

GE1315: SILICON NANO ELECTRONICS

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Silicon Nanoelectronics

Subject Code

GE - Gateway Education

Course Number

1315

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

GE Area (Primary)

Area 3 - Science and Technology

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

Just how do you turn sand, which you can find everywhere on a beach, into a trillion dollars? How could you turn sand into almost anything you can imagine (Apple products, Wii sets, flat screen TV, handheld music players) as well as the once unimaginable (Facebook, Ebay, MSN). Why do tech products get better and cheaper at the same time? How do these products, conjured out of sand like magic, affect the way we live today especially how we relate to one another? How can high-tech wastes and bi-products destroy communities and what can be done from legislation? These questions will be addressed in this course. What these questions have in common is one word: Silicon. Not fiction or myth; it is based on a true story (including the Valley). Never again will you look at the world of high tech fever in the same way.

This course aims to introduce students to how we have built our modern society on sand, literally. Students will learn how this is even possible (technology and history), how this translates to money (economics) and thinking through the opportunities that it opens up for entrepreneurs (business). Students will also be led to reflect on how these developments affect the way we live especially in our relationships (social studies) both at home and at work, notwithstanding some of the ethical and legal issues (law) involved.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Evaluate how silicon nanoelectronics has affected the way we live particularly in human relations as well as the unique social issues arising from their use	30	x		
2	Describe the history and context behind the birth of silicon nanoelectronics	10	x		
3	Explain general pricing trends in contemporary tech products by applying Moore's law	10		x	
4	Explain the workings of commonly found gadgets powered by silicon nanoelectronics and analyse the industries that produce them	20		x	
5	Describe the constraints of silicon nanoelectronics and the technological options for "More-than-Moore" of future nanoelectronics	30			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	<p>Large group activity involving the entire class registered on the course where the content pertaining to the particular CILO(s) is presented by the course instructor. The presentation will highlight the main issues concerned with each CILO, as well as the key concepts from each CILO. These will be mixed with broadcasts of selected clips from the wealth of online resources.</p>	1, 2, 3, 4, 5	3 hrs/wk
2	Team Huddle	<p>Students on the course are organized into teams. In response to the lecture material, each team will huddle for a time of brainstorming and work together on the group-based assessment tasks provided by the course instructor. By holding these sessions as part of the curriculum time, guidance is afforded to students in their discussions by the instructor and his tutors.</p>	3, 4	
3	Presentation	<p>Each team presents their findings to the rest of the class at the end of the period assigned for the group-based tasks to be completed. Presentation topics also include group findings of items researched on during a team huddle, some of which are used as formative assessments to provide regular feedback.</p>	1, 3, 4	

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Examination(Duration: 2 hrs)	1, 2, 3, 4, 5		
2	Team Project	1, 2, 3, 4	12	
3	Two Tests	2, 5	36	
4	Two Assignments	5	8	
5	Participation	1, 3, 4	4	

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

To pass the course, students are required to achieve at least 30% in the continuous assessment, 30% in examination.

Assessment Rubrics (AR)**Assessment Task**

Reflective Essay

Criterion

CAPACITY to EVALUATE the personal impact of technology

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Marginal

Failure (F)

Not even reaching marginal

Assessment Task

Team Project

Criterion

ABILITY to EXPLAIN the design, historical factors, industrial climate, social relevance of technology products.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Marginal

Failure (F)

Not even reaching marginal

Assessment Task

Quiz

Criterion

ABILITY to EXPLAIN the science behind the properties and processing of silicon and workings of silicon devices.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Marginal

Failure (F)

Not even reaching marginal

Assessment Task

Examination

Criterion

ABILITY to EXPLAIN the science behind the properties and processing of silicon, future technology trends on nanotechnology.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Marginal

Failure (F)

Not even reaching marginal

Part III Other Information

Keyword Syllabus

Moore's law, Silicon Valley, Integrated Circuits (IC), Nanoelectronics, More than Moore, Disruptive Innovation.

Reading List**Compulsory Readings**

Title	
1	John D. Cressler, "Silicon Earth: Introduction to the Microelectronics and Nanotechnology Revolution" (Cambridge University Press)

Additional Readings

Title	
1	Michael E. Porter, "Competitive Strategy: Techniques for Analyzing Industries and Competitors" (The Free Press) - MEP The selected excerpts from this text cover the concepts in CILOs 1-2 and 4
2	Clayton M. Christensen, "The Innovator's Dilemma: The Revolutionary Book that Will Change the Way You Do Business" (Collins Business Essentials) - CMC The selected excerpts from this text cover the concepts in CILOs 1-2 and 4
3	http://www.quickmba.com/strategy/porter.shtml
4	http://innovationzen.com/blog/2006/10/04/disruptive-innovation/
5	http://en.wikipedia.org/wiki/Silicon_Valley
6	http://www.siliconvalleyhistory.org/
7	http://sliceofsiliconvalley.com/story.html
8	http://en.wikipedia.org/wiki/Silicon
9	http://www.thomasnet.com/articles/plastics-rubber/silicone-products-industrial-applications
10	http://www.st.com/stonline/books/pdf/docs/5038.pdf

Annex (for GE courses only)

A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

Please indicate which CILO(s) is/are related to this PILO, if any (can be more than one CILOs in each PILO)

PILO 1: Demonstrate the capacity for self-directed learning

1, 3, 4

PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology

2, 5

PILO 3: Demonstrate critical thinking skills

1, 3, 4, 5

PILO 4: Interpret information and numerical data

3, 4, 5

PILO 5: Produce structured, well-organised and fluent text

1, 3, 4

PILO 6: Demonstrate effective oral communication skills

1, 3, 4

PILO 7: Demonstrate an ability to work effectively in a team

1, 3, 4

PILO 9: Value ethical and socially responsible actions

1

PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation

1, 3, 4

B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task

Team project report