47. Course Specification of Electrical Drives

I. Course Identification and General Information:

1.	Course Title:	Electrical Drives				
2.	Course Code & Number:	PME327				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	2	2	-	4
4.	Study level/ semester at which this course is offered:	Fourth Year/ Second Semester				
5.	Pre –requisite (if any):	PME221, PME224, PME244				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered:	Electrical Power and Machines Engineering				
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:

Electrical drives circuits are a subject where a student will deal with various types of electric drives machines which are employed in industries, power stations, domestic and commercial appliances etc. It gives students the skills in the definitions, analysis, and solving problems related to electric variable speed drive. The course enables students to analyzes and discuss the basic characteristics, types, operating modes of DC motors, induction motor, synchronous motor, stepper motor and theirs methods speed control with special emphasis on Computer simulations are used for understanding electric drives-based power-electronics converters and the design of feedback controllers. Laboratory experiments and MATLB simulation tool are carried out for different types of power electronics elements to verify the theoretical concepts.

III. Course Intended learning outcomes (CILOs) of the course	Referenced PILOs

Head of Department Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi	Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti	Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad	Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

a1	Demonstrate the mechanical system requirements for electric drives and the switch -mode power electronic converters in electric drives	A1
a2	Define the dynamic modeling of Induction motor drive, volt - herts, vector control and speed control of synchronous motors.	A2
b1	Identify the DC-motor drives, electronically-commutated motor drives and energy efficiency of electric drives and inverter-motor interactions.	B1
b2	Differentiate between different AC/DC drive for solving engineering problems and selection the appropriate solution according to needed specification.	B3
c1	Apply a variety of device models and circuit analysis theorems to analysis, design and implementing power control systems for engineering systems applications.	C2
c2	Carry out practical hands-on work in the field.	C3
d1	Work in teams to conduct experiments, analyze results, and develop technically sound reports of outcomes.	D1
d2	Use computer and Internet to extract information related to field of study.	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- Demonstrate an understanding the mechanical system requirement for electric drives and the switch -mode power electronic converters in electric drives	▪ Lectures ▪ Tutorials ▪ Self-learning ▪ Dialogue and discussion	▪ written exam ▪ Oral discussion ▪ Reports evaluation ▪ Presentations and evaluation
a2- Define the dynamic modeling of Induction motor drive, volt - hertz, vector control and speed control of synchronous motors.	▪ Lectures ▪ Tutorials ▪ Self-learning ▪ Dialogue and discussion	▪ written exam ▪ Oral discussion ▪ Reports evaluation ▪ Presentations and evaluation

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Identify the DC-motor drives, electronically-commutated motor drives and energy efficiency of electric drives and inverter-motor interactions.	▪ Lectures ▪ Analysis and Problem solving ▪ Tutorials ▪ Project	▪ Written Test and Quizzes ▪ Laboratory reports evaluation ▪ Project reports ▪ Presentations
b2- Differentiate between different AC/DC drive for solving engineering problems and selection the appropriate solution according to needed specification.	▪ Lectures ▪ Analysis and Problem solving ▪ Tutorials ▪ Project	▪ Written Test and Quizzes ▪ Laboratory reports evaluation ▪ Project reports ▪ Presentations

© 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- Apply a variety of device models and circuit analysis theorems to analysis, design and implementing power control systems for engineering systems applications.	▪ Lectures ▪ Laboratory ▪ Projects ▪ Design exercises ▪ Simulation tools	▪ Written Test and Quizzes ▪ Laboratory reports evaluation ▪ Presentations evaluation ▪ Project reports ▪ Observation of performance
c2- Carry out practical hands-on work in the field.	▪ Lectures ▪ Laboratory ▪ Projects ▪ Design exercises ▪ Simulation tools	▪ Written Test and Quizzes ▪ Laboratory reports evaluation ▪ Presentations evaluation ▪ Project reports ▪ Observation of performance

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:

