

Module (Course Syllabus) Catalogue 2022-2023

College/ Institute	Erbil Technology College	
Department	AITE	
Module Name	AC Machine	
Module Code	AEM403	
Degree	Technical Diploma	
Semester	4	
Qualification	Ms.c	
Scientific Title	Assistant Lecture	
ECTS (Credits)	8	
Module type	Core	
Weekly hours	6	
Weekly hours (Theory)	(2)hr Class	(118) Total hrs Workload
Weekly hours (Practical)	(2)hr Class	(64) Total hrs Workload
Number of Weeks	12	
Lecturer (Theory)	Abubaker aziz ahmed	
E-Mail & Mobile No.	Abubaker.ahmed@epu.edu.iq 07504889179	
Lecturer (Practical)	Mustaq talib ,Adnan, and Zahra	
E-Mail & Mobile No.		
Websites		

Course Book

<p>Course Description</p>	<ul style="list-style-type: none"> • Review of single- and three-phase circuits. Basics of magnetic circuits. Single- & three-phase transformers. Theory, construction, equivalent circuit, and performance. Fundamentals of rotating machinery and rotating field. <ol style="list-style-type: none"> 1. Construction, Principal, Types, emf equation, no load and short circuit test, equivalent circuits, back-to-back (Sumpner's test), phasor diagram, Voltage regulation 2. Efficiency, Condition for maximum efficiency, all day efficiency, parallel operation, auto-transformer, basic idea of welding transformer, current and potential transformer, separation of losses. <p>Synchronous machines, equivalent circuit and characteristics. Induction motors, equivalent circuit of three-phase motor, its performance and characteristics.</p>
<p>Course objectives</p>	<ul style="list-style-type: none"> • Course objective: <ul style="list-style-type: none"> ❖ AC machines objective is to familiarize electric department students with basic structure, function, operation, characteristics and if any mathematical and practical problems associated with electrical AC machines. That will help electric department students to have a better understanding of the AC electrical machine subject. ❖ Briefly the course structure will involve mainly the following topics. <ol style="list-style-type: none"> i. Transformers: Transformer Fundamentals, Importance of transformers, Types and construction, The ideal transformer, Leakage reactance, Theory and operation of single phase transformer, Losses and phasor diagram, The equivalent circuit of a real transformer, No load and short circuit test, The per unit system, The transformer voltage regulation and efficiency, Autotransformers and concept of its power rating advantages, Current transformer (CT) and Potential transformer (PT), Three phase Transformers, Construction of power Transformer. ii. AC motors: Type of motors, torque equation, characteristics, losses and efficiency, <ol style="list-style-type: none"> 1. Three Phase Induction Motor

	<ul style="list-style-type: none"> ○ Construction, Basic concepts and working principles, Synchronous speed, Slip and its effect on rotor frequency and rotor voltage, Equivalent circuit, Power and torque, Torque speed characteristics, losses, efficiency and power factor <p>2. Single Phase and Special Purpose Motors</p> <ul style="list-style-type: none"> ○ The Universal motor, Introduction to single phase induction motor, Starting single phase induction motors, Split phase windings, Capacitor start motor, Permanent split capacitor motor, Capacitor start and capacitor run motors, Shaded pole motors, Reluctance motors, The Hysteresis motor
<p>Student's obligation</p>	<p>The students should attend the theoretical lectures and study them very well to understand them and ask about any part which is not clear, also the students should have daily examinations about the previous lecture and solve the homework questions.</p> <p>For the practical part the students should attend in time every week to make the experiment and prepare a report about it, in addition the students should have daily exams about the previous experiment and of course there will exams at the end of each term At the end of the semester the students should have both practical and theoretical examinations.</p> <p>Missed classes will not be compensated including the quizzes and the scheduled assignments. The students will lose marks on unattended classes with quizzes unless a legal document or authorized leave is presented which should explain the excuse of the absence. However, the absent student should take the responsibility for making up the missed lecture.</p> <ol style="list-style-type: none"> 1. Regular attendance to classes.(must not be exceed to 10%) 2. Written tests clearly linked to learning objectives. 3. Seminar
<p>Required Learning Materials</p>	<ul style="list-style-type: none"> • Forms of teaching <p>Lecturing style in theory and laboratory in practice.</p> <p>Methods of delivering the course (teaching method):</p> <p>The teaching method used to deliver the course material does varies, but mainly using data show (power point). Variety methods are implemented, whenever necessary, to bring about a better understanding of the electrical machine material to the students.</p> <p>Power point slides contain a simplified notes (appropriate method which is suitable for students to understand more easily), sometimes via animations, videos, tables, diagrams and figures.</p>

