



Course Syllabus

**According to JORDAN National Qualification Framework
(JNQF)**

Course Name: Electrical Machines

Course Number: 04083151

General Course Information:

Course title	Electrical Machines
Course number	04083151
Credit hours	3h. theory
Education type	[Face-to-Face]
Prerequisites/corequisites	Electrical circuits 1, Electromagnetism I, and Electrical circuits 2 (04022130, 04022230, 04023130)
Academic Program	Renewable Energy Engineering, Communications & Electronics Engineering.
Program code	REE, CEE
Faculty	Engineering
Department	Renewable Energy Engineering Department
Level of course	3rd year
Academic year /semester	2021/2022; Second
Awarded qualification	B.Sc.
Other Departments involved in teaching the course	Communications & Electronics Engineering Department.
Language of instruction	English
Date of production/revision	6 March 2022

Course Coordinator:

Coordinator's name	Dr, Zakaria Al-Omari
Office No	4203
Office Phone extension number	2488
Office Hours	Su. 13:00-14:00
Email	Zakaria.alomari@iu.edu.jo

Other Instructors:

Instructor name	
Office No	
Office Phone extension number	
Office Hours	
Email	

Course Description (*English/Arabic*):

English	Transformers: construction, principles, and operation, ideal and nonideal, performance characteristics, three-phase, autotransformers. Three-phase induction motors: construction, operation, performance calculations, starting and speed control. Synchronous machines: construction, generator, and motor operations. DC machines: construction, classifications, performance equations of generators and motors, starting and speed control of motors.
----------------	--

Textbook: *Author(s), Title, Publisher, Edition, Year, Book website.*

S. J. Chapman, "Electric Machinery Fundamentals", Fifth Edition, McGraw-Hill, 2012.

References: Author(s), Title, Publisher, Edition, Year, Book website.

Required book (s), assigned reading, and audio-visuals:

1. P. C. Sen, "Principles of Electric Machines and Power Electronics", 2nd Edition, Wiley, 1997.
2. S. A. Nasar, I. Boldea, "Electric Machines: Steady-State Operation", Hemisphere Publishing Corporation, 1990.
3. A. E. Fitzgerald, C. Kingsley, S. D. Umans, Electric Machinery, sixth edition, New York, McGraw-Hill. 2003.
4. Internet links
<https://youtu.be/DsVbaKZZOFQ>
<https://youtu.be/CWuIQ1ZSE3c>
https://youtu.be/vh_aCAHThTQ

Course Educational Objectives (CEOs):

1.	State the purpose of a transformer.
2.	Determine the output voltage of a transformer if the input voltage and turns ratio are known.
3.	Determine the full-load current of a transformer given the kVA and voltages of the primary and secondary windings.
4.	Understand the importance and advantage of the 3-phase transformer.
5.	Parallel Operation of 3-phase Transformers
6.	To give exposure to the students about the concepts of the rotating magnetic field.
7.	Understand the difference between synchronous speed and mechanical speed.
8.	Understand the concepts of alternating current machines including the Constructional details, the principle of operation, and performance analysis.
9.	To learn the characteristics of induction machines and to learn how they can be employed for various applications.
10.	Provide the student a comprehensive treatment of synchronous machines viz. synchronous generator which is universally employed for the generation of 3-phase power at all generation stations
11.	Provide the student a comprehensive treatment of synchronous motors and single-phase induction motors which are used in daily life like washing machines, fans, etc.
12.	Introduce DC Generators and Motors: principles, analysis, and performance characteristics.

Intended Learning Outcomes (ILOs):

	Subject Intended learning outcomes (ILOs) describe what students are expected to know and be able to do at the end of the course. These outcomes are related to the knowledge, skill, and competence that students acquire:	Relationship to CEOs	Contribution to PLOs	Bloom Taxonomy Levels*	Descriptors**
A	Knowledge and Understanding:				
A1	Understand the acceptable approximation based on the full understanding of the machines and transformers	1	1	1	K
A2	Understand the generation and the motor principles	1, 2, 3	1, 2	1	K
A3	Understand some phenomena's like armature reaction, back emf, eddy current, hysteresis losses	4, 5	1, 2	1	K

B	Intellectual skills:				
B1	Define the input-output characteristics of each machine	3, 4, 5	1, 2	2	S
B2	Analyze the speed-torque characteristics for all motors	3, 4, 5	1, 2		
C	Subject-specific skills:				
C1	Explain all physical quantities by the suitable electric elements with the proper connections	1, 2, 3, 4, 5	1, 2	3	S
D	Transferable skills:				

