University of Sana'a
Faculty of Engineering
Department: Biomedical Engineering
Title of the Program: Biomedical Engineering

Course Specification of Power Electronics and Drivers

Course Code (BE326)

I. Course Identification and General Information:						
1	**Course Title:**	Power Electronics and Drivers				
2	**Course Code & Number:**	BE326				
3	**Credit hours:**	C.H				TOTAL
		Th.	Seminar	Pr	Tr.	
		2	--	2	--	3
4	**Study level/ semester at which this course is offered:**	Fourth Level / First Semester				
5	**Pre –requisite (if any):**	Electronics2 (BE223) & Electrical Machines(BE214)				
6	**Co –requisite (if any):**	None				
7	**Program (s) in which the course is offered:**	Biomedical Engineering Program				
8	**Language of teaching the course:**	English				
9	**Location of Teaching the Course:**	Faculty of Engineering				
10	**Prepared by:**	Assoc. Prof. Dr. Radwan AL Bouthigy				
11	**Reviewed by:**	Assoc. Prof. Dr. Farouk Al-Fahaidy				
12	**Date of Approval:**					

I. Course Description:

This course is prepared to provide students with the principle concepts in the field of power electronics and drives as enabling technologies. This is an introductory course to power electronics with emphasis on applications such as energy conservation and renewable energy. Topics include introductory switching devices, devices for power electronics, and converter design and simulation. Basic concepts of DC-DC converters in continuous and discontinuous modes are included, DC- AC inverter along with design for motor drives. Laboratory experiments and MATLB simulation tool will be carried for different types of power electronics elements to verify the theoretical concepts related to power electronics devices practicing.

III. Course Intended learning outcomes (CILOs) of the course (maximum 8CILOs)		**Referenced PILOs** (Only write code number of referenced Program Intended learning outcomes)
Knowledge and Understanding: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
a1	Distinguish the common power control devices includes, diodes, Thyristors and transistors and their circuits.	A1 Describe and explain the underlying mathematical methods and theories; life scientific-principles; and engineering core concepts related to the Biomedical Engineering context.
a2	Explain the dynamic modeling of Induction and synchronous motor drive and the V/f, vector control and speed control of Induction/ synchronous motors.	A3 Recognize and explain the need for a high level of management, professional and ethical behavior, responsibility, quality assurance systems, codes of practice, standards, health and safety requirements, and environmental impacts in biomedical systems.
B. Cognitive/ Intellectual Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
b1	Analyze relevant technical	B2 Identify, formulate and solve the complex

	problems in the field of power electronics and drives, and suggest an optimum solution, by applying a systematic design methodology.	problems related to the Biomedical Engineering fields in a creative and innovative manner by using a systematic and analytical thinking methods.
b2	Evaluate the operation conditions, modeling and designing principles of DC/DC chopper, DC/AC inverter and induction motor drive using mathematical models and computer simulation.	B3 Design the biomedical systems or processes within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
C. Professional and Practical Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
c1	Use the electronic instrumentation and modern simulation tools to design, implement, and test power electronic circuits, electric drives and useful power control project.	C2 Use a wide range of analytical tools, techniques, IT, modern engineering tools, software packages and develop required computer programs to solve, modeling and analyzing Biomedical Engineering problems.
c2	Conduct laboratory experiments safely to verify theoretical concepts related to power electronics components and biomedical systems	
D. Transferable Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
d1	Perform effectively within multi-disciplinary teams to reach to a collaborative environment.	D1 Lead and motivate individuals, show capability to work in stressful environments and within constraints, collaborate effectively within multidisciplinary team.
d2	Share ideas, communicate with	D2 Acquire entrepreneurial skills and effectively

	others and apply quantitative reasoning skills to solve problems.	manage tasks, time, processes and resources.

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Distinguish the common power control devices includes, diodes, Thyristors and transistors and their circuits.	• Staff-led lectures, • Interactive class discussions, • Exercises and home works.	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Design and problem solving exercises, • Coursework activities assessment,
a2. Explain the dynamic modeling of Induction and synchronous motor drive and the V/f, vector control and speed control of Induction/ synchronous motors	• Staff-led lectures, • Interactive class discussions, • Exercises and home works.	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Design and problem solving exercises, • Coursework activities assessment.

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Analyze relevant technical problems in the field of power electronics and drives, and	• Staff-led lectures, • Interactive class discussions, • Exercises and home works,	• Written tests (mid and final terms and quizzes), • Home works and

suggest an optimum solution, by applying systematic design methodology.	• Computer laboratory-based sessions.	assignments, • Coursework activities assessment.
b2. Evaluate the operation conditions, modeling and design principles of DC/DC chopper, DC/AC inverter and induction motor drive using mathematical models and computer simulation.	• Staff-led lectures, • Interactive class discussions, • Exercises and home works, • Computer laboratory-based sessions.	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Design and problem solving exercises.

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1. Use the electronic instrumentation and modern simulation tools to design, implement, and test power electronic circuits, electric drives and useful power control project.	• Individual design projects, • Laboratory/Practical experiments based session, • Experiential workshop practice, • Team work (cooperative learning).	• Coursework activities assessment, • Project work assessment, • Project reports (individual and group) assessment.
c2. Conduct laboratory experiments safely to verify theoretical concepts related to power electronics components and biomedical systems	• Individual design projects, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Experiential workshop practice, • Team work (cooperative learning).	• Computer Lab performance assessment, • Coursework activities assessment, • Project work assessment, • Project reports (individual and group) assessment.

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Perform effectively within multi-disciplinary teams to reach to a collaborative environment.	• Directed self- study, • Student-led seminars and presentations, • Individual design projects, • Computer laboratory-based sessions, • Team work (cooperative learning),	• Computer Lab performance assessment, • Oral and visual presentations, • Project reports (individual and group) assessment.
d2. Share ideas, communicate with others and apply quantitative reasoning skills to solve problems.	• Directed self- study, • Student-led seminars and presentations, • Individual design projects, • Computer laboratory-based sessions, • Team work (cooperative learning).	• Computer Lab performance assessment, • Oral and visual presentations, • Project reports (individual and group) assessment.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	**Introduction**	a1	– Power Electronics Defined – Power semiconductor devices	**1**	**2**

			– Power Diodes – Power Transistors – Thyristors and TRIAC		
2	**Uncontrolled Rectifiers**	b1,b2,	– Single phase uncontrolled rectifiers – Three phase uncontrolled rectifiers – Harmonic analysis – Output voltage with LC filter	**1**	**2**
3	**Controlled Rectifiers**	b1,b2,	– Single phase controlled rectifiers – Three phase controlled rectifiers – Harmonic analysis – Power factor improvement	**1**	**2**
4	**DC –DC Chopper Converters**	a1,b1,b2,	– Step down chopper converter – Step up chopper converter – Classifications of chopper converter	**1**	**2**
5	**DC – AC Inverters**	a1,b1,b2	– Single-Phase Voltage Source Inverters – Three-Phase Voltage Source Inverters – Current Source Inverters – Pulse width modulation technique	**3**	**6**

			– Voltage Control of Three-Phase Inverters – Closed-Loop Operation of Inverters		
6	**Mid-Term Theoretical Exam**	a1,a2,b1,b2	– All Topics	**1**	**2**
7	**AC Voltage converter**	a1, b1,b2	– Single Phase AC Controllers. – Three Phase AC Controllers. – Harmonic analysis – Cycloconverters	**1**	**2**
8	**DC drives**	a1, b1,b2,	– Single phase drives – Three phase drive – Chopper drives – Closed loop control of DC motors	**3**	**6**
9	**AC drives**	a2,b1,b2,	– Stator voltage control – Rotor voltage control – Frequency control – Voltage frequency control – Current control – Voltage, current and frequency control – Closed loop control of induction motor – Synchronous motor control	**3**	**6**
10	**Final Theoretical Exam**	a1,a2,b1,b2	– All Topics	**1**	**2**

Number of Weeks /and Units Per Semester	16	32

B - Practical Aspect: (if any)

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	- Safety regulations and requirements in electrical laboratories. - Introduction to main laboratory devices and instrumentations. - Introduction to main measurement devices. - Reporting format.	1	2	a1
2	- Diodes, SCR and TRIC Characteristics	1	2	c1,c2,d1,d2
3	- Single phase half and full wave uncontrolled rectifier - Simulating uncontrolled rectifiers by using MATLAB	1	2	c1,c2,d1,d2
4	- Three phase half	1	2	

	wave and full wave uncontrolled rectifier - **Simulating uncontrolled rectifiers by using MATLAB**			c1,c2,d1,d2
5	- **Single phase half wave and semi wave controlled rectifier** - **Simulating uncontrolled rectifiers by using MATLAB**	1	2	,c1,c2,d1,d2
6	- **Single phase full wave controlled rectifier** - **Simulating controlled rectifiers by using MATLAB**	1	2	c1,c2,d1,d2
7	- **Three phase half wave and full wave controlled rectifier** - **Simulating controlled rectifiers by using MATLAB**	2	4	c1,c2,d1,d2

8	**Mid-Term Practical Exam**	1	2	c1,c2
9	- **Induction motors control used inverters** - **Simulating Induction motors control used inverters by using MATLAB**	2	4	c1,c2,d1,d2
10	- **Induction motors control used volt/herts control** - **Simulating uncontrolled volt/herts control by using MATLAB**	2	4	c1,c2,d1,d2
11	- **Slip power control of wound rotor induction motors** - **Simulating uncontrolled Slip power control by using MATLAB**	1	2	c1,c2,d1,d2
12	**Final Practical Exam**	**1**	2	c1,c2
Number of Weeks /and Units Per Semester			**15**	**30**

C. Tutorial Aspect:

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	None			
Number of Weeks /and Units Per Semester		--	--	

V. Teaching Strategies of the Course:

- Staff-led lectures,
- Interactive class discussions,
- Tutorials,
- Exercises and home works,
- Laboratory/Practical experiments based session,
- Computer laboratory-based sessions,
- Team work (cooperative learning).
- Directed self- study,
- Individual design projects.

VI. Assessment Methods of the Course:

- Written tests (mid and final terms and quizzes),
- Home works and assignments,
- Coursework activities assessment,
- Design and problem solving exercises,
- Computer Lab performance assessment,
- Project work assessment,
- Project reports (individual and group) assessment,

VI. Assessment Methods of the Course:

- Oral and visual presentations.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	**Assignments1:** Comparison between types of power diodes	b1,b2,c2	3	2
2	**Assignments2:** Design and implementation of uncontrolled rectifier circuits using MATLAB tools	b1,b2,c2	5	2
3	**Assignments3:** Design and implementation of controlled rectifier circuits using MATLAB tools	b1,b2,c2	9	2
4	**Assignments4:** Design and implementation of DC – DC choppers circuits using MATLAB tools	b1,b2,c2,d2	11	2
5	**Assignments5:** Design and implementation of DC- AC rectifier circuits using MATLAB tools	b1,b2,c2,d1	13	2
Total				10

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	**Assignments**	3,5, 10,13,14	10	6.67%	a1,a2, b1,b2,c2
2	**Quizzes 1 & 2**	6, 12	10	6.67%	a1, a2, b1,b2
3	**Mid-Term Theoretical Exam**	8	20	13.33%	a1, a2, b1,b2
4	**Mid-Term Practical Exam**	9	20	13.33%	c1,c2
5	**Final Practical Exam**	15	30	20%	c1,c2
6	**Final Theoretical Exam**	16	60	40%	a1, a2, b1, b2
Total			150	100%	

IX. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

Example

1- Niku, Saeed B., 2011, **Introduction to Robotics: Analysis, Control, Applications**, 2nd Edition, USA, Wiley.

1- Required Textbook(s) (maximum two).

1. M. H. Rashid, 2014, "Power electronics: circuits, devices, and applications," 4th edition, Prentice Hall
2. Austin Hughes, (2019) Electric Motors and Drives Fundamentals, Types and Applications, 5th Edition, Newnes.

2- Essential References.

1. Robert W. Erickson, 2020, "Fundamentals of Power electronics", 3rd edition, Springer.
2. Ned Mohan, 2002, Power Electronics: Converters, Applications, and Design, 3rd edition, Wiley
3. Fang Lin Luo, Hong Ye, Muhammad Rashid,2005, "Digital Power Electronics and Applications", Elsev USA
4. Paul Scherz,2016, Practical Electronics for Inventors, 3rd , McGraw-Hill Education

	5. Philip Krein, 2014,Elements of Power Electronics,2nd, Oxford University Press;
3- Electronic Materials and Web Sites *etc*.	
	Websites: 1- Power electronics books https://www.goodreads.com/shelf/show/power-electronics http://www.circuitstoday.com/3-good-books-to-learn-power-electronics https://electricalbaba.com/best-book-power-electronics/Journals: Journals: 1- IEEE Transactions on power electronics: Peer reviewed academic journal in the field of power electronics, with emphasis on mathematical and theoretical approaches. https://www.ieee-pels.org/publications/ieee-transactions-on-power-electronics 2 - International Journal of Power Electronics and Drive Systems (IJPEDS): The leading peer reviewed academic journal in robotics with a focus on formal experiments as well as theory. http://ijpeds.iaescore.com/index.php/IJPEDS 3- Journal of power electronics (JPE): The leading peer reviewed academic journal in robotics with a focus on formal experiments as well as theory. https://jpels.org/https://journals.sagepub.com/home/ijr Other Web Sources: 1- www.goelectricdrive.com/ 2 - www.electricmachinery.com/ 3- www.goelectricdrive.com/ 4 - http://www.ece.tamu.edu/~empelab/

X. Course Policies:

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university

	Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He/she is permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam
4	**Assignments & Projects**: In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.
5	**Cheating**: For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.
7	**Other policies**: - Mobile phones are not allowed to use during a class lecture. It must be closed; **otherwise** the student will be asked to leave the lecture room. - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments might be given directly to students using soft or hard copy.

University of Sana'a
Faculty of Engineering
Department: Biomedical Engineering
Title of the Program: Biomedical Engineering

Template for Course Plan (Syllabus)

Power Electronics and Drivers (BE326)

I. Course Identification and General Information:					
1	**Course Title:**	Power Electronics and Drivers			
2	**Course Code & Number:**	BE326			
3	**Credit Hours:**	**Credit Hours**	**Theory Hours**		**Lab. Hours**
			Lecture	**Exercise**	
		3	2	--	2
4	**Study Level/ Semester at which this Course is offered:**	Fourth Level / First Semester			
5	**Pre –Requisite (if any):**	Electronics2 (BE223) & Electrical Machines(BE214)			
6	**Co –Requisite (if any):**	None			
7	**Program (s) in which the Course is Offered:**	Bachelor of Biomedical Engineering			
8	**Language of Teaching the Course:**	English			
9	**Location of Teaching the Course:**	Faculty of Engineering			
10	**Prepared by:**	Assoc. Prof. Dr. Radwan AL Bouthigy			
11	**Reviewed by:**	Assoc. Prof. Dr. Farouk Al-Fahaidy			
12	**Date of Approval:**				

II. Course Description:

This course is prepared to provide students with the principle concepts in the field of power electronics and drives as enabling technologies. This is an introductory course to power electronics with emphasis on applications such as energy conservation and renewable energy. Topics include introductory switching devices, devices for power electronics, and converter design and simulation.

Basic concepts of DC-DC converters in continuous and discontinuous modes are included, DC- AC inverter along with design for motor drives. Laboratory experiments and MATLB simulation tool will be carried for different types of power electronics elements to verify the theoretical concepts related to power electronics devices practicing.

III. Course Intended Learning Outcomes (CILOs): (مخرجات تعلم المقرر)

A. Knowledge and Understanding: Upon successful completion of the course, students will be able to:	
a1	Distinguish the common power control devices includes, diodes, Thyristors and transistors and their circuits.
a2	Explain the dynamic modeling of Induction and synchronous motor drive and the V/f, vector control and speed control of Induction/ synchronous motors
B. Intellectual Skills: Upon successful completion of the course, students will be able to:	
b1	Analyze relevant technical problems in the field of power electronics and drives, and suggest an optimum solution, by applying systematic design methodology.
b2	Evaluate the operation conditions, modeling and design principles of DC/DC chopper, DC/AC inverter and induction motor drive using mathematical models and computer simulation.
C. Professional and Practical Skills: Upon successful completion of the course, students will be able to:	
c1	Use the electronic instrumentation and modern simulation tools to design, implement, and test power electronic circuits, electric drives and useful power control project.
c2	Conduct laboratory experiments safely to verify theoretical concepts related to power electronics components and biomedical systems
D. Transferable Skills: Upon successful completion of the course, students will be able to:	
d1	Perform effectively within multi-disciplinary teams to reach to a collaborative environment.
d2	Share ideas, communicate with others and apply quantitative reasoning skills to solve problems.

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	**Introduction**	– Power Electronics Defined – Power semiconductor devices – Power Diodes – Power Transistors – Thyristors and TRIAC	1	2
2	**Uncontrolled Rectifiers**	– Single phase uncontrolled rectifiers – Three phase uncontrolled rectifiers – Harmonic analysis – Output voltage with LC filter	1	2
3	**Controlled Rectifiers**	– Single phase controlled rectifiers – Three phase controlled rectifiers – Harmonic analysis – Power factor improvement	1	2
4	**DC –DC Chopper Converters**	– Step down chopper converter – Step up chopper converter – Classifications of chopper converter	1	2
5		– Single-Phase Voltage Source Inverters – Three-Phase Voltage Source Inverters – Current Source Inverters	3	6

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
	DC – AC Inverters	– Pulse width modulation technique – Voltage Control of Three-Phase Inverters – Closed-Loop Operation of Inverters		
6	**Mid-Term Theoretical Exam**	– All Topics	1	2
7	**AC Voltage converter**	– Single Phase AC Controllers. – Three Phase AC Controllers. – Harmonic analysis – Cycloconverters	1	2
8	**DC drives**	– Single phase drives – Three phase drive – Chopper drives – Closed loop control of DC motors	3	6
9	**AC drives**	– Stator voltage control – Rotor voltage control – Frequency control – Voltage frequency control – Current control – Voltage, current and frequency control – Closed loop control of induction motor – Synchronous motor control	3	6

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
10	Final Theoretical Exam	– All Topics	1	2
Number of Weeks /and Units Per Semester			16	32

B. Case Studies and Practical Aspect:

No.	Tasks/ Experiments	Number of Weeks	Contact Hours
1	- Safety regulations and requirements in electrical laboratories. - Introduction to main laboratory devices and instrumentations. - Introduction to main measurement devices. - Reporting format.	1	2
2	- Diodes, SCR and TRIC Characteristics	1	2
3	- Single phase half and full wave uncontrolled rectifier - Simulating uncontrolled rectifiers by using MATLAB	1	2
4	- Three phase half wave and full wave uncontrolled rectifier - Simulating uncontrolled rectifiers by using MATLAB	1	2
5	- Single phase half wave and semi wave controlled	1	2

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
	rectifier - **Simulating uncontrolled rectifiers by using MATLAB**		
6	- **Single phase full wave controlled rectifier** - **Simulating controlled rectifiers by using MATLAB**	1	2
7	- **Three phase half wave and full wave controlled rectifier** - **Simulating controlled rectifiers by using MATLAB**	2	4
8	- **Mid-Term Practical Exam**	1	2
9	- **Induction motors control used inverters** - **Simulating Induction motors control used inverters by using MATLAB**	2	4
10	- **Induction motors control used volt/herts control** - **Simulating uncontrolled volt/ herts control by using MATLAB**	2	4
11	- **Slip power control of wound rotor induction motors** - **Simulating uncontrolled Slip power control by using MATLAB**	1	2
12	**Final Practical Exam**	**1**	2
Number of Weeks /and Units Per Semester		**15**	**30**

C. Tutorial Aspect:			
No.	**Tutorial**	**Number of Weeks**	**Contact Hours**
1	None		
Number of Weeks /and Units Per Semester		**15**	**30**

V. Teaching Strategies of the Course:

- Staff-led lectures,
- Interactive class discussions,
- Exercises and home works,
- Laboratory/Practical experiments based session,
- Computer laboratory-based sessions,
- Team work (cooperative learning).
- Directed self- study,
- Individual design projects.

VI. Assessment Methods of the Course:

- Written tests (mid and final terms and quizzes),
- Home works and assignments,
- Coursework activities assessment,
- Design and problem solving exercises,
- Computer Lab performance assessment,
- Project work assessment,
- Project reports (individual and group) assessment,
- Oral and visual presentations.

VII. Assignments:

No.	Assignments	Week Due	Mark
1	**Assignments1:** Comparison between types of power diodes	3	2
2	**Assignments2:** Design and implementation of uncontrolled rectifier circuits using MATLAB tools	5	2
3	**Assignments3:** Design and implementation of controlled rectifier circuits using MATLAB tools	9	2
4	**Assignments4:** Design and implementation of DC – DC choppers circuits using MATLAB tools	11	2
5	**Assignments5:** Design and implementation of DC- AC rectifier circuits using MATLAB tools	13	2
Total			**10**

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	**Assignments**	3,5, 10,13,14	10	6.67%
2	**Quizzes 1 & 2**	6, 12	10	6.67%
3	**Mid-Term Theoretical Exam**	8	20	13.33%
4	**Mid-Term Practical Exam**	9	20	13.33%
5	**Final Practical Exam**	15	30	20%
6	**Final Theoretical Exam**	16	60	40%
Total			**150**	**100%**

IX. Learning Resources:

- *Written in the following order:*

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

Example

1- Niku, Saeed B., 2011, **Introduction to Robotics: Analysis, Control, Applications**, 2nd Edition, USA, Wiley.

1- Required Textbook(s) (maximum two):

1- M. H. Rashid, 2014, "Power electronics: circuits, devices, and applications," 4th edition, Prentice Hall

1- Austin Hughes, (2019) Electric Motors and Drives Fundamentals, Types and Applications, 5th Edition, Newnes.

2- Essential References:

1- Robert W. Erickson, 2020, "Fundamentals of Power electronics", 3rd edition, Springer.

2- Ned Mohan, 2002, Power Electronics: Converters, Applications, and Design, 3rd edition, Wiley

3- Fang Lin Luo, Hong Ye, Muhammad Rashid,2005, "Digital Power Electronics and Applications", Elsev USA

4- Paul Scherz,2016, Practical Electronics for Inventors, 3rd , McGraw-Hill Education

5- Philip Krein, 2014,Elements of Power Electronics,2nd, Oxford University Press;

3- Electronic Materials and Web Sites etc.:

Websites:

1- Power electronics books

https://www.goodreads.com/shelf/show/power-electronics

http://www.circuitstoday.com/3-good-books-to-learn-power-electronics

https://electricalbaba.com/best-book-power-electronics/**Journals:**

Journals:

1- IEEE Transactions on power electronics: Peer reviewed academic journal in the field of

IX. Learning Resources:

power electronics, with emphasis on mathematical and theoretical approaches.

https://www.ieee-pels.org/publications/ieee-transactions-on-power-electronics

2 - International Journal of Power Electronics and Drive Systems (IJPEDS): The leading peer reviewed academic journal in robotics with a focus on formal experiments as well as theory. http://ijpeds.iaescore.com/index.php/IJPEDS

3- Journal of power electronics (JPE): The leading peer reviewed academic journal in robotics with a focus on formal experiments as well as theory. https://jpels.org/https://journals.sagepub.com/home/ijr

Other Web Sources:

1- www.goelectricdrive.com/

2 - www.electricmachinery.com/

3- www.goelectricdrive.com/

4 - http://www.ece.tamu.edu/~empelab/

X. Course Policies:

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He/she is permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be

	considered as absent in exam
4	**Assignments & Projects**: In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.
5	**Cheating**: For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.
7	**Other policies**: - Mobile phones are not allowed to use during a class lecture. It must be closed; **otherwise** the student will be asked to leave the lecture room. - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments might be given directly to students using soft or hard copy.