University of Sana'a
Faculty of Engineering
Department: Biomedical Engineering
Title of the Program: Biomedical Engineering

Course Specification of Electrical Circuits 1

Course Code (BE111)

I. Course Identification and General Information:						
1	Course Title:	Electrical Circuits 1				
2	Course Code & Number:	BE111				
3	Credit hours:	C.H				TOTAL
		Th.	Seminar	Pr	Tr.	
		2	--	2	--	3
4	Study level/ semester at which this course is offered:	Second Level / First Semester				
5	Pre –requisite (if any):	Engineering Physics (FR002)				
6	Co –requisite (if any):	None				
7	Program (s) in which the course is offered:	Biomedical Engineering Program				
8	Language of teaching the course:	English				
9	Location of Teaching the Course:	Faculty of Engineering				
10	Prepared by:	Assoc. Prof. Dr. Radwan AL Bouthigy				
11	Reviewed by:	Assoc. Prof. Dr. Farouk Al-Fahaidy				
12	Date of Approval:					

II. Course Description:

The course offers a comprehensive knowledge about DC circuits analysis and it is considered to be the foundation course for biomedical engineers. Course Topics; Electrical variables: voltage, current, power and energy; Electric circuit elements: Sources, R, L & C; Circuits topologies: series, parallel & series-parallel networks; Basic laws: Ohm's, KVL, KCL; Circuit analysis techniques: Nodal, Mesh, Y-to-delta and delta-to-y conversions; Network theorems: Thevenin's, Norton's, superposition, and maximum power transfer; Transient response of first-order networks. Through interactive lectures based on textbook, lab work. Students will learn how to design and simulate electric networks practically and using simulations tools such as Multisim and MATLAB.

III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
Knowledge and Understanding: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
a1	Demonstrate knowledge and understanding of science and mathematics fundamentals, and their applications in electrical circuit analysis.	A1 Describe and explain the underlying mathematical methods and theories; life scientific-principles; and engineering core concepts related to the Biomedical Engineering context.
a2	Recognize the laws, rules and principle techniques used in the design and solution of DC electric circuit.	A2 Clarify the design principles and techniques and the engineering materials characteristics and how these are relevant to the developments and technologies in a biomedical systems context.
B. Cognitive/ Intellectual Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
b1	Examine the performance of DC electric systems that meet desired	B2 Identify, formulate and solve the complex problems related to the Biomedical Engineering fields in a creative and

	applications in the field of Biomedical engineering.	innovative manner by using a systematic and analytical thinking methods.
b2	Explore appropriate electrical techniques and tools to design renewable energy systems within realistic constraints.	B3 Design the biomedical systems or processes within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
C. Professional and Practical Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
c1	Apply circuit principles and techniques while designing, simulating, and implementing basic DC electric systems related to renewable energy engineering.	C2 Use a wide range of analytical tools, techniques, IT, modern engineering tools, software packages and develop required computer programs to solve, modeling and analyzing Biomedical Engineering problems.
c2	Conduct experiments safely to verify theoretical: concepts, rules, and theorems covered throughout the course.	C3 Use computational facilities and techniques, measuring instruments, workshops and laboratory equipment to design and conduct experiments, collect, analyse and interpret data and present results in the biomedical systems practice.
D. Transferable Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
d1	Work effectively and successfully as a team member during Lab sessions, assignments, and projects activities.	D1 Lead and motivate individuals, show capability to work in stressful environments and within constraints, collaborate effectively within multidisciplinary team.
d2	Bring up-to-date knowledge as needed as a part of life-long self-learning related to electrical	D3 Recognize the needs for, and engage in life-long self-learning.

	circuits/systems analysis and design.	