Head of Department Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi	Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti	Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad	Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1- Work in teams to conduct experiments, analyze results, and develop technically sound reports of outcomes.	▪ Laboratory ▪ Projects ▪ Presentations ▪ Research	▪ Observation and interviews ▪ Laboratory reports evaluation ▪ Research reports ▪ Presentations
d2- Use computer and Internet to extract information related to field of study.	▪ Laboratory ▪ Projects ▪ Presentations ▪ Research	▪ Observation and interviews ▪ Laboratory reports evaluation ▪ Research reports ▪ Presentations

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
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IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction of Drives	a1,a2,b1,b2	▪ Basic characteristics and operating modes of DC Motor Drives ▪ Performance characteristics of Induction Motor ▪ Performance characteristics Synchronous motors ▪ Stepper motor	2	4
2.	DC drives	a1, b1, c1,c2,d2	▪ Single phase drives ▪ Three phase drive ▪ Chopper drives ▪ Closed loop control of DC motor	4	8
3.	Induction motor drives	b1,b2,c1,c2,d2	▪ Stator voltage control ▪ Rotor voltage control ▪ Frequency control ▪ Voltage frequency control ▪ Current control ▪ Voltage, current and frequency control ▪ Closed loop control of induction motor	4	8
4.	Vector control	a1, b1,b2,c1,d2	▪ Basic Principle of Vector Control ▪ Direct and Quadrature-Axis Transformation ▪ Indirect Vector Control ▪ Direct Vector Control	1	2

5.	Synchronous motor drives	a2, b2,c1,c2,d2	▪ Cylindrical rotor motors ▪ Salient pole motors ▪ Reluctance motors ▪ Permanent magnetic motors ▪ Switched reluctance motors ▪ Closed loop control of synchronous motor	2	4
6.	Stepper motor drives	b1,b2,c1,c2,d2	▪ Stepper motor control ▪ Variable Reluctance stepper motors ▪ Permanent Magnetic stepper motors	1	2
Number of Weeks /and Units Per Semester				**14**	**28**

B- Tutorial Aspect:

Order	Tasks/ Tutorial	No. of Weeks	Contact Hours	Learning Outcomes
1.	▪ Operation and c Basic Characteristics of Dc Motors ▪ Operating Modes of Separately Excited Dc Motor ▪ Operating Modes of Series Excited Dc Motor	1	2	a1,b1,d1,d2
2.	▪ Operation and characteristics of Single-Phase Semi converter Drives. ▪ Operation and characteristics of Single-Phase Full-Converter Drives ▪ Operation and characteristics of Single-Phase Dual-Converter Drives ▪ Simulating single phase drives by using MATLAB	2	4	a1,a2,b1,b2, d1,d2
3.	▪ Operation and characteristics of three-Phase Semi converter Drives.	2	4	a1,a2,b1,b2, c1,d1,d2

	▪ Operation and characteristics of three-Phase Full-Converter Drives ▪ Operation and characteristics of three-Phase Dual-Converter Drives ▪ Simulating three phase drives by using MATLAB			
4.	▪ Principle of Power Control ▪ Principle of Regenerative Brake Control ▪ Principle of Rheostatic Brake Control ▪ Principle of Combined Regenerative and Rheostatic Brake control ▪ Two- and Four-Quadrant Dc–dc Converter Drives ▪ Open-Loop Transfer Function of Separately Excited motors ▪ Open-Loop Transfer Function of Series Excited Motors ▪ Closed-Loop Transfer Function ▪ Simulating DC-DC drives by using MATLAB	2	4	b1,b2,c1,d1,d2
5.	▪ Performance Characteristics of induction motors ▪ Torque–Speed Characteristics ▪ Stator Voltage Control ▪ Rotor Voltage Control ▪ Frequency Control ▪ Voltage and Frequency Control 789 ▪ Current Control ▪ Constant Slip-Speed Control ▪ Voltage, Current, and Frequency Control ▪ Closed-Loop Control of Induction Motors ▪ Simulating induction motors drives by using MATLAB	3	6	a1,a2, c1,d1,d2
6.	▪ Basic Principle of Vector Control	1	2	a1,a2,b1,b2,c1

