Sana'a University
Faculty of Engineering
Electrical Engineering Department
B.Sc. of Computer and Control Engineering

24. Template for Course Plan of Electrical circuits 2

I. Information about Faculty Member Responsible for the Course:

Name of Faculty Member	Asst. Prof. Dr. Eng. Mohammad Ali Nasr Saif	**Office Hours**					
Location &Telephone No.	Faculty of Engineering	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	dmansaif@gmail.com						9-12

II. Course Identification and General Information:

1.	Course Title:	Electrical circuits 2				
2.	Course Number & Code:	PME112				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	2	2	-	4
4.	Study level/year at which this course is offered:	First year Electrical engineering/ Second term				
5.	Pre –requisite (if any):	Electrical circuits 1 (PME111)				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered	Electrical Programs (All Three Programs)				
8.	Language of teaching the course:	English				
9.	System of Study:	Regular				
10.	Mode of delivery:	Lecture				
11.	Location of teaching the course:	Class and laboratory				

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III. Course Description:

This course is the second basic course on electrical circuits and it is also essential in the department. It is intended to enhance the knowledge of students with regard to electrical AC circuits and to develop their skills.

The course topics focus on fundamentals, calculations and analysis of AC circuits, and it inclu impedance, admittance, voltage, current and powers of AC circuits and their components also the use of different techniques, laws, and theorems to analyze the simple and complex types of the AC circuits.

This course enables students to:

- Perform the calculation techniques of the AC circuits using time-domain forms of AC quantities.
- Understand the effect of the frequency on the AC circuit impedance.
- Draw the diagrams (triangles) of impedance and admittance of an AC circuit
- Perform the calculation techniques of the AC circuits using phasor-domain (complex) forms of AC quantities.
- Calculate the powers of an AC circuit.
- Know the importance of power factor in AC circuits.
- Draw the phasor diagram of powers of an AC circuit.
- Understand the magnetically coupled circuits, applications and their calculation techniques.
- Understand the poly-phase circuits, their importance and calculation techniques.
- Understand the tow-port circuits, their rules and calculation techniques.

IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop**:**

1. Defin the difference between the DC and AC quantities and circuits.
2. Acquire knowledge of the impedance, admittance and the parameters of the pure (ideal) and normal elements in the AC circuit .

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3. Acquire knowledge of representing an AC quantity on the time-domain plane (as a waveform) and/or on the (complex) plane (as a phasor diagram) and the difference between the two representations.
4. Recognize the poly-phase circuits, their importance and calculation techniques .
5. Analyze the AC simple circuits by the use of phasor, non-sinusoidal and sinusoidal time-domain AC quantities.
6. Solve the complex and tow-port AC circuits using different circuit analyzing techniques.
7. Apply the time-domain sinusoidal, non-sinusoidal and phasor AC quantities to solve AC circuits.
8. Practice related computer software to design simple AC circuits.
9. Enhance the self-learning activities using faculty library and computer and internet resources.

V. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact hours
1.	General Introduction to the course. AC Circuit elements	▪ Introduction to electrical AC circuits. ▪ The objectives, requirements and guidelines to comply with the course. ▪ Impedance, admittance, parameters and AC quantities of a pure element in AC Circuits. ▪ Representing the pure element quantities in time-domain and complex planes.	1st	2
2.	AC Circuit elements	▪ Impedance, admittance, parameters and AC quantities of a normal element in AC Circuits.	2nd	2

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		▪ Waveform, phasor diagram or/and triangle of the normal element quantities in an AC circuit. ▪ Frequency effect on the impedance and parameters of an element in AC circuit.		
3.	Calculations of AC Networks:	▪ Calculations of ac circuits using non-sinusoidal time-domain quantities: - With a simple-pure element circuit. - With a simple-normal element circuit. ▪ Calculations of ac circuits using sinusoidal phasor-domain (complex) quantities: - Complex numbers - Complex numbers forms. - Mathematical operations of complex numbers. - Conversion between time-domain and phasor - domain (complex) quantities. ▪ Representation of time-domain and phasor-domain quantities of an AC circuit: - waveform representation of the time-domain sinusoidal and non-sinusoidal quantities. - Phasor diagram (or triangle) representation of the phasor - domain (complex) quantities.	3rd ,4th	4

