University:	Benha University
Faculty:	Faculty of Engineering at Shoubra
Department offering the program:	Electrical Engineering Department
Department offering the course:	Communications and Computer Engineering Program

1- Course Data (Basic Information)

Course Code & Title: CCE201 Solid State Electronic Devices **Semester/Year:** first / 2022-2023
Prerequisite Course(s): EMP104 Physics (2)   **Core or Elective:** Core Course
Credit Hours: 3   **Weekly Contact Hours**: **Lecture:** 2   **Tutorial:** 2   **Laboratory:** 0

2- Course Aims

The aim of this course is to provide students with the basic knowledge related to the concepts and theories to the fundamentals of electronic engineering. Moreover, understand semiconductor physics and the main differences between types of materials like conductors, insulators and semiconductors. Identify the behaviors of intrinsic and extrinsic semiconductors. And describe the process of PN junctions with/without applied voltage. Also study the V-I characteristics of conventional diodes and special purpose types. Describe principles of analyzing and design of BJT electronic circuits. Finally describe principles of analyzing and design of FET electronic circuits.

3- Course Contents (As indicated in the program Bylaw)

Basics of semiconductor physics – Fermi-Dirac distribution – Carriers concentrations – Intrinsic and Extrinsic materials – Charge neutrality – Currents in Semiconductors (drift current – diffusion current) – Semiconductor parameters (mobility, Scattering, lifetime) – Hall effect – PN junction theory – Diode IV characteristics – large and small analysis – Analog and digital diode applications (Rectifiers, Clipping circuits, Clamping Circuits, multipliers) – Special purpose diodes (Light emitting diodes, photo diodes, Zener diode and its applications) – Basics of Bipolar junction transistors (BJT) and field effect transistors (FET) – physical operations, characteristics, specifications.

4- Program Competencies Served by The Course (A1, A2,A5,A8 and B2,B5)

Level (A) Engineering Competencies

On completing this course, students will be able to:

A.1 Identify, formulate, and solve electronic engineering problems by applying fundamentals of design including elements design, process and/or a system related to specific Principles of Electronic Engineering

A.2 Develop and conduct appropriate simulation using Proteus, analyze and interpret data, and assess and evaluate findings to draw conclusions.

A.5 Practice research techniques and methods of investigation as an inherent part of learning.

A.8 Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools, by performing presentations about a selected topic decided during the semester.

Level (B) Electrical Engineering Competencies

At the end of this course, the students will be able to:

B.2 Design, model and analyze electronic engineering system for a specific application; and identify the tools required to optimize this system.

B.3 Design and implement: elements, modules, sub-systems or systems in electronic engineering using technological and professional tools.

Level (C) Communications and Computer Engineering Competences

This course is a preliminary course, and it does not serve any specific competencies of Electronics and Communications Eng. Program.

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Define concepts and theories of sciences, appropriate to the Principles of Electronic Engineering.
LO2	Apply different techniques of applying fundamentals of design including elements design, process and/or a system related to specific Principles of Electronic Engineering.
LO3	Construct the relation between Currents in Semiconductors (drift current – diffusion current).
Psychomotor Domain	
LO4	Select the appropriate simulation tool using Proteus, analyze and interpret data.
LO5	Check the PN , diode theory to study analog and digital diode applications (Rectifiers, Clipping circuits, Clamping Circuits, multipliers.
Affective Domain	
LO6	Analyze and evaluate responses of circuits containing diode, BJT and FET according to fundamental Principles of Electronic Engineering.

6- Mapping Learning Outcomes (LO's) with Competencies

LO's NARS	A1	A2	A5	A8	B2	B3
Cognitive Domain						
LO1	■					
LO2			■			
LO3		■				
Psychomotor Domain						
LO4						■
LO5					■	
Affective Domain						
LO6	■					

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes					
			LO1 A1-1	LO2 A5-2	LO3 B2-1	LO4 B3-2	LO5 B2-1	LO6 A1-1
W1	Semiconductor physics	4	■		■		■	
W2	The characteristics of conductors, insulators and semiconductors	4				■		
W3	The doping in semiconductors	4				■		
W4	Intrinsic & extrinsic Fermi level	4		■				
W5	Conductivity and mobility in semiconductors	4			■			
W6	Currents in Semiconductors	4				■		
W7	Thirty exam	4				■		
W8	PN junction and Diode characteristics	4					■	

Week	Topics	Planned Hours	Learning Outcomes					
			LO1 A1-1	LO2 A5-2	LO3 B2-1	LO4 B3-2	LO5 B2-1	LO6 A1-1
W9	Diode applications	4						
W10	Special purpose diodes and its applications	4					■	
W11	Basics of Bipolar junction transistors (BJT)	4						■
W12	Applications and analysis of BJT circuits	4						■
W13	Basics of field effect transistors (FET)	4						
W14	Applications and analysis of FET circuits	4						■

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	●		●						●	●
	LO2	●		●	●					●	●
	LO3	●	●	●							
Psychomotor Domain	LO4		●	●			●			●	
	LO5	●		●	●		●	●	●	●	
Affective Domain	LO6	●		●	●						●

Student Academic Counseling and Support

• Students are directed to contact teaching staff for academic support during specific office hours.

- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●			●				●		●
	LO2	●				●			●		●
	LO3		●		●	●			●		
Psychomotor Domain	LO4		●					●			
	LO5	●			●	●	●			●	
Affective Domain	LO6	●			●						●

b- Assessment Schedule and Weight

Assessment Tools	Week	Weight
Midterm Examination	7	30 %
Final Examination	(As Schedule)	40 %
Quizzes	5	5 %
Home assignments	12	5 %
Mini Project	10	20 %
Total		**100** %

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- ■ Lecture Hall
- ■ Sound and Microphone
- □ Other: ………………

- □ Smart Board
- ■ White Board
- ■ Data Show

- □ Computer with software
- ■ MIS system
- ■ Internet Access

11- List of References

a- Course Notes

Lectures Notes in PDF
https://bu.edu.eg/staff/sherifsalah3-courses/14354

b- Books

1. D. A. Neaman, Semiconductor Physics and Devices: Basic Principles, 3rd Edition, McGraw-Hill (2003).
2. S. M. Sze and Kwok K. Ng, Physics of Semiconductor Devices, 3rd Edition, John Wiley & Sons, Inc. (2007).

c- Recommended Books

1. B. G. Streetman, Solid State Electronic Devices, Prentice-Hall (2006).
2. R. Boylestad, Electronic Devices and Circuit Theory, 11th edition, Prentice Hall.
3. Alexander/Sadiku, Fundamentals of Electric Cricuits, 4th Ed.

d- Web Sites

- Course Coordinator: Dr. Ahmed Samir Mohamed   **Signature:**

- Program Coordinator: Prof. Dr. Hala Abdel-kader   **Signature:**