	▪ Operation of Direct and Quadrature-Axis Transformation ▪ Operation of Indirect Vector Control ▪ Operation of Direct Vector Control			
7.	▪ Control characteristics of synchronous motor and the methods for speed control ▪ Simulating ac synchronous motor using MATLAB	2	4	b1,b2,c1,d1,d2
8.	▪ Control characteristics of Variable-Reluctance Stepper Motors ▪ Control characteristics of Permanent-Magnet Stepper Motors	1	2	a2,b1,c1,d1,d2
Number of Weeks /and Units Per Semester:		**14**	**28**	

C - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	▪ Single phase semi converter drive	1	2	a1,b1,c1,c2
2.	▪ Single phase full wave converter drive	1	2	a1,b1,c1,c2,d1,d2
3.	▪ Single phase dual converter drive	1	2	b1,b2,c1,c2,d1,d2
4.	▪ Three phase half wave converter drive	1	2	a1,a2,b1,b2,c1,c2,d1,d2
5.	▪ Three phase semi converter drive	2	4	a1,a2,b1,b2,c1,c2
6.	▪ Three phase full wave converter drive	2	4	b1,b2,c1,c2,d1,d2
7.	▪ Power control drive	1	2	a1,a2,b1,b2,c1,c2, d2
8.	▪ Regenerative brake control	1	2	a1,a2,b1,b2,c1,c2,d1
9.	▪ Induction motors control used AC voltage control	1	2	a1,a2,b2,c1,c2,d1,d2

10.	▪ Induction motors control used inverters	1	2	a1, b2,c1,c2,d1,d2
11.	▪ Slip power control of wound rotor induction motors	1	2	a1,a2,b2,c1,c2
12.	▪ Review	1	2	a1,a2,b1,b2,c1,c2
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Lectures
- Problem Solving
- Design exercises
- Laboratory works
- Homework
- Project work
- Simulation Tools
- Presentations

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Comparison between types of modes operation	a1,a2,b1,b2,d2	3rd	4
2.	Design and implementation of power control circuits using MATLAB tools	a1,a2,b1,b2,c1	4th	4
3.	Design and implementation of dynamic brake control circuits using MATLAB tools	a1,a2,b1,b2,c1	6th	4
4.	Design and implementation of closed loop control of S.E.D.C. motor circuits using MATLAB tools	a1,a2,b1,b2,c1	8th	4
5.	Design and implementation of volt- hertz control of induction motor using MATLAB tools	a1,a2,b1,b2,c1	10th	4
	Total			**20**

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

Head of Department Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi	Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti	Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad	Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Quizzes	4th,7th ,10th, and 13th	20	10%	a1,a2,b1,b2
2.	Assignments	Weekly	20	10%	a1,a2,b1,b2,c1,d1
3.	Mid-Term exam	7th	20	10%	a1,a2,b1,b2
4.	Final exam practical	15th	40	20%	a1,a2,b1,b2,c1,c2
5.	Final Exam theory	16th	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. M. H. Rashid, 2014, "Power electronics: circuits, devices, and applications," fourth edition, Prentice Hall
2. Austin Hughes, (2006) Electric Motors and Drives Fundamentals, Types and Applications, 3rd Edition, Elsevier Ltd.

2- Essential References.

1. Cyril W. Lander, 1993, "Power electronics", 3rd edition, McGraw-Hill.
2. B. W. Williams, 1992, Power Electronics, Devices, Drivers, Application and Passive components
3. Fang Lin Luo, Hong Ye, Muhammad Rashid, "Digital Power Electronics and Applications", 2005, Elsev USA
4. E. Acha, Power Electronics control in Electrical system, 1st , 2002, Newnes.

3- Electronic Materials and Web Sites *etc*.