***Bloom Taxonomy Levels**

Level #	1	2	3	4	5	6
Level Name	Knowledge	Comprehension	Application	Analysis	Evaluation	Synthesis

**** Descriptor (National Qualification Framework Descriptors): K: Knowledge, S: Skill, C: Competency.**

Program Learning Outcome (PLOs):

Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program. A graduate of the (_____) program will demonstrate:		Descriptors**		
		K	S	C
1.	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	✓		
2.	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.		✓	
3.	An ability to communicate effectively with a range of audiences.		✓	
4.	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.		✓	
5.	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.		✓	
6.	An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgment to draw conclusions.		✓	
7.	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.		✓	

**** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)**

Weekly Schedule (please choose the type of teaching)

✓ Face to Face

- Hybrid (2 Lectures Face-To-Face +1 Lecture Asynchronous)
- Hybrid (1 Lectures Face - To - Face +1 Lecture Asynchronous)
- Online (2 Lectures Synchronous +1 lecture Asynchronous)

Week	First Lecture (.....)	Second Lecture (.....)	Third Lecture (.....)	Ach. ILOs	Ach. PLOs	Descriptors* *
1	Introduction	Revision to circuit analysis	Introduction to the magnetic circuit	A1	1	K

2	Magnetic circuit	Magnetic circuit	Magnetic circuit	A1	1	K
3	Transformers	Transformers	Transformers	A1, A3		
4	Transformers	Transformers	Transformers	A1, A3		
5	Transformers	Transformers	Autotransformers	A1, A3		
6	Autotransformers	3-phase transformers	3-phase transformers	A1, A3, B1		
7	3-phase transformers	3-phase transformers	3-phase transformers	A1, A3, B1		
8	3-phase transformers	Revisions	Midterm Exam	A1, A3, B1		
9	Rotational Machines	3-phase induction motors	3-phase induction motors	A1, A3, B1		
10	3-phase induction motors	3-phase induction motors	3-phase induction motors			
11	3-phase induction motors	3-phase induction motors	3-phase induction motors			
12	3-phase synchronous generator	3-phase synchronous generator	3-phase synchronous generator			
13	3-phase synchronous generator	3-phase synchronous generator	3-phase synchronous generator			
14	DC machines	DC machines	DC machines			
15	Review and problem solving	Review and problem solving	Review and problem solving			

* K: Knowledge, S: Skills, C: Competency

Teaching Methods and Assignments:

The development of ILOs is promoted through the following teaching and learning methods:

- Interactive videos
- Practice Labs
- Discussion Forums
- Quizzes
- Other Interactive online activities
- Reports

Course Policies:

A- Attendance policies:

The maximum allowed absences are 15% of the lectures.

B- Absences from exams and handing in assignments on time:

The midterm exam can be retaken based on approval of excuse by the instructor's discretion.

Not handing in assignments on time will incur penalties.

C- Academic Health and safety procedures

D- Honesty policy regarding cheating, plagiarism, and misbehavior:

Cheating, plagiarism, and misbehavior will result in zero grades and further disciplinary actions may be taken.

E- Grading policy:

- All homework is to be posted online through the e-learning system.
- Exams will be marked within 72 hours and the marked exam papers will be handed to the students.
- Online Activities (Course Videos, Practice labs, Discussion Forums, Quizzes) ___%

- Midterm ___%
- Final Exam ___%

F- Available university services that support achievement in the course: **E-Learning Platform, Labs, Library.**

Required equipment:

- **PC / Laptop with webcam and mic**
- **Internet Connection**
- **Access to the IU E-Learning Platform at: <https://elearn.iu.edu.jo/>**
- **E-learning plan**
- Satisfaction questionnaires for online and face-to-face learning
- Software for e-learning
- Training

Assessment Tools implemented in the course:

- Final Exam
- Midterm Exam
- Quizzes
- Homework
- Practice Labs
- Discussion Forums
- Periodic reports for learning assessment
- Improvement plans for online or face-to-face teaching
- Others:.....

Responsible Persons and their Signatures:

Course Coordinator	Dr. Zakaria Al-Omari	Completed Date	29/6/2022
		Signature	
Received by (Department Head)	Dr. Zakaria Al-Omari	Received Date	29/9/2022
		Signature	