Sana'a University
Faculty of Engineering
Electrical Engineering Department
B.Sc. of Computer and Control Engineering

37. Course Specification of Electrical Machines

I. Course Identification and General Information:

1.	Course Title:	Electrical Machines				
2.	Course Code & Number:	PME225				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	2	2	-	4
4.	Study level/ semester at which this course is offered:	Third Year/ Second Semester				
5.	Pre –requisite (if any):	Electrical circuits 1&2				
6.	Co –requisite (if any):	NA				
7.	Program (s) in which the course is offered:	Computer Engineering and Control program				
8.	Language of teaching the course:	English				
9.	Location of teaching the course:	Class & lab				
10.	Prepared By:	Assoc. prof. Dr. Radwan AL bouthigy				
11.	Date of Approval	2020				

II. Course Description:

This course is designed 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-phase Synchronous Motors (Reluctance and Hysteresis) and linear motors as well as, starting and speed control of the different types of motors. Laboratory experiments and MATLAB simulation tool are carried out for different types of machines devices to verify the theoretical concepts.

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	III. Course Intended learning outcomes (CILOs) of the course	Referenced PILOs
a1	Recognize operation principles, speed control and application in industrial system of various type of general-purpose DC motor and special machines.	A1
a2	Acquire knowledge to professionally design and analysis the special machines using computer simulators and practical experiments.	A2,A3
b1	Differentiate between the elements of special machines by their characteristics and construction.	B1
b2	Evaluate the modeling and design principles of DC motor special machines used in the process of designing the elements of systems.	B3
c1	Test and practically investigate the performance of DC motor and special machines by performing electrical, mechanical and related measurements such as: current, voltage, power speed, and torque.	C3
c2	Perform and evaluate practical design of industrial system using computer software such as Modelica, Simulink, LVSim, MATLAB.	C2,C4
d1	Develop students cooperative work though team work.	D1
d2	Encourage students self-learning of general IT skills through presentations.	D2,D5

(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 and special machines.	Lectures, Tutorial, interactive class discussions, laboratory experiments, Self-study. Homework	Assignments, Written exams, quizzes
a2- Acquire knowledge to professionally design and analysis the DC motor and	Lectures, Tutorial, interactive class discussions, laboratory experiments,	Assignments, Written exams, quizzes

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special machines using computer simulators and practical experiments.	Self-study. Homework	
(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Differentiate between the elements of DC motor and special machines by their characteristics and construction.	Lectures, Interactive class discussions, Homework, Laboratory experiments, Self and cooperative learning.	Assignments, Quizzes, Written exams, Homework. Lab. reports.
b2- Evaluate the modeling and design principles of DC motor and special machines used in the process of designing the elements of systems.	Lectures, Interactive class discussions, Homework, Laboratory experiments, Self and cooperative learning.	Assignments, Quizzes, Written exams, Homework. Lab. reports.

© 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- Test and practically investigate the performance of DC motor and special machines by performing electrical, mechanical and related measurements such as: current, voltage, power speed, and torque.	Lectures, Interactive class discussion Exercises, Series of laboratory experiment, Self-study assignments and homework.	Quizzes Laboratory assignments and reports, Homework, Midterm and final exam.
c2- Perform and evaluate practical design of industrial system	Lectures,	Quizzes

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using	computer software such as Modelica, Simulink, LVSim, MATLAB.	Interactive class discussion Exercises, Series of laboratory experiment, Self-study assignments and homework.	Laboratory assignments and reports, Homework, Midterm and final exam.

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(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 students cooperative work though team work.	Lectures, Interactive class discussion, Self-study assignments and homework.	Laboratory reports, Assignments, Quizzes, Written exams, Lab. Exams, Homework.
d2- Encourage students self-learning of general IT skills through presentations,	Lectures, Interactive class discussion, Self-study assignments and homework.	Laboratory reports, Assignments, Quizzes, Written exams, Lab. Exams, Homework.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction to Electrical Machines	a1,a2,b1,b2	▪ 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

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2.	DC motor	a1, a2, b1, c2,b2, d1, d2	▪ 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	a1, a2, b1, b2,	▪ 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	3	6
4.	DC and AC servo motors	a1, a2, b1, b2, d1, d2	▪ DC Servo motor ▪ AC servo motor ▪ Three phase servo motor	2	4
5.	universal motor	a1, a2, b1, b2, d1, d2,	▪ Principle of operation of a universal motor ▪ Applications of Universal Motors	2	4

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			▪ Torque-Speed characteristics of a universal motor ▪ Speed Control of Universal Motors ▪ Reversing direction of rotation of a universal motor		
6.	Single-phase Synchronous Motors	a1, a2, b1, b2, d1, d2	▪ Principle of operation of a reluctance motor ▪ Torque-Speed characteristics of a reluctance motor ▪ Construction of a hysteresis motor ▪ Principle of operation of a hysteresis motor ▪ Torque-Speed characteristics of a hysteresis motor ▪ Applications of Hysteresis Motors ▪ Mathematical analysis for the developed torque in the hysteresis motor	2	4
7.	Linear motor	a1, a2, b1, b2, c1, c2, d1, d2	▪ Operation principles ▪ Construction, modeling and application of Permanent Magnet (PM) linear synchronous motors. ▪ And Wound Secondary type linear synchronous motors.	1	2
Number of Weeks /and Units Per Semester				**14**	**28**

A- Tutorials Aspect:

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Order	Tutorial Skills List	№ of Weeks	C.H.	CILOs
1.	▪ Calculation of magnetic circuits, magnetic flux, flux density, magnetic field intensity, and permeability. ▪ Force and torque calculations.	1	2	a1,a2,b1,b2
2.	▪ Equivalent circuit of types DC motor. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of DC motors. ▪ Speed – torque control of DC motors.	3	6	a1,a2,b1,b2, c2,d1,d2
3.	▪ Equivalent circuit and equations types stepper motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of stepper motors. ▪ Speed – torque control of stepper motors.	2	4	a1,a2,b1,b2, c2,d1,d2
4.	▪ Equivalent circuit and equations types servo motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of servo motors. ▪ Speed – torque control of servo motors.	2	4	a1,a2,b1,b2, c2,d1,d2
5.	▪ Equivalent circuit and equations types servo motors.	2	4	a1,a2,b1,b2, c2,d1,d2

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	▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of DC motors. ▪ Speed – torque control of servo motors.			
6.	▪ Equivalent circuit and equations types universel motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model universel motors. ▪ Speed – torque control of universel motors.	1	2	a1,a2,b1,b2, c2,d1,d2
7.	▪ Equivalent circuit and equations types single phase synchronous motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of single-phase synchronous motors. ▪ Speed – torque control of single-phase synchronous motors.	2	4	a1,a2,b1,b2, c2,d1,d2
8.	▪ Equivalent circuit and equations types linear motors motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of linear motors. ▪ Speed – torque control of linear motors.	1	2	a1,a2,b1,b2, c2,d1,d2

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Number of Weeks /and Units Per Semester	**14**	**28**	

C - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	▪ Safety regulations and requirements in electrical laboratories. ▪ Experimental work outlines and requirements. ▪ Introduction to main laboratory devices and instrumentations. ▪ Introduction to main measurement devices.	1	2	a1, a2, b1, b2, c1,c2
2.	▪ Terminal characteristics of a separately, shunt, series and compound motors. ▪ Starting control of D.C motors	3	6	a1, a2, b1, b2, c1, c2
3.	▪ Speed control Stepper motors ▪ Torque-Speed characteristics ▪ Computer modeling stepper motor	2	4	a1, a2, b1, b2, c1, c2
4.	▪ Speed control servo motors ▪ Torque-Speed characteristics ▪ Computer modeling servo motor	2	4	a1, a2, b1, b2, c1, c2
5.	▪ Torque-Speed characteristics of a universal motor	1	2	a1, a2, b1, b2, c1, c2
6.	▪ Torque-Speed characteristics of a reluctance motor	1	2	a1, a2, b1, b2, c1, c2
7.	▪ Torque-Speed characteristics of a hysteresis motor	1	2	a1, a2, b1, b2, c1, c2
8.	▪ Familiarize with practical a single-sided and double-sided linear induction motors.	2	4	a1, a2, b1, b2, c1,c2

