SCHOOL OF ELECTRICAL, ELECTRONICS, AND COMPUTER ENGINEERING	Course Code and Title: ECEA125-1P MICROELECTRONICS 1	
	Curriculum: 2020-2023	Page 1 of 9
Prepared by: FEBUS REIDJ G. CRUZ	Approved by: FLORDELIZA L. VALIENTE	Revision Date: Aug 2023 / Effectivity Date: 1Q 2023-2024

VISION

Mapua University, a global leader in education, fosters sustainable socio-economic growth through innovation, digital transformation, and lifelong education.

MISSION

1. The University shall provide a learning environment in order for its students to acquire the attributes that will make them globally competitive.
2. The University shall engage in publishable and/or economically viable research, development and innovation.
3. The University shall provide state-of-the-art solutions to problems of industries and communities.

PROGRAM EDUCATIONAL OBJECTIVES	MISSION		
Within five years after graduation, graduates of the Electronics Engineering program should have:	1	2	3
1. Undertaken, singly or in teams, projects that show ability to solve complex engineering problems.	✓	✓	✓
2. Had substantial involvement in projects that take into consideration safety, health, environmental concerns and the public welfare, partly through adherence to required codes and laws.	✓	✓	✓
3. Demonstrated professional success via promotions and/or positions of increasing responsibility.	✓		
4. Demonstrated life-long learning via progress toward completion of an advanced degree, professional development/continuing education courses, or industrial training courses.	✓	✓	✓
5. Demonstrated technical expertise, professionalism, and ethics in ICT, entrepreneurship or other related fields in the practice of Electronics Engineering for the advancement of industry and society.	✓		✓

	ABET Student Outcomes	Program Educational Objectives				
		1	2	3	4	5
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	✓			✓	✓
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	✓	✓		✓	✓
3	An ability to communicate effectively with a range of audiences	✓	✓			✓
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts		✓	✓	✓	✓
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	✓	✓	✓	✓	✓
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	✓	✓		✓	✓
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	✓	✓	✓	✓	✓

	PTC and CHED Student Outcomes	Program Educational Objectives				
		1	2	3	4	5
A	An ability to apply knowledge of mathematics and science to solve complex engineering problems	✓			✓	✓
B	An ability to design and conduct experiments, as well as to analyze and interpret from data	✓	✓		✓	✓
C	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, in accordance with standards	✓	✓		✓	✓
D	An ability to function on multidisciplinary teams	✓	✓	✓	✓	
E	An ability to identify, formulate, and solve engineering problems	✓			✓	✓
F	An understanding of professional and ethical responsibility		✓	✓	✓	✓
G	An ability to communicate effectively	✓	✓			✓
H	The broad education necessary to understand the impact of engineering solutions in the global and societal context		✓		✓	✓
I	A recognition of the need for, and an ability to engage in life-long learning				✓	✓
J	A knowledge of contemporary issues	✓	✓		✓	✓
K	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	✓		✓		✓
L	Knowledge and understanding of engineering and management principles as a member and leader in a team, to manage projects in multidisciplinary environments	✓	✓	✓		✓
M	Understand at least one specialized field of Electronics Engineering practice		✓		✓	✓

COURSE SYLLABUS

1. **Course Code: ECEA125-1P**

2. **Course Title: MICROELECTRONICS 1**

3. **Pre-requisite: 3rd year standing**

4. **Co-requisite: none**

5. **Credit: 3 units / 3 lecture hours and 4.5 laboratory hours per week**

6. **Course Description:** An introductory course in microelectronics specialization. Comprised of three modules, namely: ECEA125-1PM1 - Microelectronics Overview, Technology, and Fabrication; ECEA125-1PM2 - Integrated Circuit Layer, Device, and Layout; and ECEA125-1PM3: Integrated Circuit Netlist, Model, and Simulation.

7. **Course Outcomes (COs) and Relationship to General Education Outcomes**

After completing the course, the students must be able to:	Student Outcomes* ABET							Student Outcomes* PTC and CHED												
	1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L	M
Module 1: Microelectronics Overview, Technology, and Fabrication																				
1. Explain the scope of microelectronics and illustrate the process flow of integrated circuit fabrication.	R					R		R	R	R								R		R
Module 2: Integrated Circuit Layer, Device, and Layout																				
2. Make use of design rules and apply the properties of layers to draw the layout of integrated circuit.	R					R		R	R	R								R		R
Module 3: Integrated Circuit Netlist, Model, and Simulation																				
3. Utilize the device models in circuit simulation tool to develop and to characterize a sample integrated circuit.	R					R		R	R	R								R		R

