

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Electrical Engineering Department

1- Course Data (Basic Information)

Course Code: EPE448 **Course Title:** Applications of Power Electronics
Semester/Year: Second/ 2020-2021 **Core or Elective:** elective Course
Weekly Contact Hours: 4 **Lecture:** 2 **Tutorial:** 2 **Laboratory:** 0

2- Course Aims

The aim of this course is to provide students with some power electronics applications based on different converters. Moreover, employ the methods of design the rectifier output filters, drive circuits and protections of power electronics switches. Finally, identify the analysis of some power electronics applications.

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

Design Considerations in rectifiers, inverters, AC voltage controllers and choppers circuits, DC and AC power supplies, DC and AC motors control.

4- Program Competencies Served by The Course (B4 , C1, and C4)

Level (B) Electrical Engineering Competencies

B.4 Estimate and measure the performance of an electrical system and circuit under specific input excitation and evaluate its suitability for a specific application.

Level (C) Electrical Power and Machines Engineering Competencies

C.1 Identify and formulate engineering problems to solve problems in the field of electrical power and machines engineering.

C. 4 Apply modern techniques, skills and engineering tools to electrical power and machines engineering systems.

5- Learning Outcomes (LO's)

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

Cognitive Domain	
LO1	Identify the types and characteristics of power semiconductor switches
LO2	Design consideration of rectifiers output filters
LO3	Analyze HVDC application and VSI
Psychomotor Domain	
LO4	Modify the performance of different converters
LO5	Design the converter protection circuits and drive circuit
Affective Domain	
LO6	Develop applications of the AC regulator, inverter, chopper, and DC power supplies

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

LO's \ NARS	B4	C1	C4
Cognitive Domain			
LO1	■		
LO2			■

Competency-Based Learning Outcomes Course Specifications (2nd Semester 2021/2022)

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	LO2	LO3	LO4	LO5	LO6
W1	Types of Power electronics applications,	4	■			■		
W2	Analysis of load L-filter, LC-filter in rectifier circuit	4	■	■				
W3	Three-phase inverter	4		■				
W4	PWM inverter	4		■				
W5	<ul style="list-style-type: none"> Characteristics of semiconductor switches Switching losses of SCR, BJT, MOSFET and IGBT 	4	■			■		
W6	<ul style="list-style-type: none"> Conduction losses of SCR, BJT, MOSFET and IGBT Design of snubber circuits 	4				■		
W7	Analysis and design of the component of snubber circuits	4	■					
W8	Types and characteristics of heat sink	4	■				■	
W9	Design of the triggering circuits of SCR	4		■			■	
W10	Design of driving circuits of BJT	4					■	
W11	Design of driving circuits of MOSFET	4						■
W12	Design of driving circuits of IGBT	4		■			■	
W13	Comparison between the different power semiconductor switches and their drive circuits.	4	■	■			■	
W14	Practical applications	4						■

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

8) Teaching and Learning Methods

Competency-Based Learning Outcomes Course Specifications (2nd Semester 2021/2022)

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

Cognitive Domain		Learning Outcomes	Assessment Methods									
			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	●		●		●			●			●

Competency-Based Learning Outcomes Course Specifications (2nd Semester 2021/2022)

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

b- Assessment Schedule and Weight

Assessment	Week	Weight
Midterm Examination	7	15 %
Final Examination	(As Schedule)	70 %
Quizzes (2 times)	5, 12	5 %
Home assignments, and Reports	2, 4, 8, 11	2 %
Mini Project	8	8 %
Total		100 %

10- Facilities

The following facilities are needed for this course:

- | | | |
|---|---|---|
| <input checked="" type="checkbox"/> Classroom | <input type="checkbox"/> Smart Board | <input type="checkbox"/> Computer with software |
| <input type="checkbox"/> Lecture Hall | <input checked="" type="checkbox"/> White Board | <input checked="" type="checkbox"/> MIS system |
| <input type="checkbox"/> Sound and Microphone | <input checked="" type="checkbox"/> Data Show | <input checked="" type="checkbox"/> Internet Access |
| <input type="checkbox"/> Other: | | |

11- List of References

a- Course Notes

Lectures Notes in Microsoft team

b- Books

1. Miguel Castilla. “Control Circuits in Power Electronics”, 1st edition, The Institution of Engineering and Technology, 2016.
2. Robert W. Erickson, "Fundamental of Power Electronics ",Springer, 3rd Edition, 2020.
3. P.S. Bimbhra: “Power Electronics”, Khanna Publishers, India, 2007

c- Recommended Books

1. Daniel W. Hart: “Power Electronics”, McGraw-Hill Companies, USA, 2011
2. M. H. Rashid: “Power Electronics, Circuits, Devices and Applications”, Third Edition, Prentice Hall, 2003

- Course Coordinator: Prof. Hamed Gala Hamed

Signature

Dr. Khaled Hassannen& Dr. Islam Mohamed

Signature:

- Program Coordinator: Asoci. Prof. Mohamed Ibrahim

Signature: