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

Course Specification of Electrical Machines

Course Code (BE214)

I. Course Identification and General Information:						
1	Course Title:	Electrical Machines				
2	Course Code & Number:	BE214				
3	Credit hours:	C.H				TOTAL
		Th.	Seminar	Pr	Tr.	
		2	--	2	--	3
4	Study level/ semester at which this course is offered:	Third Level / Second Semester				
5	Pre –requisite (if any):	Electrical circuit analysis 2 (BE112)				
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:					

II. Course Description:

This course aim to provide principal concepts of electric machines as a major Electric system component. The course includes: Electromechanical energy conversion (EMEC) principles. The construction, classification, performance characteristics, analysis, parallel operation, testing and applications of: DC motors, DC and AC stepper motors, DC and AC servo motors, universal motor, single/three phase transformer and Single-phase induction Motors as well as, starting and speed control of the different types of motors and three phase induction motor. Laboratory experiments and MATLAB simulation tool are carried for different types of machines devices to verify the theoretical concepts and to provide practical skills related to electrical machine operations and 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	Recognize operation principles, speed control and application in industrial system of various type of general purpose DC motor	A1 Describe and explain the underlying mathematical methods and theories; life scientific-principles; and engineering core concepts related to the Biomedical Engineering context.
a2	Acquire knowledge to professionally design and analysis of special machines related biomedical systems	A2 Clarify the design principles and techniques and the engineering materials characteristics and how these are relevant to the developments and technologies in a biomedical systems context.
B. Cognitive/ Intellectual Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
b1	Investigate the methods of controlling the generated voltage	B2 Identify, formulate and solve the complex problems related to the Biomedical

	and speed of DC machines.	Engineering fields in a creative and innovative manner by using a systematic and analytical thinking methods.
b2	Evaluate the modeling and design principles of DC motor and special machines used in the process of designing the elements of systems.	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	Perform an evaluation of practical design for industrial system using computer software such as, Simulink, L.V. Simulink, and MATLAB.	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	Test practically for investigating the performance of DC motor and induction machines by performing electrical, mechanical and related measurements such as: current, voltage, speed, frequency and torque.	C3 Use computational facilities and techniques, measuring instruments, workshops and laboratory equipment to design and conduct experiments, collect, analyse and interpret data and present results in the biomedical systems practice.
D. Transferable Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
d1	Develop student's cooperative work though team work.	D1 Lead and motivate individuals, show capability to work in stressful environments and within constraints, collaborate effectively within multidisciplinary team.
d2	Encourage students in self-learning of general IT skills through presentations.	D3 Recognize the needs for, and engage in life-long self-learning.

(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.Recognize operation principles, speed control and application in industrial system of various type of general purpose DC motor	• 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,
a2.Acquire knowledge to professionally design and analysis of special machines related biomedical systems	• 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

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1.Investigate the methods of controlling the generated voltage and speed of DC machines.	• Staff-led lectures, • Interactive class discussions, • Problem based learning, • Exercises and home works	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Design and problem solving exercises, • Hands-on-tasks performance assessment

b2.Evaluate the modeling and design principles of DC motor, special machines used in the process of designing the elements of systems.	• 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, • Hands-on-tasks performance assessment,

(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. Perform an evaluation of practical design for industrial system using computer software such as, Simulink, L.V. Simulink, and MATLAB.	• Individual design projects, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Team work (cooperative learning).	• Essay and report writing assessment, • Hands-on-tasks performance assessment, • Coursework activities assessment, • Project work assessment, • Project reports (individual and group) assessment.
c2.Test practically for investigating the performance of DC motor and induction machines by performing electrical, mechanical and related measurements such as: current, voltage, speed, frequency and torque.	• Individual design projects, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Team work (cooperative learning).	• Essay and report writing assessment, • Hands-on-tasks performance assessment, • 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. Develop student's cooperative work though team work.	• Directed self- study, • Student-led seminars and presentations, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Team work (cooperative learning), • Industrial visits.	• Essay and report writing assessment, • Hands-on-tasks performance assessment, • Computer Lab performance assessment, • Oral and visual presentations, • Project work assessment, • Project reports (individual and group) assessment.
d2. Encourage students in self-learning of general IT skills through presentations.	• Directed self- study, • Student-led seminars and presentations, • Individual design projects, • Laboratory/Practical experiments based session, • Computer laboratory-based	• Essay and report writing assessment, • Computer Lab performance assessment, • Oral and visual presentations,

