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

17. Template for Course Plan of Electrical Circuits 1

I. Information about Faculty Member Responsible for the Course:

Name of Faculty Member	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 1				
2.	Course Number & Code:	EPM111				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	2	2	-	4
4.	Study level/year at which this course is offered:	Second year /First term				
5.	Pre –requisite (if any):	Engineering Physics				
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 introduces fundamental properties and methods for analysis of direct- current (DC) electric circuits including components such as resistors, capacitors, inductors, operational amplifiers, switches, and ideal and dependent voltage and current sources. Both steady state and transient circuit behavior are covered as well as practical applications of circuit analysis. This course will also introduce a number of circuits' laws such as Ohm's law, and Kirchhoff's laws, in addition to a number of techniques for analyzing more complex circuits

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

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

1. Define units, unit systems, and physics of electrical circuits i.e. charge, current, voltage, power and energy.
2. Acquire knowledge of the main electrical DC circuit elements, laws, rules, and techniques used in simple and complex DC circuits analysis.
3. Recognize the laws, rules and techniques of a simple magnetic circuits.
4. Acquire knowledge of the AC Circuits principles with time-domain and phasors values, waveforms, and phasor diagrams of an AC quantity.
5. Identify information related to the circuit elements like color codes, name plate data and the data sheets of circuit elements.
6. Analyze the DC circuits by simple and complex analysis methods.
7. Solve a simple magnetic circuit using electromagnetic induction principles.
8. Employ measurement devices and apply measurement skills to define the different parameters of the practical DC circuit/device.
9. Apply circuit design principles to design basic magnetic and electric DC circuits.
10. Perform practical design of simple DC circuits by related computer software.
11. Practice simple DC circuits in practical printed board.
12. Enhance the self-learning activities using faculty library and computer and internet resources.

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13. Communicate effectively to professionals and non-specialists alike through reports and presentations.

V. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact hours
1.	General Introduction to the course. Introduction to basic electrical quantities and unit systems.	▪ Introduction to electrical circuits as a basis for electrical engineering. ▪ The objectives, requirements and guidelines to comply with the course. ▪ Electric charge, current, energy power and voltage. ▪ Units and units systems.	1st	2
2.	Basic circuit elements and Ohm's law.	▪ Electrical resistance and conductance. ▪ Type of resistances. Color codes. ▪ DC voltage and current sources. ▪ Electrical symbols of basic elements. ▪ Relation between Current and Voltage (Ohm's Law). ▪ Voltmeter, Ammeter and Ohmmeter.	2nd	2
3.	Simple DC circuits.	▪ series DC circuits. ▪ Nodes, branches and loops. ▪ Kirchhoff's voltage law (KVL). ▪ Resistance levels ratio method (RLRM) in series circuits. ▪ Voltage divider rule (VDR).	3rd	2

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		▪ Single- and double-subscript voltages notation. ▪ Power dissipated in series circuits.		
4.	Simple DC circuits- continue.	▪ Parallel DC circuits ▪ Kirchhoff's current law (KCL). ▪ Resistance levels ratio method (RLRM) in parallel circuits. ▪ Current divider rule (CDR). ▪ Power dissipated in parallel circuits.	4th	2
5.	Simple DC circuits - continue.	▪ Series-Parallel DC circuits. ▪ Reproducing of Series-Parallel circuits to simple equivalent circuits. ▪ Δ to Y and Y to Δ conversion.	5th	2
6.	Advanced analysis methods.	▪ Branch current analysis method. ▪ Mesh analysis method. ▪ Implementing of Pspice.	6th	2
7.	Advanced analysis methods- continue.	▪ Conversion between sources. ▪ Nodal analysis method. ▪ Pspice simulations.	7th	2
8.	Mid-Term Exam	▪ Covers all sub topics up to the 7th week.	8th	2
9.	Advanced analysis methods- continue.	▪ Relationship between mesh and nodal analyses. ▪ Bridges and their applications.	9th	2
10.	Network theorems in DC circuits.	▪ Supper position theorem ▪ Thevenin's theorem. ▪ Norton's theorem. ▪ Maximum power transfer theorem. ▪ Millman's theorem.	10th	2