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1.. Demonstrate knowledge and understanding of science and mathematics fundamentals, and their applications in electrical circuit analysis.	• Staff-led lectures, • Interactive class discussions, • Exercises and home works.	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Design and problem solving exercises, • Coursework activities assessment,
a2.. Recognize the laws, rules and principle techniques used in the design and solution of DC electric circuit.	• Staff-led lectures, • Interactive class discussions, • Problem based learning, • Exercises and home works,	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Design and problem solving exercises, • Coursework activities assessment,

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1..Examine the performance of DC electric systems that meet desired applications in the field of Biomedical engineering.	• Staff-led lectures, • Interactive class discussions, • Problem based learning, • Exercises and home works,	• Written tests (mid and final terms and quizzes), • Home works and assignments,

	• Computer laboratory-based sessions,	• Design and problem solving exercises, • Computer Lab performance assessment, • Coursework activities assessment,
b2. Explore appropriate electrical techniques and tools to design renewable energy systems within realistic constraints.	• Staff-led lectures, • Interactive class discussions, • Problem based learning, • Individual design projects, • Exercises and home works, • Computer laboratory-based sessions,	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Design and problem solving exercises, • Computer Lab performance assessment, • Coursework activities assessment,

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1. Apply circuit principles and techniques while designing, simulating, and implementing basic DC electric systems related to renewable energy engineering.	• Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Team work (cooperative learning).	• Computer Lab performance assessment, • Project work assessment, • Project reports (individual and group) assessment.
c2. Conduct experiments safely to verify theoretical: concepts, rules, and theorems covered throughout the course	• Directed self- study, • Problem based learning, • Individual design projects, • Laboratory/Practical experiments based session,	• Design and problem solving exercises, • Essay and report writing assessment, • Computer Lab

	• Computer laboratory-based sessions,	performance assessment, • Project work assessment,

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Work effectively and successfully as a team member during Lab sessions, assignments, and projects activities.	• Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Team work (cooperative learning),	• Essay and report writing assessment, • Computer Lab performance assessment, • Coursework activities assessment, • Oral and visual presentations, • Project work assessment, • Project reports (individual and group) assessment.
d2. Bring up-to-date knowledge as needed as a part of life-long self-learning related to electrical circuits/systems analysis and design.	• Directed self- study, • Student-led seminars and presentations, • Individual design projects, • Computer laboratory-based sessions, • Team work (cooperative learning)	• Essay and report writing assessment, • Computer Lab performance assessment, • Oral and visual presentations, • Project work assessment, • Project reports

		(individual and group) assessment.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	**Introduction**	a1	– Course objectives, learning outcomes, requirements and guidelines to comply with the course. – Essential Attributes of Electric circuits – Units and unit systems. – Power of Ten Notation, Prefixes, Engineering Notation,	**1**	**2**
2	**Electrical variables**	a1,b1	– Charge, Current, – Voltage Sources – Power and Energy – Potential and potential difference (Voltage).	**1**	**2**
3	**Electric materials**	a2,b1, b2	– Conductor, Insulator, Semiconductor, and superconductor – resistivity, Resistance of conductor, conductance, – wire tables.	**1**	**2**
4	**Basic Laws and**	a1,b1,b2	– Ohm's Law,	**1**	**2**

	basic electric measurements		– Power, and Energy, – Efficiency, – Voltage Polarity and Current, Direction, – Measurements of: Current, Voltage, and Resistance.		
5	**Circuit Topology and Kirchhoff's Laws**	a1,a2,b1,b2	– Series circuits, – Kirchhoff's voltage law (KVL), – Voltage divider rule (VDR), – Definitions of node, branch, loop, mesh, – Parallel circuits, – Kirchhoff's current law (KCL), – Current divider rule (CDR), – Series-Parallel Combination, – Switches, Fuse, C.B, – Concept of Open circuit, Short circuit.	**2**	**4**
6	**Circuit Analysis Techniques**	a1,a2,b1,b2	– Voltage & Current Sources: Conversion between sources, – Mesh and Nodal Analysis of Electric Circuits	**1**	**2**
7	**Mid-Term Theoretical Exam**	a1,a2,b1,b2	– All Topics	**1**	**2**

