Ministry of Higher Education and
Scientific Research - Iraq
Al-Furat Al-Awsat Technical University
Al-Musaib Technical College
Department of Electrical Engineering Techniques

MODULE DESCRIPTOR FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**ELECTRICAL TRANSFORMERS AND INDUCTION MACHINES**	**Module Delivery**	
Module Type	CORE	✓ **Theory** **Lecture** ✓ **Lab** **Tutorial** ✓ **Practical** ✓ **Seminar**	
Module Code	ATU23053		
ECTS Credits	5		
SWL (hr/sem)	١٢٥		
Module Level	٣	**Semester of Delivery**	1
Administering Department	**DEPARTMENT OF ELECTRICAL ENGINEERING TECHNIQUES**	**College**	**AL-FURAT AL-AWSAT TECHNICAL UNIVERSITY/AL-MUSAIB TECHNICAL COLLEGE**
Module Leader		**e-mail**	
Module Leader's Acad. Title		**Module Leader's Qualification**	
Module Tutor	None	**e-mail**	None
Peer Reviewer Name	None	**e-mail**	None
Review Committee Approval	14/06/2023	**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	1-Understand the principles of operation of electrical transformers and induction machines, including the basic theory and working principles. 2-Analyze and calculate the performance characteristics of transformers and induction machines, such as voltage transformation, efficiency, losses, and regulation. 2- Select transformers and induction machines for specific applications, considering factors such as power requirements, voltage levels, and load characteristics. 3-Evaluate the efficiency and losses in transformers and induction machines, and identify methods to improve efficiency and reduce losses. 4-Recognize the different types and configurations of transformers and induction machines, and understand their advantages, limitations, and applications.

	5-Apply troubleshooting techniques and maintenance practices for transformers and induction machines, including identifying common faults, conducting tests, and performing routine maintenance tasks. 6-Understand the importance of energy efficiency and sustainability in transformer and motor selection, and evaluate the impact of transformers and induction machines on energy consumption. 7-Develop critical thinking and problem-solving skills by analyzing real-world scenarios and applying theoretical concepts to solve practical problems related to transformers and induction machines.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1-Describe the principles of operation of electrical transformers and induction machines. 2-Analyze and evaluate the performance characteristics of transformers, including voltage transformation, efficiency, losses, and regulation. 3-Analyze and evaluate the performance characteristics of induction machines, including torque-speed characteristics, starting methods, and slip. 4- induction machines for specific applications, considering factors such as power requirements, torque-speed requirements, and control methods. 5-Calculate and analyze the losses and efficiency of transformers and induction machines, and propose methods for improving efficiency and reducing losses. 6-Compare and contrast different types and configurations of transformers and induction machines, and evaluate their advantages, limitations, and applications.
Indicative Contents المحتويات الإرشادية	• Introduction to Electrical Transformers and Induction Machines: • Overview of transformers and induction machines. • Importance and applications in various industries. • Historical development and advancements. • Transformer Principles and Operation: • Transformer construction and components. • Magnetic circuits and core materials. • Electromagnetic induction and transformer action. • Ideal transformer model and equations. • Introduction to induction machines (squirrel cage and wound rotor). • Construction and components of induction machines. • Rotating magnetic field and slip. • Equivalent circuit model and phasor diagrams. • Torque-speed characteristics and starting methods (direct-on-line, star-delta, etc.). • Induction Machine Performance and Design: • Motor performance parameters: efficiency, power factor, and torque-speed characteristics. • Losses in induction machines: copper losses, iron losses, and mechanical losses. • Efficiency calculations and improvement methods. • Motor starting and speed control techniques: soft starters, variable frequency drives (VFDs), etc.