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11.	Inductors, capacitors, magnetic and electrical fields.	▪ Capacitance calculations and capacitive circuits. ▪ Energy stored in the electric field. ▪ Transients in RC-DC networks. ▪ Analyzing of RC-DC networks in Pspice.	11th	2
12.	Magnetic circuits.	▪ Magnetic fields, flux and flux density. ▪ Reluctance and Ohm's law for magnetic circuits. ▪ The magneto motive and magnetizing forces. ▪ Amperes' circuital law and magnetic circuits calculations.	12th	2
13.	Transients of R-L and R-C DC circuits.	▪ Faraday's law of electro-magnetic induction. ▪ Lenz's law ▪ Self and mutual inductances. ▪ Energy stored in the magnetic field. ▪ Transient in RL-DC circuits. ▪ Analyzing of RL-DC networks in Pspice.	13th	2
14.	Introduction to AC circuit principles and AC quantities with their values and representations.	▪ Introduction to AC quantities. ▪ Sinusoidal and Non-sinusoidal AC waveforms. ▪ Generation, frequency, period, angular velocity of the periodic sinusoidal AC waveforms. ▪ Time-domain value of the AC waveforms. ▪ Phase shift and relations of the AC waveforms.	14th	2

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		▪ Average and effective (r.m.s.) values of the AC quantities. ▪ Phasor-domain (complex) value of the sinusoidal AC waveforms.		
15.	General Review and consultancy	▪ All main subjects by requirement.	15th	2
16.	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.	▪ Calculations of Systems of units, conductance and résistance of an element using different systems of units. ▪ Numerical and graphical applications of Ohm, s law in DC Circuits. ▪ Defining the values of charge, power, energy, and efficiency in DC Circuits.	1st ,2nd ,3rd	6
2.	▪ Defining the values of total resistance and the input and output voltages, currents of DC series circuits. ▪ Applications of K. V. L., R. L. R. M. and V. D. R. techniques in designing and calculations of DC series circuits. ▪ Analaysis of DC circuits by the use of single- and double-subscript voltages. ▪ Calculations of the input, output and element powers in DC series circuits. ▪ Defining the values of the internal resistance as well as the internal and external voltages of the DC sources.	4th ,5th ,6th	6

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3.	▪ Defining the values of total resistance and the input and output voltages, currents of DC parallel circuits. ▪ Applications of K. C. L., R. L. R. M. and C. D. R. techniques in designing and calculations of DC parallel circuits. ▪ Calculations of the input, output and element powers in DC parallel circuits. ▪ Calculations of DC circuits with open and short-circuited elements.	7^{th} ,8^{th} ,9^{th}	6
4.	▪ Applications of block diagram and reduce and return approaches in DC series-parallel circuits. ▪ Analaysis of DC circuits by the use of Δ to Y and Y to Δ conversions.	10^{th} ,11^{th}	4
5.	▪ Analaysis of complex DC circuits by the use of branch current, mesh and nodal approaches.	12^{th} ,13^{th}	4
6.	▪ Analaysis of complex DC circuits by the use of network theorems. ▪ Determining the physical behaviour of inductor and capacitor in DC circuits. ▪ Analaysis of simple magnetic circuits. ▪ Analyses of DC circuits transients. ▪ Defining the values of basic AC quantities and waveforms.	14^{th} ,15^{th} ,16^{th}	6
Number of Weeks /and Units Per Semester		**16**	**32**

C - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours
1.	▪ Safety regulations and requirements in electrical laboratories. ▪ Introduction to main laboratory devices and instrumentations.	1^{st}	2