Level: I – Introduced; R – Reinforced; D – Demonstrated

8. **Outcome-Based Modular Course Design**

Course Title	Credit Units	Module Code	Module Title	Lec Hrs.	Lab Hrs.	Weeks	Credit Units	Pre-requisites	May be taken if remedial
Microelectronics 1	3	ECEA125-1PM1	Microelectronics Overview, Technology, and Fabrication	12	18	4	1		Yes
		ECEA125-1PM2	Integrated Circuit Layer, Device, and Layout	12	18	4	1		Yes
		ECEA125-1PM3	Integrated Circuit Netlist, Model, and Simulation	9	13.5	3	1		Yes

9. Course Coverage

Week	Topic	Session	TLA			AT			Learning Objects	CO
			F2F (Onsite)	Synchronous Online	Asynchronous Online	F2F (Onsite)	Synchronous Online	Asynchronous Online		
Module 1: Microelectronics Overview, Technology, and Fabrication										
1	Course Orientation Microelectronics Overview	1	Lecture Discussion						-Syllabus -Lecture recording	CO1
	CMOS Fabrication	2		Access to eBooks					-Ch.7 CMOS Fabrication in: CMOS Circuit Design, Layout, and Simulation by R. Jacob Baker	
2	CMOS Unit Processes	3	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.7 CMOS Fabrication	
		4		Online Assessment Access to eBooks			Coursework 1			
3	CMOS Process Integration	5	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.7 CMOS Fabrication	
		6		Online Assessment Access to eBooks			Coursework 2			
4	Backend Processes	7	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.7 CMOS Fabrication	
	Microelectronics Overview, Technology, and Fabrication	8	Problem-based Learning			Exam 1				

Week	Topic	Session	TLA			AT			Learning Objects	CO
			F2F (Onsite)	Synchronous Online	Asynchronous Online	F2F (Onsite)	Synchronous Online	Asynchronous Online		
Module 2: Integrated Circuit Layer, Device, and Layout										
5	The Well	9	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.2 The Well	CO2
		10		Online Assessment Access to eBooks			Coursework 3			
6	The Metal Layers	11	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.3 The Metal Layers	
		12		Online Assessment Access to eBooks			Coursework 4			
7	The Active and Poly Layers	13	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.4 Active & Poly Layers	
		14		Online Assessment Access to eBooks			Coursework 5			
8	Integrated Circuit Layers, Devices, and Layout	15	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.5 Resistors, Capacitors, MOSFETs	
		16	Problem-based Learning			Exam 2				

Week	Topic	Session	TLA			AT			Learning Objects	CO
			F2F (Onsite)	Synchronous Online	Asynchronous Online	F2F (Onsite)	Synchronous Online	Asynchronous Online		
Module 3: Integrated Circuit Netlist, Model, and Simulation										
9	Resistors, Capacitors, MOSFETs	17	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.5 Resistors, Capacitors, MOSFETs	CO3
		18		Online Assessment Access to eBooks			Coursework 6			
10	MOSFET Operation	19	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.6 MOSFET Operation	
		20		Online Assessment Access to eBooks			Coursework 7			
11	Integrated Circuit Netlist, Model, and Simulation	21	Lecture Discussion						-Lecture recording -Micro-video lecture -Students' works -Ch.5 Rs, Cs, MOSFETs -Ch.6 MOSFET Operation	
		22	Problem-based Learning			Exam 3				

10. Lifelong-Learning Opportunities

The students will use computer-aided-design tools to draw the layout of integrated circuits; and to run simulations for the analysis and characterization of microelectronics devices and circuits; and eventually, design their own integrated circuits.

11. Contribution of Course to Meeting the Professional Component

Engineering Topics: 100%

12. Prescribed E-Book and Courseware

CMOS Circuit Design, Layout, and Simulation by R. Jacob Baker, 4th Edition, John Wiley and Sons, 2019.

13. Other References and Educational Resources

Microelectronics by Behzad Razavi, 2nd Edition International Student Version, John Wiley & Sons, 2015.
Understanding Microelectronics: A Top-Down Approach by Franco Maloberti, John Wiley & Sons, 2012.
Solid State Physics: An Introduction by Philip Hofmann, Second Edition, Wiley, 2015.
Microelectronic Circuits: Analysis and Design by Rashid, 3rd Edition, Cengage, 2017.
Mapua E-Text Infinity Solution (METIS).

14. Course Evaluation

Student performance will be rated based on the following:

Assessment Tasks	Weight	Minimum Average for Satisfactory Performance
Coursework	30%	21%
Module Exam	70%	49%
Total	100%	70%

The module grades will correspond to the weighted average scores shown below:

Average	Module Grade	Average	Module Grade
0.00 – 34.99	5.00	83.00 - 85.99	2.00
35.00 – 69.99	IP	86.00 - 89.99	1.75
70.00 - 72.99	3.00	90.00 - 92.99	1.50
73.00 - 75.99	2.75	93.00 - 95.99	1.25
76.00 - 79.99	2.50	96.00 - 100.00	1.00
80.00 - 82.99	2.25	For approved medical reasons only	I