	• Motor selection and design considerations for specific applications. • Induction Machine Testing and Maintenance: • Motor efficiency assessment and energy-saving measures

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies

1. Lectures: In-class lectures can provide a comprehensive overview of the theoretical concepts, principles, and operating characteristics of electrical transformers and induction machines. Lectures can include visual aids, demonstrations, and examples to enhance understanding.
2. Practical Demonstrations: Hands-on demonstrations and experiments can be conducted to illustrate the operation and behavior of transformers and induction machines. This can help students visualize the concepts and gain practical insights into their functioning.
3. Problem-Solving Sessions: Dedicated problem-solving sessions can be conducted to apply the theoretical knowledge to solve numerical and analytical problems related to transformers and induction machines. This helps students develop critical thinking and problem-solving skills.
4. Case Studies: Real-world case studies can be presented to demonstrate the practical application of transformers and induction machines in various industries. Students can analyze and discuss these cases to understand the challenges, design considerations, and solutions implemented.
5. Computer Simulations and Virtual Laboratories: Utilizing computer simulations and virtual laboratories can provide a virtual environment for students to interact with transformers and induction machines. This enables them to explore different scenarios, conduct experiments, and observe the effects in a controlled setting.
6. Group Discussions and Debates: Organizing group discussions and debates on specific topics related to transformers and induction machines can encourage active participation and collaboration among students. This facilitates the exchange of ideas and perspectives, fostering a deeper understanding of the subject matter.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	47	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.13
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	10% (10)	5, 10	LO #3, 5and 6
	Assignments	8	10% (10)	2, 12	LO # 3, 4 and 5
	Projects / Lab.	9	10% (10)	Continuous	All
	Report	9	10% (10)	2, 12	LO # 5, and 6

Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1-6
	Final Exam	3 hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
١	Introduction
٢	Basic construction of electrical machines.
٥	Theory of an ideal transformer.
٦	Practical transformer.
٧	Equivalent circuit of a loaded transformer.
٨,٩,١٠	Three phase - Transformer , Efficiency of a transformer , Parallel operation of single-phase transformer.
١١	Three-phase induction motors
١٢,١٣	Equivalent circuit of induction motor , Power relations and Methods of starting of induction motors.
١٤	Speed control of induction motors.
١٥	• **Final Examination**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Practical Part
١	**Lab ١: open circuit test of single-phase transformer.**
٢	**Lab ٢: short circuit test of single-phase transformer.**
٣	**Lab ٣: Single Phase Transformer on Load Test (Resistive)**
٤	**Lab ٤: Single Phase Transformer on Load Test (Inductive)**
٥	**Lab ٥: Parallel Operation of Single-Phase Transformer**
٦	**Lab ٦: Three Phase Transformer Voltage and Current Ratio Test**
٧	**Lab ٧: Star-Delta Connection in Three Phase Transformer**
٨	**Lab ٨: Three phase induction motor no load test.**
٩	**Lab ٩: Three phase induction motor locked rotor test.**
١٠	**Lab ١٠: Three phase induction motor load test.**
١١	**Lab ١١: speed control for three phase induction motor (slip - ring).**
١٢	**Lab ١٢: speed control for three phase induction motor (squirrel cage).**
١٣	**Lab ١٣: star delta starting for three phase indication motor.**
١٤	**Lab ١٤: Rotor resistance starting for ٣-Ph.I.M (slip-Ring).**

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 ٢٠٠٠.	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 (٥٠ - ١٠٠)	**A** - Excellent	امتياز	٩٠ - ١٠٠	Outstanding Performance
	B - Very Good	جيد جدا	٨٠ - ٨٩	Above average with some errors
	C - Good	جيد	٧٠ - ٧٩	Sound work with notable errors
	D - Satisfactory	متوسط	٦٠ - ٦٩	Fair but with major shortcomings
	E - Sufficient	مقبول	٥٠ - ٥٩	Work meets minimum criteria
Fail Group (٠ – ٤٩)	**FX** – Fail	مقبول بقرار	(٤٥-٤٩)	More work required but credit awarded
	F – Fail	راسب	(٠-٤٤)	Considerable amount of work required

Note:

NB Decimal places above or below ٠,٥ will be rounded to the higher or lower full mark (for example a mark of ٥٤,٥ will be rounded to ٥٥, whereas a mark of ٥٤,٤ will be rounded to ٥٤. 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.