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	▪ Introduction to main measurement devices. ▪ Resistors type, standard values and color coding.		
2.	▪ Construction of simple resistive circuit and validation of Ohm's law. ▪ Extending the circuit in (2) to simple series circuits to: ▪ Verify Kirchhoff'svoltagelaw (KVL). ▪ Validate of voltage divider rule (VDR). ▪ Propose and discuss about possible practical applications of Ohm's law, KVL and VDR.	2nd	2
3.	▪ Assembling simple parallel circuits and: ▪ Prove Kirchhoff's current law (KCL). ▪ Verify validity of Current divider rule (CDR). ▪ Familiarize with oscilloscope and its applications.	3rd	2
4.	▪ Superposition and Maximum power transfer theorem in DC circuits.	4th	2
5.	▪ Thévenin's and Norton's theorems in DC circuits.	5th	2
6.	▪ DC Transient in RC and RL-DC circuits.	6th	2
7.	▪ Balance of bridges. ▪ Applications of bridges in finding of unknown resistance, capacitance and inductance.	7th	2
8.	▪ Introduction to AC circuit. ▪ The use of oscilloscope for investigation of time dependant wave forms.	8th	2
9.	▪ Ohm's Law in AC circuits. Kirchhoff's voltagelaw (KVL) in AC circuits. Kirchhoff's current law (KCL) in AC circuits.	9th	2

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10.	▪ Lab mini project: Designing of a simple printed board and soldering practice. ▪ Designing a modest circuit and analyzing it using Pspice or Multisem computer software. ▪ Installing and testing the circuit experimentally in the lab. ▪ Realizing the circuit on a printed board by soldering the circuit component on the board. ▪ Performing an experimental test to chick the correctness of the designed printed board.	10^{th} ,11^{th} ,12^{th} ,13^{th}	8
11.	▪ Laboratory exam. ▪ Note: only 2 contact hours in 2weeks were assigned because only half of the class carry the exam in each week.	14^{th} ,15^{th}	4
Number of Weeks /and Units Per Semester		**15**	**30**

VI. Teaching strategies of the course:

- Lectures,
- tutorials,
- interactive class discussion,
- exercises,
- series of laboratory experiment coursework
- experimental work

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Resistors type, standard values and color coding for group of resistors	a1, b1, c1	2	2
2.	Validation of Ohm's law by simple resistive circuit	a1, a2, b1, c1, c2	3	2

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3.	Circuit Calculation using Kirchhoff's Voltage Law	a2, a4, b1, b2, c1 c2	5	3
4.	Application of Voltage Divider Rule	a3, b1, b2, c1 c2	8	2
5.	Homework on Superposition and maximum power transfer Theorem	a3, b1, b2, c1 c2	9	3
6.	Calculation of Circuit elements by Thevenin's and Norton's Theorems	a3, b1, c1 c2	10	2
7.	Solve examples on DC Transient in RC and RL-DC circuits.	a2, a3, b1, c1 c2	11	3
8.	Applications of bridges in finding of unknown resistance, capacitance and inductance	a2, a3, b1, c1 c2	12	3
	Total			**20**

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1.	Exercises & Homework	2, 5, 8, 11,13	20	10%
2.	Written Test (1)	8	15	7.5%
3.	Written Test (2)	12	15	7.5%
4.	Laboratory reports	Weekly from week 3 to 10	20	10%
5.	Laboratory mini project.	14	20	10%
6.	Laboratory exam.	15	10	5%
7.	Final Exam (theoretical)	To be arranged by the examination board of faculty at the End of the term	100	50%
	Total grades		**200**	**100%**

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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 H
2. New Jersey, USA.
3. Mahmood Nahvi&Joseph A. Edminister, 2003, Electric circuits, 4th Ed, Schaum'
4. Outline Series, McGRAW-HILL, New York, USA.

2- Essential References.

1. Charles K. Alexander & Matthew N. O. Sadiku, 2001, Fundamentals of Electric circuits,
2. 3rd Ed McGRAW-HILL, New York, USA.McGRAW-HILL, New York, USA.
3. Charles A. Desoer, Ernest S. Kuh, 2009, Basic Circuit Theory, McGraw-Hill Education
4. (India).
5. Allan H. Robbins, Wilhelm C. Miller, 2012, Circuit Analysis: Theory And Practi 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/solderingHow 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

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	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:** For cheating in exam, a student will be considered as fail. 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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