabrication processes.		x	x	
2	Apply nanotechnology to nanostructures, devices and microsystems fabrication.		x	x	
3	Explain the limits of nanotechnology for different applications.		x	x	
4	Explain the applications of different microsystems		x	x	
5	Design nanotechnology for specific nanostructures, devices 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	Student will gain knowledge of the general concepts in nanotechnology and its applications.	1, 2, 3, 4, 5	3 hrs/wk
2	Laboratory	Student will gain hands on experience in cleanroom to practice nanotechnology.	2, 3, 4	3 hrs/wk for 1 week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min.: 2)	1, 2, 3, 4, 5	35	
2	#Assignments (min.: 3)	1, 2, 3, 4, 5	20	
3	Lab Exercises/Reports	2, 3, 4	5	

Continuous Assessment (%)
60

Examination (%)
40

Examination Duration (Hours)
2

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. Also, 100% laboratory attendance rate must be obtained.

may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)

Assessment Task
Examination

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

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

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
- Micro-Electro-Mechanical Systems (MEMS) and their applications

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).