8	**Circuit Analysis Techniques (Cont.)**	a1,a2,b1,b2	– Ladder Networks, – Star delta transformations Y to Δ and Δ to Y, – bridge networks.	**1**	**2**
9	**Network Theorems in DC Circuits.**	a1,a2,b1,b2	– Super Position Theorem, – Thevenin's Theorem, Norton's Theorem – Theorem of Maximum Power – Transfer Theorem, – Reciprocity Theorem	**3**	**6**
10	**Capacitors and Transients in RC circuits.**	a1,b1,b2	– Capacitors and Capacitance , – Capacitors in series and in parallel, – voltage –current relationships, – Transients in Capacitive Networks, – Energy stored in capacitors.	**2**	**4**
11	**Inductors and Transients in R-L circuits.**	a1,b2	– Inductance – Induced Voltage V_L – R-L Transients: Storage Phase, and Release Phase – Instantaneous Values – Steady-State Conditions – Energy Stored by an Inductor	**1**	**2**

12	**Final Theoretical Exam**	a1,a2,b1,b2	– All Topics	**1**	**2**
Number of Weeks /and Units Per Semester				**16**	**32**

B - Practical Aspect: (if any)

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	**Lab 1 Orientation:** • **Safety regulations,** • **Requirements for effective lab work,** • **Introduction to main laboratory devices and instrumentations.** • **Lab-Report Construction,** • **Lab Policy and Grading,** • **Student Responsibilities.**	1	2	c2, d1
2	**Experiments No. 1 Resistance** • **Resistance measurements,** • **Resistance Color Coding,** • **Resistance tolerance,** • **Verification of equivalent resistance.**	1	2	c1, c2, d1, d2
3	**Experiments No. 2 Ohm's Laws** • **Measurements of Current and Voltage,** • **Plotting Ohm's Laws,** • **Validation of Ohm's law.**	1	2	c1, c2, d1, d2
4	**Experiments No. 3 Series Circuits** • **Series Circuits equivalent resistance,** • **Verification of:**	1	2	a2, c1, c2, d1, d2,

	– Kirchhoff's Voltage Law (KVL), and – Voltage Divider Rule (VDR)			
5	**Experiments No. 4 Parallel Circuits** • Parallel Resistors equivalent resistance, • Verification of: – Kirchhoff's current law (KCL). – Current divider rule (CDR).	1	2	b2, c1, c2, d1, d2
6	**Experiments No. 5 mesh analysis** Verification of mesh analysis by: – using hardware implementation, and – digital simulation.	1	2	c1, c2, d1, d2
7	Experiments No. 6 nodal analysis Verification of Nodal analysis by: – using hardware implementation, and – digital simulation	1	2	c1, c2, d1, d2
8	**Experiments No. 7 Superposition Theorem** Verification of Superposition theorem by: – hard ware implementation, and – digital simulation.	1	2	c1, c2, d1, d2,
9	– Mid-Term Practical Exam	1	2	c1, c2

	(if any)			
10	**Experiments No. 8 Thevenin's Theorem** **Verification of Thevenin's of theorem by:** – **hardware implementation , and** – **digital simulation.**	1	2	c1, c2, d1, d2
11	**Experiments No.9 Norton's Theorems** **Verification of Norton's theorems by:** – **hardware implementation , and** – **digital simulation.**	1	2	c1, c2, d1, d2,
12	**Experiments No. 10 RC and RL circuit RL circuits.** • **Capacitance Measurements** • **Capacitors in Series and Parallel** • **Transients response measurements of RC Circuits.** **Simulation of RC circuits performance using Multisim and MATLAB Electronics package**	2	4	c1, c2, d1, d2,
13	**Experiments No. 11 RL circuits.** • **inductance Measurements** • **inductance in Series and Parallel**	1	2	c1, c2, d1, d2,

	• **Transients response measurements of RL Circuits. Simulation of RL circuits performance using Multisim and MATLAB Electronics package**			
14	**Final Practical Exam**	1	2	c1, c2
Number of Weeks /and Units Per Semester			**15**	**30**

C. Tutorial Aspect:

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**NONE….it's wrong**			
2	**Must be Tutorial**			
Number of Weeks /and Units Per Semester		**--**	**--**	

V. Teaching Strategies of the Course:

- Staff-led lectures,
- Interactive class discussions,
- Directed self- study,
- Problem based learning,
- Individual design projects,
- Exercises and home works,
- Laboratory/Practical experiments based session,
- Computer laboratory-based sessions,
- Team work (cooperative learning).