1. www.goelectricdrive.com/
2. www.electricmachinery.com/
3. www.goelectricdrive.com/

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

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 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

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**

Head of Department Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi	Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti	Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad	Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

	Name of Reviewer from the Department: Asst. Prof. Dr. Adel Ahmed Al-Shakiri
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

Head of Department Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi	Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti	Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad	Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

47. Template for Course Plan of Electrical Drives

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 Drives				
2.	Course Number & Code:	PME327				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	2	2	-	4
4.	Study level/year at which this course is offered:	Fourth Year/ Second Semester				
5.	Pre –requisite (if any):	PME221, PME224, PME244				
6.	Co –requisite (if any):	NA				
7.	Program (s) in which the course is offered	POWER & Machines program				
8.	Language of teaching the course:	English				
9.	System of Study:	Semester				
10.	Mode of delivery:	semester				
11.	Location of teaching the course:	Class & lab				

III. Course Description:

Electrical drives circuits are a subject where a student will deal with various types of electric drives machines which are employed in industries, power stations, domestic and commercial appliances etc. It gives students the skills in the definitions, analysis, and solving problems related to electric variable speed drive. The course enables students to analyzes and discuss the basic characteristics, types, operating modes of DC motors, induction motor, synchronous

motor, stepper motor and theirs methods speed control with special emphasis on Computer simulations are used for understanding electric drives-based power-electronics converters and the design of feedback controllers. Laboratory experiments and MATLB simulation tool are carried for different types of power electronics elements 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. Demonstrate the mechanical system requirements for electric drives and the switch - mode power electronic converters in electric drives
2. Define the dynamic modeling of Induction motor drive, volt - herts, vector control and speed control of synchronous motors.
3. Identify the DC-motor drives, electronically-commutated motor drives and energy efficiency of electric drives and inverter-motor interactions.
4. Differentiate between different AC/DC drive for solving engineering problems and selection the appropriate solution according to needed specification.
5. Apply a variety of device models and circuit analysis theorems to analysis, design and implementing power control systems for engineering systems applications.
6. Carry out practical hands-on work in the field.
7. Work in teams to conduct experiments, analyze results, and develop technically sound reports of outcomes.
8. Use computer and Internet to extract information related to field of study.

V. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction of Drives	▪ Basic characteristics and operating modes of DC Motor Drives ▪ Performance characteristics of Induction Motor ▪ Performance characteristics Synchronous motors ▪ Stepper motor	1st ,2nd	4

2.	DC drives	▪ Single phase drives ▪ Three phase drive ▪ Chopper drives ▪ Closed loop control of DC motor	3rd ,4th ,5th ,6th	8
3.	Midterm exam		7th	2
4.	Induction motor 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	8th ,9th ,10th ,11th	8
5.	Vector control	▪ Basic Principle of Vector Control ▪ Direct and Quadrature-Axis Transformation ▪ Indirect Vector Control ▪ Direct Vector Control	12th	2
6.	Synchronous motor drives	▪ Cylindrical rotor motors ▪ Salient pole motors ▪ Reluctance motors ▪ Permanent magnetic motors ▪ Switched reluctance motors ▪ Closed loop control of synchronous motor	13th ,14th	4
7.	Stepper motor drives	▪ Stepper motor control ▪ Variable Reluctance stepper motors ▪ Permanent Magnetic stepper motors	15th	2
8.	Final exam	▪ All topics	16th	2
Number of Weeks /and Units Per Semester			**16**	**32**

B- Tutorial Aspect:

Order	Tasks/ Tutorial	No. of Weeks	Contact Hours
1.	▪ Operation and c Basic Characteristics of Dc Motors ▪ Operating Modes of Separately Excited Dc Motor ▪ Operating Modes of Series Excited Dc Motor	1st	2

Head of Department Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi	Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti	Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad	Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