The module grade average will be the weighted average of the module grades based on the credit units of each module:

$$\text{Module Grade Average} = \frac{\sum_{i=1}^{\text{no of modules}} \left(\text{credit unit}\right)_i \left(\text{module grade}\right)_i}{\text{total credit units of the course}}$$

The course grade will be determined from the module grade average using the table below:

Module Grade Average (MGA)	Course Grade
1.00 ≤ MGA ≤ 1.10	1.00
1.10 < MGA ≤ 1.40	1.25
1.40 < MGA ≤ 1.60	1.50
1.60 < MGA ≤ 1.85	1.75
1.85 < MGA ≤ 2.10	2.00
2.10 < MGA ≤ 2.40	2.25
2.40 < MGA ≤ 2.60	2.50
2.60 < MGA ≤ 2.85	2.75
2.85 < MGA ≤ 3.00	3.00
IP	IP
5.00	5.00

15. Other Course Policies

a. Attendance
According to CHED policy, a student's total number of absences should not be more than 20% of the total number of meetings or 9 hours for a three-unit course. Students incurring more than 9 hours of unexcused absences automatically get a failing grade regardless of class standing.

b. Guided Learning Output
Guided learning outputs through various worksheets in each cluster of topics are assigned to the students. Problems encountered in the worksheets will be discussed in class.

c. Written Examination
Exams will be given face-to-face for Tri-X, Bio-X, and Blended modes and online for UOX.

d. Course Portfolio
Selected guided learning outputs and examinations are to be compiled and collected before the end of the term. The selection is based on statistical data gathering (lowest, median, highest). Guided learning outputs and examinations with marks lowest, median, and highest must be photocopied and must be given back to the instructor for course portfolio keeping.

e. Language of Instruction
Lectures, discussion, and documentation will be in English. Written and spoken work may receive a lower mark if it is, in the opinion of the instructor, deficient in English.

f. Dress and Grooming Codes
All of us have been instructed on the Dress and Grooming Codes of the University.

g. Academic Integrity Policy
It is the student's responsibility to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions. Any of the following sanctions may be imposed on any student who is found guilty of committing online academic dishonesty:
a. Failed mark in the course.
b. Suspension for a period of less than one term, with or without community service.
c. Suspension for a period of one term or more, with or without community service.
d. Non-readmission to the University.
e. Dismissal from the University.
f. Expulsion.

The following are considered academic dishonesty:

1. Using another MyMapua email address to log in to any platform (such as BlackBoard and Coursera) with or without permission.
2. Asking or hiring someone else to do their exams, homework, Coursera course, papers, projects, or other academic requirements.
3. Recording and saving copies of exam questions or answers, or answer keys for distribution.
4. Receiving copies of exam questions or answers, or answer keys to an exam from someone who has already taken it.
5. Plagiarizing or the unethical act of stealing the thoughts of another without proper citation or reference, acquiring information from the Internet without acknowledging the author, copying from another student's work without permission, and submitting it as own work.
6. Massive, pre-meditated, organized online cheating using instant messaging/email during a quiz or exam.
7. Any form of dishonesty in peer-reviewed assignments/submissions (e.g., Coursera peer-graded submissions).
8. Engaging in any activities that will dishonestly improve results, or dishonestly improve or damage the results of others.
9. Any other form of dishonesty or cheating in any assessment or course requirement.

All students who violate the Academic Integrity Policy of the university will be given zero marks for the exam or for the activity and will be given a failing grade for the course. He or she will also be referred to the Prefect of Discipline for appropriate sanction.

h. Consultation Schedule

Consultation schedules with the Professor are posted outside the EECE Faculty room and in the School web page (http://eece.mapua.edu.ph). It is recommended that the student first set an appointment to confirm the instructor's availability.

i. Appeal System

All appeals on student assessment must be made by the concerned student within one week after the return of the assessed student work.

In case the student is not satisfied, no later than one week after the decision of the faculty has been made, he can elevate the appeal to the program chair or dean in case there is no program chair. The decision of the program chair or dean is final. The faculty must abide with the moderated decision of the program chair or dean.

j. Use of Generative AI

It is expected that students will adhere to generally accepted standards of academic honesty, including but not limited to refraining from cheating, plagiarizing, misrepresenting one's work, and/or inappropriately collaborating. This includes the use of generative AI tools that have not been cited or documented or authorized. Students will also be expected to adhere to the prescribed professional and ethical standards of the profession/discipline for which the student is preparing. Any student who engages in academic dishonesty or who violates the professional and ethical standards for the profession/discipline for which the students is preparing, may be subject to academic sanctions as the University's academic Integrity Policy.

16. Course Materials to be Provided to Students

16.1. Syllabus
16.2. Lecture recording

17. Committee Members

Febus Reidj G. Cruz
Ramon G. Garcia
Joseph Bryan G. Ibarra
Mary Ann E. Latina
Charmaine C. Paglinawan
Flordeliza L. Valiente
Leonardo L. Valiente Jr.