	<p>Power point is a modern teaching method, that is both time and money saving. Speed teaching is less boring for student, and encouraging students to participate in the subject, via asking questions on the subject.</p> <p>Means of explanation:</p> <ol style="list-style-type: none"> 1. Data show and power point 2. White board 3. Laboratory exercise model. 4. Video lessons (recorded by the lecturer), inserted in Moodle program on line <p><i>NOTE: Due to the health condition, we are using Zoom In software to trample theory</i></p>				
Evaluation	Task		Weight (Marks)	Due Week	Relevant Learning Outcome
	Paper Review				
	Assignments	Homework	10%		
		Class Activity	2%		
		Report			
		Seminar	14%		
		Essay			
	Project				
	Quiz		4%		
	Lab.		14%		
	Midterm Exam(P+T)		16%		
	Final Exam (P+T)		40%		
Total		100%			
Specific learning outcome:	<p>Student learning outcome:</p> <ul style="list-style-type: none"> • Explain construction and operation principle of transformer and AC motors <ol style="list-style-type: none"> 1. Describe the working principle of a transformer and AC motor . 2. List and describe the main components of a transformer and AC motor. 3. Describe the operation of, and factors affecting output transformer and AC motor. 				
Course References:	<p><u>Key references:</u></p> <ol style="list-style-type: none"> i. <u>A text book of Electrical Technology by Thiraja</u> ii. <u>Electrical Engineering ,U.A. Bakshi @V.A Bakshi</u> 				

	<p>iii. <u>Electrical Technology, U.A. Bakshi @V.A Bakshi</u></p> <p>▪ Useful references:</p> <p>i. <u>Electrical Machines, U.A. Bakshi @V.A Bakshi</u></p> <p>ii. <u>Direct current Machine, R.K. Rajput</u></p> <p>iii. <u>Electrical Machines, S.N. Ali</u></p> <p>▪ Magazines and review (internet): open.</p> <p><u>Students are free to use the above course books or any alternative electrical machine books of their own</u></p>
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Course topics (Theory)	Week	Learning Outcome
<ul style="list-style-type: none"> • Introduction to transformer • Theory and operation of single phase transformer and its construction • Different types of core. 	1	
<ul style="list-style-type: none"> • Types of transformer • EMF equation of a transformer and transformation ratio. • Different types of losses and condition for maximum efficiency • Losses and phasor diagram 	2	
<ul style="list-style-type: none"> • The equivalent circuit of a real transformer • No load and short circuit test • 	3	
<ul style="list-style-type: none"> • Understand basic concepts of (Auto transformer- current transformer- voltage transformer) • Understand basic concepts of Three phase transformer(solve mathematically problem) 	4	
<ul style="list-style-type: none"> • Equivalent circuit Referred to primary and secondary(solve mathematically problem) 	5	
<ul style="list-style-type: none"> • (solve mathematically problem) about the equivalent circuit of transformer. 	6	
<ul style="list-style-type: none"> • Cooling Methods Of A Transformer 	7	
<ul style="list-style-type: none"> • Introduce students to different types of A.C motor 	8	
<ul style="list-style-type: none"> • Three phase and single phase Induction motor structure • Torque and speed propertice of different type of motors 	9	

<ul style="list-style-type: none"> Introduce students to different types Starting in AC motor control 	10	
<ul style="list-style-type: none"> Equivalent circuit of a single phase and three phase induction motor 	11	
<ul style="list-style-type: none"> (solve mathematically problem) about the equivalent circuit of a three phase induction motor 	12	
<p>Practical Topics:</p> <ul style="list-style-type: none"> The laboratory will involve experiments on the laboratory bench kits, along with the corresponding subject in the lectures. A brief outline of the experiments to be done are as follows: 	Week	Learning Outcome
Open circuit test single phase transformer	1	
Short circuit test single phase transformer	2	
Connection single phase transformer in parallel	3	
Connection single phase transformer in series	4	
Load test single phase transformer (resistance, inductive, capacitive)	5	
Load test three phase transformer (star/star) connection	6	
Starting of induction motor	7	
Open circuit test of three phase induction motor	8	
Speed control three phase induction motor	9	
Starting current measurement and Torque induction motor	10	
Load test of single phase motor	11	
	12	
<p>Questions Example Design</p> <p>1-Compositional:</p> <p>Q/How Does A Transformer Work?</p> <p>Q/ Can DC supply Applied To Transformers ?</p> <p>2-Multiple choices:</p> <p>Q/ choose the most correct answer and (prove your chosen with aide of equation):</p>		

1. When the turns ratio of a transformer is 20 and the primary ac voltage is 12 V, the secondary voltage is

- A. 12 V
- B. 120 V
- C. 240 V
- D. 2,400 V

1. How many primary volts must be applied to a transformer with a turns ratio of 0.1 to obtain a secondary voltage of 9 V?

- A. 9 V
- B. 90 V
- C. 900 V
- D. 0.9 V

3-Problems

Obtain the equivalent circuit of a 200/400V, 50Hz, single phase transformer from the following test data:

O.C. test 200V 0.7A 70W at L.V side
S.C. test 15V 10A 85W at H.V side

Determine:

- 1- Determine the parameters referred to primary and draw equivalent circuit.
- 2- The secondary voltage when delivering 5KW at power factor lagging, the primary voltage being 200V.

Extra notes:

External Evaluator

- This course book have been reviewed, resigned and approved by (Hilmi Fadhil Ameen.) former lecturer of this subject.

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