VI. Assessment Methods of the Course:

- Written tests (mid and final terms and quizzes),
- Home works and assignments,
- Design and problem solving exercises,
- Essay and report writing assessment,
- Computer Lab performance assessment,
- Coursework activities assessment,
- Oral and visual presentations,
- Project work assessment,
- Project reports (individual and group) assessment.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	**Homework no 1** • **Kirchhoff's voltage law (KVL),** • **Voltage divider rule (VDR).** • **Voltage Sources connections.**	a1, a2, b1, b2	4	**2**
2	**Homework no 2** • **Kirchhoff's Current Law,** • **Current Divider Rule,** • **Energy conservation,** • **Voltage Source in Parallel** • **Open and Short Circuits effects.**	a1, a2, b1, b2	7	2
3	**Homework no 3** • **Series-Parallel Networks,** • **Ladder Networks,**	a1, a2, b1	9	2

	• **Potentiometer Loading.**			
4	**Homework no4** • **Source Conversions,** • **Mesh Analysis, Nodal Analysis,** • **Bridge Networks,** • **Y-Δ and Δ-Y Conversions.**	a1, a2,c1, c2	11	2
5	**Homework no 5** • **Network Theorems.**	c1, c2,d1,d2	13	**2**
Total				10

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	**Assignments**	4,7, 9,11,13	10	6.67%	a1,a2, b1,b2,c2,d1,d2
2	**Quizzes 1 & 2**	6, 12	10	6.67%	a1, a2, b1,b2
3	**Mid-Term Theoretical Exam**	8	20	13.33%	a1, a2, b1,b2
4	**Mid-Term Practical Exam**	9	20	13.33%	c1,c2
5	**Final Practical Exam**	15	30	20%	c1,c2
6	**Final Theoretical Exam**	16	60	40%	a1, a2, b1,b2
Total			150	100%	

IX. Learning Resources:

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

Example

1- Niku, Saeed B., 2011, **Introduction to Robotics: Analysis, Control, Applications**, 2nd Edition, USA, Wiley.

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

1. Boylestad, Robert L., 2016, Introductory Circuit Analysis, 13th Edition, NJ, Pearson Prentice Hall.
2. Richard C. Dorf, 2018, Introduction to Electric Circuits, 9th Ed., John Wiley and Sons.

2- Essential References.

1. James W. Nilsson and Susan A. Riedel, 2014, Electric Circuits, 19th edition, NJ, Pearson Prentice Hall.
2. Floyd , 2007, Electric Circuits: Conventional Current Version, 8th edition, NJ, Pearson Prentice Hall.

3- Electronic Materials and Web Sites *etc*.

Websites:

1- All About Circuits : Free *Electric Circuits* Textbooks

https//www.allabout**circuits**.com/

2- Class Central, Circuits and Electronics:

https://www.classcentral.com/course/edx-circuits-and-electronics-1-basic-circuit-analysis-444

3- Tutorial - Multisim Live

https://www.multisim.com/help/getting-started/

4- Mathcad User's Guide

https://neuron.eng.wayne.edu/auth/ece4340/mathcad/mathcad_user_guide.pdf

5- NPTEL, Basic Circuit Elements and Waveforms:

https://nptel.ac.in/courses/108/104/108104139/

X. Course Policies:

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he/she 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 a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He/she 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:** In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.
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 proofed a plagiarism of a student, he/she 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 or according to the university roles.
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 might be given directly to students using soft or hard copy.