	sessions, • Team work (cooperative learning), • Industrial visits.	• Project work assessment, • 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	– Magnetic circuits – Definition of DC motor. – Torque development due to alignment of two fields and the concept of torque angle. – Electro-magnetically induced emf. – Elementary concept of an electrical machine	**1**	**2**
2	**DC MOTOR**	a1,a2	– Main distinction between DC generators and motors. – Types, Construction, Operation principles and application areas of DC motors. – Performance characteristics and the equivalent circuit of DC	**3**	**6**

			motors. – Speed control of DC motors. – The mathematical and MATLAB model of DC motor.		
3	**DC and AC stepper motor**	a1,b1	– Principle of operation of single-stack, variable-reluctance stepping motor. – Principle of operation of multi-stack variable-reluctance stepping motor. – Principle of operation of Hybrid Stepper Motors – Comparison of stepper motor types	**1**	**2**
4	**DC and AC servo motors**	b1,b2	– DC Servo motor – AC servo motor – Three phase servo motor	**1**	**2**
5	**Universal Motor**	a2,b2	– Principle of operation of a universal motor – Applications of Universal Motors – Torque-Speed characteristics of a universal motor – Speed Control of Universal Motors – Reversing direction of	**1**	**2**

			rotation of a universal motor		
6	**Mid-Term Theoretical Exam**	a1,a2,b1,b2	– All topics	**1**	**2**
7	**Single phase Transformer**	a1,a2,b1	– Equivalent circuits, – Modelling, – Power and efficiency.	**1**	**2**
8	**Single phase Transformer**	a1,a2,b1	– Construction. – Major parameters, – Winding group, – Parallel operations.	**1**	**2**
9	**Single-phase induction Motors**	a2,b1,b2	– Construction and Operation principles. – Performance characteristics, equivalent circuits and application areas. – Modelling of single-phase induction motors.	**2**	**4**
10	**Three phase induction motor**	a1,a2,b1,b2	– Construction, Operation principles and application areas. – Performance characteristics and equivalent circuits. – Speed control and starting methods – Mathematical and MATLAB modelling.	**3**	**6**

11	**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,b1
2	- **Terminal characteristics of a separately, shunt and series motors.**	3	6	c1,c2,d1
3	- **Speed control Stepper and servo motors**	1	2	c1,d1

4	- **Speed control servo motors**	1	2	c1,d2
5	- **Torque-Speed characteristics of a universal motor**	1	2	c2,d1
6	- **Open-circuit, Short-circuit and load test of single phase transformer.**	1	2	c1,c2,d1
7	- **Mid-Term Practical Exam (if any)**	1	2	c1,c2
8	- **Open-circuit, Short-circuit and load test of three phase transformer.**	1	2	c1,c2,d1
9	- **Single-phase Induction motors starting and operation characteristics.** - **Computer modelling of single-phase induction motors.**	1	2	c1,c2,d1,d2
10	- **Three-phase Induction motors performance**	3	6	c1,c2,d1,d2

	characteristics. - **Three phase induction motors parameters.** - **Speed – torque control of three-phase Induction motors.** - **Computer modelling of three-phase induction motors.**			
11	**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….It's wrong			
Number of Weeks /and Units Per Semester		**--**	**--**	

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	Aligned CILOs(symbols)	Week Due	Mark
1	**Comparison between types of DC motors**	a1,a2,b1,b2	3	2
2	**Design and implementation of DC motors circuits**	b1,b2,c2	5	2

	using MATLAB tools			
3	**Design and implementation of servo and stepper motors circuits using MATLAB tools**	b1,b2,c2	10	2
4	**Design and implementation of single phase induction motor circuits using MATLAB tools**	b1,b2,c2,d1	13	2
5	**Design and implementation of three induction motor circuits using MATLAB tools**	b1,b2,c2,d2	14	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. Chapman s. j. 2012, Electric Machinery Fundamentals, 5th Edition, McGraw-Hill.
2. Fitzgerald A. E. 2013, Electric Machinery, 7th Edition, McGraw-Hill.

2- Essential References.

1- B.L. Theraja. (2008), Electrical Technology, 2nd Edition, Chand (S.) & Co Ltd, India .
2- Bandyopadhyay M.N, (2009), electrical machines: theory and practice, 1st Edition, Prentice-hall Of India Pvt Ltd.
3- Theodore Wildi, (2005), Electrical Machines, Drives and Power Systems, 6th Edition Pearson Publishers.

3- Electronic Materials and Web Sites *etc*.