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4.	Series and Parallel AC Circuits:	▪ Input impedance, admittance, parameters, voltage, current and power of series AC circuits. ▪ Division of the input current and power on the elements of series AC circuit: - Kirchhoff's voltage law (KVL). - Voltage divider rule (VDR). ▪ Input admittance, impedance, parameters, voltage, current and power of parallel AC circuits. ▪ Division of the input voltage and power on the elements of parallel AC circuit: - Kirchhoff's current law (KCL). - Current divider rule (CDR). ▪ Single- and double-subscripts voltages notations in AC circuits. ▪ Input and output powers of series or parallel AC circuits: - Complex powers rules.	5^{th} ,6^{th}	4
5.	Series-Parallel AC Circuits:	▪ Techniques used in analyzing the circuit: - Reduce and return approach. - Block diagram approach. - Ladder circuits.	7^{th}	2
6.	Advanced analysis methods in AC Circuits:	▪ Branch current analysis method in AC circuits. ▪ Mesh analysis method in AC circuits. ▪ Nodal analysis method in AC circuits.	8^{th}	2
7.	Network theorems in AC Circuits:	▪ Superposition theorem. ▪ Millman's theorem. ▪ Thevenin's theorem. ▪ Norton's theorem.	9^{th}	2

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		▪ Maximum power transfer theorem.		
8.	Mid-Term Exam	▪ Covers all sub topics upto the 7th week.	10th	2
9.	Poly-phase systems:	▪ ABC sequence. ▪ ACB sequence. ▪ Y-connected three-phase balanced system. ▪ □-connected Three-phase balanced system. ▪ Voltage, current and power of Y-and □-connected three-phase balanced systems. ▪ Y- Y three-phase balanced systems. ▪ □- □ three-phase balanced systems. ▪ Y- □ three-phase balanced systems. ▪ Calculations in a three-phase balanced circuit.	11th ,12th	4
10.	Magnetically coupled circuits:	▪ Air-core and iron-core magnetic (coil) circuits. ▪ Self and mutual inductances of coil circuits. ▪ Series connection of the magnetically coupled coils. ▪ Electrical networks with the magnetically coupled coils.	13th	2
11.	Tow-port networks:	▪ Types of two-port networks. ▪ Input and output impedance and admittance of two-port networks. ▪ Two-port cascade networks.	14th	2

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		▪ Input and transfer parameters of the impedance and admittance of two-port network. ▪ Hybrid parameters of two-port network. ▪ Hybrid input and output impedance of two-port network.		
12.	General Review and consultancy	All main subjects by requirement.	15th	2
13.	Final Exam		16th	2
Number of Weeks /and Units Per Semester			**16**	**32**

B. Tutorials Aspect:

Order	Tutorial Skills List	Nº of Weeks	C.H.
1.	▪ Features of different types of pure and normal impedances. ▪ Responses of AC quantities applied to different types of pure and normal impedances. ▪ Waveforms and phasor diagrams of the responses of different types of pure and normal impedances with applying different AC quantities. ▪ Power phasor diagrams and power factors of different types of pure and normal impedances.	1st ,2nd	4
2.	▪ Calculations of series and parallel AC circuits by the use of sinusoidal, non sinusoïdal and phasor quantities. ▪ Analysis of different types of series and parallel AC circuits. ▪ Phasor diagrams of the input and output of voltage, current and power of series and parallel AC circuits.	3rd ,4th	4

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3.	▪ Calculations of different series-parallel AC circuits by the use of sinusoidal and phasor quantities. ▪ Analysis of different types of series-parallel AC circuits.	5^{th} ,6^{th}	4
4.	▪ Applying mesh and nodal analyses to a complex AC circuit. ▪ Analaysis of different complex AC circuits using mesh and nodal analyses.	7^{th} ,8^{th}	4
5.	▪ Applying network theorems to a complex AC circuit. ▪ Analaysis of different complex AC circuits using different network theorems.	9^{th} ,10^{th}	4
6.	▪ Analaysis Poly-phase networks using abc and cba sequences.	11^{th}	2
7.	▪ Calculations of different Magnetically coupled circuits	12^{th} ,13^{th}	4
8.	▪ Analaysis of tow-port networks	14^{th}	2
Number of Weeks /and Units Per Semester		**14**	**28**

C- Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours
1.	Orientation	**1^{st}**	**2**
2.	Average and RMS values	**2^{nd}**	**2**
3.	Response of RLC circuits	**3^{rd}**	**2**
4.	Phasor relationships for simple circuits	**4^{th}**	**2**
5.	Input impedance and active circuits	**5^{th}**	**2**
6.	Capacitors and series RC circuits	**6^{th}**	**2**
7.	Inductors and series RL circuits	**7^{th}**	**2**
8.	Parallel RC and LC circuits	8^{th}	2
9.	Power relationships and power factor	9^{th}	2

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10.	Analysis of some AC circuits by MATLAB computer software	10^{th} ,11^{th} ,12^{th} ,13^{th} ,14^{th}	10
Number of Weeks /and Units Per Semester		**14**	**28**

VI. Teaching strategies of the course:

- Lectures
- Dialogue and discussion
- Brainstorming
- Problem Solving
- Practical application
- Assignments and Reports

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Exercises & Homework	a1, a2, a3, b1, c1, d1	2, 5, 8, 11,13	20
2.	Written Test (1)	a1, a2, a3, a4, b1, c1, d1	8	15
3.	Written Test (2)	a1, a2, a3, a4, b1, c1, d1	12	15
4.	Laboratory reports	a1, a2, a3, a4, b1, c1, c2, d1	Weekly from week 3 to 10	20
5.	Laboratory mini project.	a1, a2, a3, a4, b1, c1, c2, d1	14	20
6.	Laboratory exam.	a1, a2, a3, a4, b1, c1, c2, d1	15	10
7.	Final Exam (theoretical)	a1, a2, a3, a4, b1, c1, d1	To be arranged by the examination board of faculty at the End of the term	100

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	Total grades		**200**

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

No.	Assessment Method	Week Due	Mark
1.	Exercises & Homework	2, 5, 8, 11,13	20
2.	Written Test (1)	8	15
3.	Written Test (2)	12	15
4.	Laboratory reports	Weekly from week 3 to 10	20
5.	Laboratory mini project.	14	20
6.	Laboratory exam.	15	10
7.	Final Exam (theoretical)	To be arranged by the examination board of faculty at the End of the term	100
	Total grades		**200**

IX. Learning Resources:

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

1- Required Textbook(s) (maximum two).

1. Robert L. Boylestad, 2007, Introductory circuit analysis,11Ed, Pearson Prentice Ha New Jersey, USA.
2. Mahmood Nahvi & Joseph A. Edminister, 2003, Electric circuits, 4th Ed, Schaum's Outline Series, McGRAW-HILL, New York, USA.

2- Essential References.

1. Charles K. Alexander & Matthew N. O. Sadiku, 2001, Fundamentals of Electric circuits,
   3rd Ed McGRAW-HILL, New York, USA. McGRAW-HILL, New York, USA.
2. Charles A. Desoer, Ernest S. Kuh, 2009, Basic Circuit Theory, McGraw-Hill Education

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	(India). **3.** Allan H. Robbins, Wilhelm C. Miller, 2012, Circuit Analysis: Theory And Practice, Fifth Edition, Cengage Learning.
3- Electronic Materials and Web Sites *etc*.	
	1. All About Circuits: Free Electric Circuits Textbooks **2.** www.allaboutcircuits.com/ **3.** http://www.uta.edu/ee/hw/pspice/ **4.** http://www.youtube.com/watch?feature=player_detailpage&v=dZUPBLNuaHk **5.** http://denethor.wlu.ca/PSpice/pspice_tutorial.html **6.** www.seas.upenn.edu/~jan/.../PSpice_LibraryguideOrCAD.pdf **7.** www.ladyada.net/learn/soldering How to Do It: Basic Soldering - YouTube **8.** http://www.youtube.com/watch?v=BLfXXRfRIzY

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:**

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	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

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