University of Sana'a
Faculty of Engineering
Department: Biomedical Engineering
Title of the Program: Biomedical Engineering

Template for Course Plan (Syllabus)

Electrical Circuits 1 BE111

I. Course Identification and General Information:						
1	**Course Title:**	Electrical Circuits 1				
2	**Course Code & Number:**	BE111				
3	**Credit Hours:**	**Credit Hours**	**Theory Hours**		**Lab. Hours**	
			Lecture	**Exercise**		
		3	2	--	2	
4	**Study Level/ Semester at which this Course is offered:**	Second Level / First Semester				
5	**Pre –Requisite (if any):**	Engineering Physics (FR002)				
6	**Co –Requisite (if any):**	None				
7	**Program (s) in which the Course is Offered:**	Bachelor of Biomedical Engineering				
8	**Language of Teaching the Course:**	English				
9	**Location of Teaching the Course:**	Faculty of Engineering				
10	**Prepared by:**	Assoc. Prof. Dr. Radwan AL Bouthigy				
11	**Reviewed by:**	Assoc. Prof. Dr. Farouk Al-Fahaidy				
12	**Date of Approval:**					

II. Course Description:

The course offers a comprehensive knowledge about DC circuits analysis and it is considered to be the foundation course for biomedical engineers. Course Topics; Electrical variables: voltage, current, power and energy; Electric circuit elements: Sources, R, L & C; Circuits topologies: series, parallel & series-parallel networks; Basic laws: Ohm's, KVL, KCL; Circuit analysis techniques: Nodal,

Mesh, Y-to-delta and delta-to-y conversions; Network theorems: Thevenin's, Norton's, superposition, and maximum power transfer; Transient response of first-order networks. Through interactive lectures based on textbook, lab work. Students will learn how to design and simulate electric networks practically and using simulations tools such as Multisim and MATLAB.

III. Course Intended Learning Outcomes (CILOs): (مخرجات تعلم المقرر)	
A. Knowledge and Understanding: Upon successful completion of the course, students will be able to:	
a1	Demonstrate knowledge and understanding of science and mathematics fundamentals, and their applications in electrical circuit analysis.
a2	Recognize the laws, rules and principle techniques used in the design and solution of DC electric circuit.
B. Intellectual Skills: Upon successful completion of the course, students will be able to:	
b1	Examine the performance of DC electric systems that meet desired applications in the field of Biomedical engineering.
b2	Explore appropriate electrical techniques and tools to design renewable energy systems within realistic constraints.
C. Professional and Practical Skills: Upon successful completion of the course, students will be able to:	
c1	Apply circuit principles and techniques while designing, simulating, and implementing basic DC electric systems related to renewable energy engineering.
c2	Conduct experiments safely to verify theoretical: concepts, rules, and theorems covered throughout the course
D. Transferable Skills: Upon successful completion of the course, students will be able to:	
d1	Work effectively and successfully as a team member during Lab sessions, assignments, and projects activities.

III. Course Intended Learning Outcomes (CILOs): (مخرجات تعلم المقرر)	
d2	Bring up-to-date knowledge as needed as a part of life-long self-learning related to electrical circuits/systems analysis and design.

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	**Introduction**	– Course objectives, learning outcomes, requirements and guidelines to comply with the course. – Essential Attributes of Electric circuits – Units and unit systems. – Power of Ten Notation, Prefixes, Engineering Notation,	**1**	**2**
2	**Electrical variables**	– Charge, Current, – Voltage Sources – Power and Energy – Potential and potential difference (Voltage).	**1**	**2**
3	**Electric materials**	– Conductor, Insulator, Semiconductor, and superconductor – resistivity, Resistance of conductor, conductance, – wire tables.	**1**	**2**
4	**Basic Laws and basic electric measurements**	– Ohm's Law, – Power, and Energy,	**1**	**2**