Websites:

1- Electrical machines books

https://www.springer.com/gp/book/9783319727295

https://www.amazon.com/Electric-Machines-Power-Engineering/dp/0849385814

https://electricalbaba.com/best-book-electrical-machine/

https://www.alibris.com/search/books/subject/Electric-machinery

https://www.vikaspublishing.com/books/engineering/electrical-engineering/a-textbook-electrical-machines/9789325975620/

2- Modelica Association (2000). ModelicaTM - A Unified Object-Oriented Language for Physical Systems Modeling. Tutorial Version 1.4 (ModelicaTutorial14.pdf). Available from: https://modelica.org/documents/

3- MapleSim Video Tutorial: Modelica Video lectures available form: http://www.youtube.com/watch?v=reehU1dzeDc.

4- Simulink-Matlab tutorial for beginners Video lectures available form:

http://www.youtube.com/results?search_query=simulink+tutorial+for+beginners&oq=simulink&gs_l=youtube.1.9.0l10.337429.342148.0.351270.8.8.0.0.0.0.738.2481.3j3-2j2j0j1.8.0...0.0...1ac.1.11.youtube.iIK7kMX6hfo

Journals:

1- IEEE Transactions on Energy Conversion: Peer reviewed academic journal in the field of energy conversion, though it tends to emphasise mathematical and theoretical approaches. https://www.ieee-pes.org/publications/transactions/transactions-on-energy-conversion

2- CES Transactions on Electrical Machines and Systems
https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7873789

3- International Journal of Analysis of Electrical Machines
http://journalspub.com/journalspub/JournalsDetails.aspx?jid=97

4- Journal of Electrical Engineering & Technology
https://www.springer.com/journal/42835

5- European Journal of Electrical Engineering
http://www.iieta.org/Journals/EJEE

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)

Electrical Machines BE214

I. Course Identification and General Information:					
1	**Course Title:**	Electrical Machines			
2	**Course Code & Number:**	BE214			
3	**Credit Hours:**	**Credit Hours**	**Theory Hours**		**Lab. Hours**
			Lecture	**Exercise**	
		3	2	--	2
4	**Study Level/ Semester at which this Course is offered:**	Third Level / Second Semester			
5	**Pre –Requisite (if any):**	Electrical circuit analysis 2 (BE112)			
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 aim to provide principal concepts of electric machines as a major Electric system component. The course includes: Electromechanical energy conversion (EMEC) principles. The construction, classification, performance characteristics, analysis, parallel operation, testing and applications of: DC motors, DC and AC stepper motors, DC and AC servo motors, universal motor,

single/three phase transformer and Single-phase induction Motors as well as, starting and speed control of the different types of motors and three phase induction motor. Laboratory experiments and MATLAB simulation tool are carried for different types of machines devices to verify the theoretical concepts and to provide practical skills related to electrical machine operations and 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	Recognize operation principles, speed control and application in industrial system of various type of general purpose DC motor
a2	Acquire knowledge to professionally design and analysis the special machines related biomedical systems
B. Intellectual Skills: Upon successful completion of the course, students will be able to:	
b1	Investigate the methods of controlling the generated voltage and speed of DC machines.
b2	Evaluate the modeling and design principles of DC motor, special machines used in the process of designing the elements of systems.
C. Professional and Practical Skills: Upon successful completion of the course, students will be able to:	
c1	Perform an evaluation of practical design of industrial system using computer software such as, Simulink, L.V. Simulink, and MATLAB.
c2	Test practically for investigating the performance of DC motor and induction machines by performing electrical, mechanical and related measurements such as: current, voltage, speed, frequency and torque.
D. Transferable Skills: Upon successful completion of the course, students will be able to:	
d1	Develop student's cooperative work though team work.
d2	Encourage students in self-learning of general IT skills through presentations.

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	**Introduction**	– Magnetic circuits – Definition of DC motor. – Torque development due to alignment of two fields and the concept of torque angle. – Electro-magnetically induced emf. – Elementary concept of an electrical machine	1	2
2	**DC MOTOR**	– Main distinction between DC generators and motors. – Types, Construction, Operation principles and application areas of DC motors. – Performance characteristics and the equivalent circuit of DC motors. – Speed control of DC motors. – The mathematical and MATLAB model of DC motor.	3	6
3	**DC and AC stepper motor**	– Principle of operation of single-stack, variable-reluctance stepping motor. – Principle of operation of multi-stack variable-reluctance stepping motor. – Principle of operation of Hybrid Stepper Motors	1	2

