



MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information

معلومات المادة الدراسية

Module Title	SYNCHRONOUS AND SPECIAL MACHINES	Module Delivery	
Module Type	CORE	✓ Theory Lecture ✓ Lab Tutorial ✓ Practical ✓ Seminar	
Module Code	UOMU0205061		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	3	Semester of Delivery	2
Administering Department	DEPARTMENT OF ELECTRICAL ENGINEERING TECHNIQUES	College	AL-MUSTAQBAL
Module Leader	Salwan Saud Hatif	e-mail	salwan.saud.hatif@uomus.edu.iq
Module Leader's Acad. Title	Doctor	Module Leader's Qualification	Doctor
Module Tutor	None	e-mail	None
Peer Reviewer Name	None	e-mail	None
Review Committee Approval	1/10/2025	Version Number	1.0

Relation With Other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	<ol style="list-style-type: none">1. Understand the principles of operation of synchronous machines and special machines, including their construction, working principles, and characteristics.2. Analyze and calculate the performance parameters of synchronous machines, such as power factor, efficiency, voltage regulation, and synchronous reactance.3. Analyze and calculate the performance parameters of special machines, such as permanent magnet machines, switched reluctance machines, and brushless DC machines.4. Design and select synchronous machines for specific applications, considering factors such as power requirements, speed control, and load characteristics.5. Design and select special machines for specific applications, considering factors such as torque-speed requirements, efficiency, and control methods.6. Evaluate the advantages, limitations, and applications of synchronous machines
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	<p>7. special machines analyzing in various industries, such as power generation, renewable energy systems, electric vehicles, and robotics.</p>
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<ol style="list-style-type: none"> 1. Demonstrate a comprehensive understanding of the principles of operation, construction, and characteristics of synchronous machines and special machines. 2. Calculate and analyze the performance parameters of synchronous machines, such as power factor, efficiency, voltage regulation, and synchronous reactance. 3. Calculate and analyze the performance parameters of special machines, such as permanent magnet machines, switched reluctance machines, and brushless DC machines. 4. Design and select synchronous machines for specific applications, considering factors such as power requirements, speed control, and load characteristics. 5. Design and select special machines for specific applications, considering factors such as torque-speed requirements, efficiency, and control methods. 6. Evaluate the advantages, limitations, and applications of synchronous machines and special machines in various industries, such as power generation, renewable energy systems, electric vehicles, and robotics. 7. Apply control methods and techniques for synchronous machines and special machines, including field control, excitation control, and speed control.
<p>Indicative Contents المحتويات الإرشادية</p>	<ul style="list-style-type: none"> • Basic principles of operation • Types of synchronous machines • Construction and components of synchronous machines • Phasor diagram and equivalent circuit • Synchronous Machine Performance Analysis • Synchronous machine modeling and equations • Calculation of synchronous machine parameters (synchronous reactance, armature reaction, etc.) • Voltage regulation and power factor control • Efficiency and losses in synchronous machines • Synchronous Machine Operation and Control • Field excitation control methods • Voltage control methods (AVR, brushless excitation system, etc.) • Reactive power control and power factor correction • Synchronization and parallel operation of synchronous generators • Applications and advantages of permanent magnet machines • Switched Reluctance Machines • Basics of switched reluctance machines • Construction and working principles of switched reluctance machines • Control techniques for switched reluctance machines • Applications and advantages of brushless DC machines • Special Machine Applications • Synchronous machines in power systems and power generation • Special machines in electric vehicles and hybrid systems • Special machines in renewable energy systems (wind turbines, hydroelectric generators, etc.)

- Special machines in industrial automation and robotics

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

1. Lectures: Conduct traditional lectures to introduce theoretical concepts, working principles, and mathematical modeling of synchronous and special machines. Use visual aids, such as slides and diagrams, to enhance understanding.
2. Practical Demonstrations: Organize practical sessions where students can observe the operation of synchronous and special machines. This can include laboratory experiments or field visits to industries using these machines.
3. Simulation and Modeling: Utilize software tools and simulations to create virtual environments for students to analyze and simulate the behavior of synchronous and special machines. This helps in understanding complex phenomena and performing virtual experiments.
4. Case Studies: Present real-life case studies of synchronous and special machines in different applications, such as power generation, renewable energy, and industrial automation. Encourage students to analyze and discuss the challenges and solutions encountered in these cases.
5. Conceptual Understanding: Begin by providing a comprehensive overview of special machines, their unique characteristics, and their applications in various industries. Help students develop a solid conceptual understanding of special machines and their significance.

Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	3.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	6	10% (10)	5, 10	LO #1, 2, and 6
	Assignments	8	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab. Report	7	10% (10)	Continuous	All
	Report	8	10% (10)	2, 12	LO # 5, 5 and 7
Summative assessment	Midterm Exam	2 hr	10% (10)	8	LO # 1-7
	Final Exam	3 hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

1	Introduction
2	Basic construction of synchronous machine.
3	Equivalent circuit of synchronous generator.
4	Parallel operation of synchronous generator.
5	Effect of changing field excitation at constant load.
6	Theory of Synchronous motor.
7	V curves for Synchronous motor.
8	Basic construction Single phase induction motor.
9	Equivalent circuit of Single-phase induction motor.
10	Starting Torque method of Single-phase induction motor.
11	Theory and construction of stepper motor
12	Theory and construction of SRM motor
13	Theory and construction of linear motor
14	Theory and construction of universal motor
15	Final Examination
Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
1	Lab 1: Determination of regulation of three _phase alternator by direct loading.
2	Lab 2: Three phase alternator open circuit characteristics.
3	Lab 3: Three phase alternator short circuit characteristics.
4	Lab 4: Three Phase alternator Load (resistance load).
5	Lab 5: Three Phase alternator Load (Inductive load).
6	Lab 6: Three Phase alternator Load (capacitive load).
7	Lab 7: Three phase synchronous motor V-curve test.
8	Lab 8: Three phase synchronous motor compensator test.
9	Lab 9: Starting torque method of three phase synchronous motor.
10	Lab 10: Run capacitor starting of single-phase induction motor.
11	Lab 11: Making single phase induction motor self-starting.
12	Lab 12: Reversing of single-phase induction motor.
13	Lab 13: No-load test of single-phase induction motor.
14	Lab 14: Review

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	"ELECTRICAL MACHINERY AND TRANSFORMERS" by BBAG S.GURU , 3th Edition, 2001	Yes
Recommended Texts	"Electric Machinery Fundamentals" by Stephen J. Chapman 2000.	No
Websites	https://books.google.com/books?id=7DvhCgAAQBAJ&dq=principles+of+electric+machines+and+power+electronics&hl=ar&newbks=1&newbks_redir=1&sa=X&ved=2ahUKEwi1tv-N9cP_AhWFIMUKHQtfCw4Q6AF6BAGDEAI	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				
NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				