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		– Efficiency, – Voltage Polarity and Current, Direction, – Measurements of: Current, Voltage, and Resistance.		
5	**Circuit Topology and Kirchhoff's Laws**	– Series circuits, – Kirchhoff's voltage law (KVL), – Voltage divider rule (VDR), – Definitions of node, branch, loop, mesh, – Parallel circuits, – Kirchhoff's current law (KCL), – Current divider rule (CDR), – Series-Parallel Combination, – Switches, Fuse, C.B, – Concept of Open circuit, Short circuit.	**2**	**4**
6	**Circuit Analysis Techniques**	– Voltage & Current Sources: Conversion between sources, – Mesh and Nodal Analysis of Electric Circuits.	**1**	**2**
7	**Mid-Term Theoretical Exam**	– All Topics	**1**	**2**
8	**Circuit Analysis Techniques continue**	– Ladder Networks, – Star delta transformations Y to Δ and Δ to Y,	**1**	**2**

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		– bridge networks.		
9	**Network Theorems in DC Circuits.**	– Super Position Theorem, – Thevenin's Theorem, Norton's Theorem – Theorem of Maximum Power – Transfer Theorem, – Reciprocity Theorem	**3**	**6**
10	**Capacitors and Transients in RC circuits.**	– Capacitors and Capacitance , – Capacitors in series and in parallel, – voltage –current relationships, – Transients in Capacitive Networks, – Energy stored in capacitors.	**2**	**4**
11	**Inductors and Transients in R-L circuits.**	– Inductance – Induced Voltage V_L – R-L Transients: Storage Phase, and Release Phase – Instantaneous Values – Steady-State Conditions – Energy Stored by an Inductor	**1**	**2**
12	**Final Theoretical Exam**	– All Topics	**1**	**2**
Number of Weeks /and Units Per Semester			**16**	**32**

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
1	**Lab 1 Orientation:** • Safety regulations, • Requirements for effective lab work, • Introduction to main laboratory devices and instrumentations. • Lab-Report Construction, • Lab Policy and Grading, • Student Responsibilities.	**1**	**2**
2	**Experiments No. 1 Resistance** • Resistance measurements, • Resistance Color Coding, • Resistance tolerance, • Verification of equivalent resistance.	**1**	**2**
3	**Experiments No. 2 Ohm's Laws** • Measurements of Current and Voltage, • Plotting Ohm's Laws, • Validation of Ohm's law.	**1**	**2**
4	**Experiments No. 3 Series Circuits** • Series Circuits equivalent resistance, • Verification of: – Kirchhoff's Voltage Law (KVL), and – Voltage Divider Rule (VDR)	**1**	**2**
5	**Experiments No. 4 Parallel Circuits** • Parallel Resistors equivalent resistance, • Verification of: – Kirchhoff's current law (KCL). – Current divider rule (CDR).	**1**	**2**
6	**Experiments No. 5 mesh analysis** Verification of mesh analysis by: – using hardware implementation, and – digital simulation.	**1**	**2**
7	**Experiments No. 6 nodal analysis**	**1**	**2**

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
	Verification of Nodal analysis by: – **using hardware implementation, and** – **digital simulation**		
8	**Experiments No. 7 Superposition Theorem** **Verification of Superposition theorem by:** – **hard ware implementation, and** – **digital simulation.**	**1**	**2**
9	**Mid-Term Practical Exam** (if any)	**1**	**2**
10	**Experiments No. 8 Thevenin's Theorem** **Verification of Thevenin's of theorem by:** – **hardware implementation , and** – **digital simulation.**	**1**	**2**
11	**Experiments No.9 Norton's Theorems** **Verification of Norton's theorems by:** – **hardware implementation , and** – **digital simulation.**	**1**	**2**
12	**Experiments No. 10 RC and RL circuit RL circuits.** • **Capacitance Measurements** • **Capacitors in Series and Parallel** • **Transients response measurements of RC Circuits.** **Simulation of RC circuits performance using Multisim and MATLAB Electronics package**	**2**	**4**
13	**Experiments No. 11 RL circuits.**	**1**	**2**

