

EE3801: MICROSYSTEMS AND NANOTECHNOLOGY

Effective Term

Semester B 2022/23

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)

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	Recognize the limits of nanotechnology for different applications.	x	x	
4	Recognize and 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.

Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)	
1	Lecture	Knowledge of the general concepts in nanotechnology and its applications.	1, 2, 3, 4, 5	3 hrs/wk
2	Laboratory	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	36
2	#Assignments (min.: 3)	1, 2, 3, 4, 5	16
3	Lab Exercises/Reports	2, 3, 4	8

Continuous Assessment (%)

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).