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	Determine the performance characteristics of single-sided motor. ▪ Computer modeling linear motor			
9.	▪ Final Exam	1	2	a1,a2,b1,b2
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Lectures.
- Interactive class discussion.
- Simulation Tools
- Series of laboratory experiment.
- Homework
- Project work

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Comparison between types of DC motors	a1,a2,b1,b2,d2	3rd	2.5
2.	Design and implementation of stepper motor circuits using MATLAB tools	a1,a2,b1,b2,c2	5th	2.5
3.	Design and implementation of servo motor circuits using MATLAB tools	a1,a2,b1,b2,c2	7th	2.5
4.	Design and implementation of single-phase synchronous motor circuits using MATLAB tools	a1,a2,b1,b2,c2	8th	2.5
5.	Project presentation	a1,a2,b1,b2	13th	10
	Total			**20**

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Quizzes	4^{th} ,7^{th} ,10^{th}, and 12^{th}	10	5%	a1,a2,b1,b2
2.	Assignments & Homework, Tasks & Presentation	Weekly	20	10%	a1,a2,b1,b2,d1,d2
3.	Mid-Term exam	8^{th}	40	20%	a1,a2,b1,b2
4.	Final exam practical	15^{th}	30	15%	a1,a2,b1,b2,c1,c2,d2
5.	Final Exam theory	16^{th}	100	50%	a1,a2,b1,b2
	Total		**200**	**100%**	

VIII. Learning Resources:

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

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

1. E.G. Janardanan, 2014, 'Special electrical machines', PHI learning Private Limited, Delhi.
2. Chapman s. j. (2005), Electric Machinery Fundamentals, 4th Edition, McGraw-Hill.

2- Essential References.

1. W. Leonhard, 1985, Control of Electrical Drives, Springer-Verlag, New York,
2. T. Wildi,2002, Electrical machines, drives and power systems, fifth edition, Upper Saddle River, New Jersey Columbus, Ohio
3. B. L. Theraja, 2005, Electrical Technology, first multi colour India, S.Chand & Company Ltd.
4. A. Hughes, 2006, Electric Motors and Drives Fundamentals, Types and Applications, third edition, Elsevier Ltd, British

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3- Electronic Materials and Web Sites etc.
1. 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/ 2. MapleSim Video Tutorial: Modelica Video lectures available form:http://www.youtube.com/watch?v=reehU1dzeDc. 3. Simulink-Matlab tutorial for beginners Video lectures available form

IX. Course Policies:

1.	**Class Attendance:** -A student should attend not less than 75 % of total hours of the subject; otherwise he 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 an approved statement from university Clinic
2.	**Tardy:** - For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:** - A student should attend the exam on time. He 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:** - The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
5.	**Cheating**: - For cheating in exam, a student will be considered as failure. 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 proved a plagiarism of a student, he will be disengaged

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	from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
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 my given directly to students using soft or hard copy

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat** **President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi** **Name of Reviewer from the Department: Assoc. Prof. Dr. Radwan Al bouthigy**
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

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37. Template for Course Plan of Electrical machines

I. Information about Faculty Member Responsible for the Course:

Name of Faculty Member	Assoc. Prof. Dr. Radwan Al bouthigy	Office Hours					
Location& Telephone No.	775284933	SAT	SUN	MON	TUE	WED	THU
E-mail	radwan006@yahoo.com						