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
	• **inductance Measurements** • **inductance in Series and Parallel** • **Transients response measurements of RL Circuits. Simulation of RL circuits performance using Multisim and MATLAB Electronics package**		
14	**Final Practical Exam**	**1**	**2**
Number of Weeks /and Units Per Semester		**15**	**30**

C. Tutorial Aspect:			
No.	**Tutorial**	**Number of Weeks**	**Contact Hours**
1	NONE		
Number of Weeks /and Units Per Semester		**--**	**--**

V. Teaching Strategies of the Course:

- Staff-led lectures,
- Interactive class discussions,
- Directed self- study,
- Problem based learning,
- Individual design projects,
- Exercises and home works,
- Laboratory/Practical experiments based session,
- Computer laboratory-based sessions,
- Team work (cooperative learning).

VI. Assessment Methods of the Course:

- Written tests (mid and final terms and quizzes),
- Home works and assignments,
- Design and problem solving exercises,
- Essay and report writing assessment,
- Computer Lab performance assessment,
- Coursework activities assessment,
- Oral and visual presentations,
- Project work assessment,
- Project reports (individual and group) assessment.

VII. Assignments:

No.	Assignments	Week Due	Mark
1	**Homework no 1** • **Kirchhoff's voltage law (KVL),** • **Voltage divider rule (VDR).** • **Voltage Sources connections.**	4	2
2	**Homework no 2** • **Kirchhoff's Current Law,** • **Current Divider Rule,** • **Energy conservation,** • **Voltage Source in Parallel** • **Open and Short Circuits effects.**	7	2
3	**Homework no 3** • **Series-Parallel Networks,** • **Ladder Networks,** • **Potentiometer Loading.**	9	2

VII. Assignments:

No.	Assignments	Week Due	Mark
4	**Homework no4** • **Source Conversions,** • **Mesh Analysis, Nodal Analysis,** • **Bridge Networks,** • **Y-Δ and Δ-Y Conversions.**	11	2
5	**Homework no 5** • **Network Theorems.**	13	2
Total			**10**

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	**Assignments**	4,7, 9,11,13	10	6.67%
2	**Quizzes 1 & 2**	6, 12	10	6.67%
3	**Mid-Term Theoretical Exam**	8	20	13.33%
4	**Mid-Term Practical Exam**	7	20	13.33%
5	**Final Practical Exam**	15	30	20%
6	**Final Theoretical Exam**	16	60	40%
Total			**150**	**100%**

IX. Learning Resources:

- *Written in the following order:*

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

IX. Learning Resources:

Example

1- Niku, Saeed B., 2011, **Introduction to Robotics: Analysis, Control, Applications**, 2nd Edition, USA, Wiley.

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

1- Boylestad, Robert L., 2016, Introductory Circuit Analysis, 13th Edition, NJ, Pearson Prentice Hall.

2- Richard C. Dorf, 2018, Introduction to Electric Circuits, 9th Ed., John Wiley and Sons.

2- Essential References:

1- James W. Nilsson and Susan A. Riedel, 2014, Electric Circuits, 19th edition, NJ, Pearson Prentice Hall.

2- Floyd , 2007, Electric Circuits: Conventional Current Version, 8th edition, NJ, Pearson Prentice Hall.

3- Electronic Materials and Web Sites etc.:

Websites:

3- All About Circuits : Free *Electric Circuits* Textbooks

https//www.allabout**circuits**.com/

4- Class Central, Circuits and Electronics:

https://www.classcentral.com/course/edx-circuits-and-electronics-1-basic-circuit-analysis-444

5- Tutorial - Multisim Live

https://www.multisim.com/help/getting-started/

6- Mathcad User's Guide

https://neuron.eng.wayne.edu/auth/ece4340/mathcad/mathcad_user_guide.pdf

7- NPTEL, Basic Circuit Elements and Waveforms:

https://nptel.ac.in/courses/108/104/108104139/

X. Course Policies:

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he/she 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 a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He/she 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:** In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.
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 proofed a plagiarism of a student, he/she 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 or according to the university roles.
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 might be given directly to students using soft or hard copy.