2.	▪ Operation and characteristics of Single-Phase Semi converter Drives. ▪ Operation and characteristics of Single-Phase Full-Converter Drives ▪ Operation and characteristics of Single-Phase Dual-Converter Drives ▪ Simulating single phase drives by using MATLAB	2nd ,3rd	4
3.	▪ Operation and characteristics of three-Phase Semi converter Drives. ▪ Operation and characteristics of three-Phase Full-Converter Drives ▪ Operation and characteristics of three-Phase Dual-Converter Drives ▪ Simulating three phase drives by using MATLAB	4th ,5th	4
4.	▪ Principle of Power Control ▪ Principle of Regenerative Brake Control ▪ Principle of Rheostatic Brake Control ▪ Principle of Combined Regenerative and Rheostatic Brake control ▪ Two- and Four-Quadrant Dc–dc Converter Drives ▪ Open-Loop Transfer Function of Separately Excited motors ▪ Open-Loop Transfer Function of Series Excited Motors ▪ Closed-Loop Transfer Function ▪ Simulating DC-DC drives by using MATLAB	6th ,7th	4
5.	▪ Performance Characteristics of induction motors ▪ Torque–Speed Characteristics ▪ Stator Voltage Control ▪ Rotor Voltage Control ▪ Frequency Control ▪ Voltage and Frequency Control 789 ▪ Current Control ▪ Constant Slip-Speed Control ▪ Voltage, Current, and Frequency Control ▪ Closed-Loop Control of Induction Motors ▪ Simulating induction motors drives by using MATLAB	8th ,9th ,10th	6
6.	▪ Basic Principle of Vector Control ▪ Operation of Direct and Quadrature-Axis Transformation	11th	2

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	▪ Operation of Indirect Vector Control ▪ Operation of Direct Vector Control		
7.	▪ Control characteristics of synchronous motor and the methods for speed control ▪ Simulating ac synchronous motor using MATLAB	12th ,13th	4
8.	▪ Control characteristics of Variable-Reluctance Stepper Motors ▪ Control characteristics of Permanent-Magnet Stepper Motors	14th	2
Number of Weeks /and Units Per Semester:		**14**	**28**

C - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours
1.	▪ Single phase semi converter drive	1st	2
2.	▪ Single phase full wave converter drive	2nd	2
3.	▪ Single phase dual converter drive	3rd	2
4.	▪ Three phase half wave converter drive	4th	2
5.	▪ Three phase semi converter drive	5th ,6th	4
6.	▪ Three phase full wave converter drive	7th ,8th	4
7.	▪ Power control drive	9th	2
8.	▪ Regenerative brake control	10th	2
9.	▪ Induction motors control used AC voltage control	11th	2
10.	▪ Induction motors control used inverters	12th	2
11.	▪ Slip power control of wound rotor induction motors	13th	2
12.	▪ Review	14th	2
Number of Weeks /and Units Per Semester		**14**	**28**

VI. Teaching strategies of the course:

- Lectures
- Problem Solving
- Design exercises

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- Laboratory works
- Homework
- Project work
- Simulation Tools
- Presentations

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Comparison between types of modes operation	a1,a2,b1,b2,d2	3rd	4
2.	Design and implementation of power control circuits using MATLAB tools	a1,a2,b1,b2,c1	4th	4
3.	Design and implementation of dynamic brake control circuits using MATLAB tools	a1,a2,b1,b2,c1	6th	4
4.	Design and implementation of closed loop control of S.E.D.C. motor circuits using MATLAB tools	a1,a2,b1,b2,c1	8th	4
5.	Design and implementation of volt- hertz control of induction motor using MATLAB tools	a1,a2,b1,b2,c1	10th	4
	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 13th	20	10%
2.	Assignments	Weekly	20	10%
3.	Mid-Term exam	7th	20	10%
4.	Final exam practical	15th	40	20%
5.	Final Exam theory	16th	100	50%
	Total		**200**	**100%**

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IX. Learning Resources:

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

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2. Austin Hughes, (2006) Electric Motors and Drives Fundamentals, Types and Applications, 3rd Edition, Elsevier Ltd.

2- Essential References.

1. Cyril W. Lander, 1993, "Power electronics", 3rd edition, McGraw-Hill.
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4. E. Acha, Power Electronics control in Electrical system, 1st , 2002, Newnes.

3- Electronic Materials and Web Sites *etc*.

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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 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 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

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

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