SYE6205: SEMICONDUCTOR THIN FILM ENGINEERING

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Semiconductor Thin Film Engineering

Subject Code
SYE - Systems Engineering
Course Number
6205

Academic Unit
Systems Engineering (SYE)

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
ADSE6205 Semiconductor Thin Film Engineering (offered until 2023/24)

Exclusive Courses
Nil

Part II Course Details

Abstract

Semiconductor Thin Film Engineering is an advanced course that explores principles, techniques, and applications of semiconductor thin films. It covers deposition methods (e.g., physical vapor deposition, chemical vapor deposition, atomic layer deposition, molecular beam epitaxy), characterization techniques, and properties and applications of thin films in devices like and integrated circuits and transistors as well as displays and solar cells. This course includes advanced topics like nanoscale thin film engineering and integration into complex device structures. It also addresses challenges such as defects, reliability, and process optimization. By course completion, students will have a strong foundation in semiconductor thin film engineering, enabling them to understand thin film technology in semiconductor applications.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand the fundamental principles and concepts of semiconductor thin film engineering, including the deposition methods, materials, and characterization techniques used in the field.	25	x	x	
2	Develop proficiency in the selection and application of appropriate thin film deposition techniques for specific semiconductor applications, considering factors such as material compatibility, film quality, and device requirements.	25	x	x	
3	Analyse and evaluate the properties and performance of semiconductor thin films through advanced characterization techniques, including surface and interface analysis, structural analysis, and electrical/optical characterization.	25	x	x	
4	Apply the knowledge gained to solve practical engineering problems related to thin film engineering, including addressing challenges such as defects, reliability issues, and process optimization, and integrating thin films into complex device structures.	25	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	Lectures on the topics of the keyword syllabus.	1, 2, 3, 4	3 hours/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Mid-term exam	1, 2, 3, 4	30	-	No

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Assessment Rubrics (AR)

Assessment Task

Mid-term exam (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Learn semiconductor thin film engineering principles, deposition methods, and characterization techniques. Develop proficiency in selecting and applying deposition techniques for specific semiconductor applications.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

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

Criterion

Analyze semiconductor thin films using advanced characterization techniques. Apply knowledge to solve engineering problems, address challenges, and integrate thin films into complex devices.

Excellent

(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Mid-term exam (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Learn semiconductor thin film engineering principles, deposition methods, and characterization techniques. Develop proficiency in selecting and applying deposition techniques for specific semiconductor applications.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate/Basic

Failure
(F) Not even reaching marginal levels

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

Criterion
Analyze semiconductor thin films using advanced characterization techniques. Apply knowledge to solve engineering problems, address challenges, and integrate thin films into complex devices.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate/Basic

Failure
(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

- Principles, techniques, applications
- Physical vapor deposition (PVD)
- Chemical vapor deposition (CVD)
- Atomic layer deposition (ALD)
- Molecular beam epitaxy
- Electroplating deposition (ECD)
- Chemical mechanical polishing (CMP)
- Characterization techniques: film thickness, structural properties, electrical/optical characteristics
- Challenges: defects, reliability, process optimization

Reading List

Compulsory Readings

	Title
1	"Thin-Film Deposition: Principles and Practice" by Donald Smith (3rd edition, published in 2019)
2	"Handbook of Thin Film Deposition Processes and Techniques" edited by Krishna Seshan (2nd edition, published in 2018)

Additional Readings

	Title
1	NIL