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		– Comparison of stepper motor types		
4	**DC and AC servo motors**	– DC Servo motor – AC servo motor – Three phase servo motor	1	2
5	**Universal Motor**	– Principle of operation of a universal motor – Applications of Universal Motors – Torque-Speed characteristics of a universal motor – Speed Control of Universal Motors – Reversing direction of rotation of a universal motor	1	2
6	**Mid-Term Theoretical Exam**	– All topics	1	2
7	**Single phase Transformer**	– Equivalent circuits, – Modelling, – Power and efficiency.	1	2
8	**Single phase Transformer**	– Construction. – Major parameters, – Winding group, – Parallel operations.	1	2
9	**Single-phase**	– Construction and Operation	2	4

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
	induction Motors	principles. – Performance characteristics, equivalent circuits and application areas. – Modelling of single-phase induction motors.		
10	**Three phase induction motor**	– Construction, Operation principles and application areas. – Performance characteristics and equivalent circuits. – Speed control and starting methods – Mathematical and MATLAB modelling.	3	6
11	**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.**	1	2

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
	- **Introduction to main measurement devices.** - **Reporting format.**		
2	- **Terminal characteristics of a separately, shunt and series motors.**	3	6
3	- **Speed control Stepper and servo motors**	1	2
4	- **Speed control servo motors**	1	2
5	- **Torque-Speed characteristics of a universal motor**	1	2
6	- **Open-circuit, Short-circuit and load test of single phase transformer.**	1	2
7	- **Mid-Term Practical Exam (if any)**	1	2
8	- **Open-circuit, Short-circuit and load test of three phase transformer.**	1	2
9	- **Single-phase Induction motors starting and operation characteristics.** - **Computer modelling of single-phase induction motors.**	1	2
10	- **Three-phase Induction motors performance characteristics.** - **Three phase induction motors parameters.** - **Speed – torque control of three-phase Induction motors.** - **Computer modelling of three-phase induction**	3	6

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
	motors.		
11	**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		**--**	**--**

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,

VI. Assessment Methods of the Course:

- 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	**Comparison between types of DC motors**	3	2
2	**Design and implementation of DC motors circuits using MATLAB tools**	5	2
3	**Design and implementation of servo and stepper motors circuits using MATLAB tools**	10	2
4	**Design and implementation of single phase induction motor circuits using MATLAB tools**	13	2
5	**Design and implementation of three induction motor circuits using MATLAB tools**	14	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%

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
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- Chapman s. j. 2012, Electric Machinery Fundamentals, 5th Edition, McGraw-Hill.

1- Fitzgerald A. E. 2013, Electric Machinery, 7th Edition, McGraw-Hill.

2- Essential References:

1- B.L. Theraja. (2008), Electrical Technology, 2nd Edition, Chand (S.) & Co Ltd, India.

2- Bandyopadhyay M.N, (2009), electrical machines: theory and practice, 1st Edition, Prentice-hall Of India Pvt Ltd.

3- Theodore Wildi, (2005), Electrical Machines, Drives and Power Systems, 6th Edition Pearson Publishers.

3- Electronic Materials and Web Sites etc.:

Websites:

1- Electrical machines books

IX. Learning Resources:

https://www.springer.com/gp/book/9783319727295

https://www.amazon.com/Electric-Machines-Power-Engineering/dp/0849385814

https://electricalbaba.com/best-book-electrical-machine/

https://www.alibris.com/search/books/subject/Electric-machinery

https://www.vikaspublishing.com/books/engineering/electrical-engineering/a-textbook-electrical-machines/9789325975620/

2- Modelica Association (2000). ModelicaTM - A Unified Object-Oriented Language for Physical Systems Modeling. Tutorial Version 1.4 (ModelicaTutorial14.pdf). Available from: https://modelica.org/documents/

3- MapleSim Video Tutorial: Modelica Video lectures available form: http://www.youtube.com/watch?v=reehU1dzeDc.

4- Simulink-Matlab tutorial for beginners Video lectures available form:

http://www.youtube.com/results?search_query=simulink+tutorial+for+beginners&oq=simulink&gs_l=youtube.1.9.0l10.337429.342148.0.351270.8.8.0.0.0.0.738.2481.3j3-2j2j0j1.8.0...0.0...1ac.1.11.youtube.iIK7kMX6hfo

Journals:

1- IEEE Transactions on Energy Conversion: Peer reviewed academic journal in the field of energy conversion, though it tends to emphasise mathematical and theoretical approaches. https://www.ieee-pes.org/publications/transactions/transactions-on-energy-conversion

2- CES Transactions on Electrical Machines and Systems

https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7873789

3- International Journal of Analysis of Electrical Machines

http://journalspub.com/journalspub/JournalsDetails.aspx?jid=97

4- Journal of Electrical Engineering & Technology

https://www.springer.com/journal/42835

5- European Journal of Electrical Engineering

http://www.iieta.org/Journals/EJEE

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.