II. Course Identification and General Information:

1.	Course Title:	Electrical machines				
2.	Course Number & Code:	PME225				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	2	2	-	4
4.	Study level/year at which this course is offered:	Third Year/ Second Semester				
5.	Pre –requisite (if any):	Electrical Circuits 1&2				
6.	Co –requisite (if any):	NA				
7.	Program (s) in which the course is offered	Computer Engineering and Control program				
8.	Language of teaching the course:	English				
9.	System of Study:	Semester				
10.	Mode of delivery:	Semesters				
11.	Location of teaching the course:	Class & lab				

III. Course Description:

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This course is designed 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-phase Synchronous Motors (Reluctance and Hysteresis) and linear motors as well as, starting and speed control of the different types of motors. Laboratory experiments and MATLAB simulation tool are carried for different types of machines devices to verify the theoretical concepts.

IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop**:**

1. Recognize operation principles, speed control and application in industrial system of various type of general-purpose DC motor and special machines.
2. Acquire knowledge to professionally design and analysis the special machines using computer simulators and practical experiments.
3. Differentiate between the elements of special machines by their characteristics and construction.
4. Evaluate the modeling and design principles of DC motor special machines used in the process of designing the elements of systems.
5. Test and practically investigate the performance of DC motor and special machines by performing electrical, mechanical and related measurements such as: current, voltage, power speed, and torque.
6. Perform and evaluate practical design of industrial system using computer software such as Modelica, Simulink, LVSim, MATLAB.
7. Develop students cooperative work though team work.
8. Encourage students self-learning of general IT skills through presentations.

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V. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction to Electrical Machines	▪ 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	1st	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.	2nd ,3rd ,4th	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 ▪ Comparison of stepper motor types	5th ,6th ,7th	6
4.	Midterm Exam	▪	8th	2

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5.	DC and AC servo motors	▪ DC Servo motor ▪ AC servo motor ▪ Three phase servo motor	9th ,10th	4
6.	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	11th ,12th	4
7.	Single-phase Synchronous Motors	▪ Principle of operation of a reluctance motor ▪ Torque-Speed characteristics of a reluctance motor ▪ Construction of a hysteresis motor ▪ Principle of operation of a hysteresis motor ▪ Torque-Speed characteristics of a hysteresis motor ▪ Applications of Hysteresis Motors ▪ Mathematical analysis for the developed torque in the hysteresis motor	13th ,14th	4
8.	Linear motor	▪ Operation principles ▪ Construction, modeling and application of Permanent Magnet (PM) linear synchronous motors. ▪ And Wound Secondary type linear synchronous motors.	15th	2
9.	Final Exam	▪ All topics	16th	2
Number of Weeks /and Units Per Semester			**16**	**32**

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B-Tutorials Aspect:			
Order	**Tutorial Skills List**	**№ of Weeks**	**C.H.**
1.	▪ Calculation of magnetic circuits, magnetic flux, flux density, magnetic field intensity, and permeability. ▪ Force and torque calculations.	1st	2
2.	▪ Equivalent circuit of types DC motor. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of DC motors. ▪ Speed – torque control of DC motors.	2nd ,3rd ,4th	6
3.	▪ Equivalent circuit and equations types stepper motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of stepper motors. ▪ Speed – torque control of stepper motors.	5th ,6th	4
4.	▪ Equivalent circuit and equations types servo motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of servo motors. ▪ Speed – torque control of servo motors.	7th ,8th	4
5.	▪ Equivalent circuit and equations types servo motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation	9th ,10th	4

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	▪ The mathematical and Modelica and/or MATLAB model of DC motors. ▪ Speed – torque control of servo motors.		
6.	▪ Equivalent circuit and equations types universel motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model universel motors. ▪ Speed – torque control of universel motors.	11th	2
7.	▪ Equivalent circuit and equations types single phase synchronous motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of single-phase synchronous motors. ▪ Speed – torque control of single-phase synchronous motors.	12th ,13th	4
8.	▪ Equivalent circuit and equations types linear motors motors. ▪ The performance characteristics. ▪ Graphical analysis ▪ Speed regulation ▪ The mathematical and Modelica and/or MATLAB model of linear motors. ▪ Speed – torque control of linear motors.	14th	2
Number of Weeks /and Units Per Semester		**14**	**28**

C - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours
1.	▪ Safety regulations and requirements in electrical laboratories. ▪ Experimental work outlines and requirements.	1st	2

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	▪ Introduction to main laboratory devices and instrumentations. ▪ Introduction to main measurement devices.		
2.	▪ Terminal characteristics of a separately, shunt, series and compound motors. ▪ Starting control of D.C motors	2nd ,3rd ,4th	6
3.	▪ Speed control Stepper motors ▪ Torque-Speed characteristics ▪ Computer modeling stepper motor	5th ,6th	4
4.	▪ Speed control servo motors ▪ Torque-Speed characteristics ▪ Computer modeling servo motor	7th ,8th	4
5.	▪ Torque-Speed characteristics of a universal motor	9th	2
6.	▪ Torque-Speed characteristics of a reluctance motor	10th	2
7.	▪ Torque-Speed characteristics of a hysteresis motor	11th	2
8.	▪ Familiarize with practical a single-sided and double-sided linear induction motors. Determine the performance characteristics of single-sided motor. ▪ Computer modeling linear motor	12th ,13th	4
9.	▪ Final Exam	14th	2
Number of Weeks /and Units Per Semester		**14**	**28**

VI. Teaching strategies of the course:

- Lectures.
- Interactive class discussion.
- Simulation Tools
- Series of laboratory experiment.
- Homework
- Project work

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VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Comparison between types of DC motors	a1,a2,b1,b2,d2	3rd	2.5
2.	Design and implementation of stepper motor circuits using MATLAB tools	a1,a2,b1,b2,c2	5th	2.5
3.	Design and implementation of servo motor circuits using MATLAB tools	a1,a2,b1,b2,c2	7th	2.5
4.	Design and implementation of single-phase synchronous motor circuits using MATLAB tools	a1,a2,b1,b2,c2	8th	2.5
5.	Project presentation	a1,a2,b1,b2	13th	10
	Total			**20**

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1.	Quizzes	4th ,7th ,10th, and 12th	10	5%
2.	Assignments & Homework, Tasks & Presentation	Weekly	20	10%
3.	Mid-Term exam	8th	40	20%
4.	Final exam practical	15th	30	15%
5.	Final Exam theory	16th	100	50%
	Total		**200**	**100%**

IX. Learning Resources:

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

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

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1. E.G. Janardanan, 2014, 'Special electrical machines', PHI learning Private Limited, Delhi.
2. Chapman s. j. (2005), Electric Machinery Fundamentals, 4th Edition, McGraw-Hill.

2- Essential References.

1. W. Leonhard, 1985, Control of Electrical Drives, Springer-Verlag, New York,
2. T. Wildi,2002, Electrical machines, drives and power systems, fifth edition, Upper Saddle River, New Jersey Columbus, Ohio
3. B. L. Theraja, 2005, Electrical Technology, first multi colour India, S.Chand & Company Ltd.
4. A. Hughes, 2006, Electric Motors and Drives Fundamentals, Types and Applications, third edition, Elsevier Ltd, British

3- Electronic Materials and Web Sites etc.

1. 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/
2. MapleSim Video Tutorial: Modelica Video lectures available form:http://www.youtube.com/watch?v=reehU1dzeDc.
3. Simulink-Matlab tutorial for beginners Video lectures available form

X. Course Policies:

1.	**Class Attendance:** -A student should attend not less than 75 % of total hours of the subject; otherwise he 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 an approved statement from university Clinic
2.	**Tardy:** - For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:**

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	- A student should attend the exam on time. He 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:** - The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
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 proved a plagiarism of a student, he 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.
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 my given directly to students using soft or hard copy

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