# MODULE DESCRIPTION FORM

# نموذج وصف المادة الدراسية

| Module Information<br>معلومات المادة الدراسية | | | | | |
|---|---|---|---|---|---|
| **Module Title** | **Electrical Circuits** | | | **Module Delivery** | |
| **Module Type** | **Core** | | | ☒ **Theory**<br>☒ **Lecture**<br>☒ **Lab**<br>☐ **Tutorial**<br>☐ **Practical**<br>☐ **Seminar** | |
| **Module Code** | **UoB12345** | | | | |
| **ECTS Credits** | **8** | | | | |
| **SWL (hr/sem)** | **200** | | | | |
| **Module Level** | 1 | | **Semester of Delivery** | 1 | |
| **Administering Department** | Type Dept. Code | | **College** | Type College Code | |
| **Module Leader** | Name | | **e-mail** | E-mail | |
| **Module Leader's Acad. Title** | Professor | | **Module Leader's Qualification** | Ph.D. | |
| **Module Tutor** | Name (if available) | | **e-mail** | E-mail | |
| **Peer Reviewer Name** | Name | | **e-mail** | E-mail | |
| **Scientific Committee Approval Date** | 01/06/2023 | | **Version Number** | 1.0 | |

| Relation with other Modules<br>العلاقة مع المواد الدراسية الأخرى | | | |
|---|---|---|---|
| **Prerequisite module** | None | **Semester** | |
| **Co-requisites module** | None | **Semester** | |

| Module Aims, Learning Outcomes and Indicative Contents<br>أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية | |
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| **Module Aims**<br>**أهداف المادة الدراسية** | 1. To develop problem solving skills and understanding of circuit theory through the application of techniques.<br>2. To understand voltage, current and power from a given circuit.<br>3. This course deals with the basic concept of electrical circuits.<br>4. This is the basic subject for all electrical and electronic circuits.<br>5. To understand Kirchhoff's current and voltage Laws problems.<br>6. To perform mesh and Nodal analysis. |
| **Module Learning Outcomes**<br>**مخرجات التعلم للمادة الدراسية** | 1. Recognize how electricity works in electrical circuits.<br>2. List the various terms associated with electrical circuits.<br>3. Summarize what is meant by a basic electric circuit.<br>4. Discuss the reaction and involvement of atoms in electric circuits.<br>5. Describe electrical power, charge, and current.<br>6. Define Ohm's law.<br>7. Identify the basic circuit elements and their applications.<br>8. Discuss the operations of sinusoid and phasors in an electric circuit.<br>9. Discuss the various properties of resistors, capacitors, and inductors.<br>10. Explain the two Kirchoff's laws used in circuit analysis.<br>11. Identify the capacitor and inductor phasor relationship with respect to voltage and current. |
| **Indicative Contents**<br>**المحتويات الإرشادية** | Indicative content includes the following.<br><br><u>Part A - Circuit Theory</u><br>DC circuits – Current and voltage definitions, Passive sign convention and circuit elements, Combining resistive elements in series and parallel. Kirchhoff's laws and Ohm's law. Anatomy of a circuit, Network reduction, Introduction to mesh and nodal analysis. [15 hrs]<br><br>AC circuits I – Time dependent signals, average and RMS values. Capacitance and inductance, energy storage elements, simple AC steady-state sinusoidal analysis. [15 hrs]<br><br>AC Circuits II - Phasor diagrams, definition of complex impedance, AC circuit analysis with complex numbers. [10 hrs]<br><br>RL, RC and RLC circuits - Frequency response of RLC circuits, simple filter and band-pass circuits, resonance and Q-factor, use of Bode plots, use of differential |

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| | equations and their solutions. Time response (natural and step responses). Introduction to second order circuits. [15 hrs]<br><br>Revision problem classes [6 hrs]<br><br><u>Part B - Analogue Electronics</u><br><br>Fundamentals<br>Resistive networks, voltage and current sources, Thevenin and Norton equivalent circuits, current and voltage division, input resistance, output resistance, coupling and decoupling capacitors, maximum power transfer, RMS and power dissipation, current limiting and over voltage protection. [15 hrs]<br><br>Components and active devices – Components vs elements and circuit modeling, real and ideal elements. Introduction to sensors and actuators, self-generating vs modulating type sensors, simple circuit interfacing. [7 hrs]<br><br>Diodes and Diode circuits – Diode characteristics and equations, ideal vs real. Signal conditioning, clamping and clipping, rectification and peak detection, photodiodes, LEDs, Zener diodes, voltage stabilization, voltage reference, power supplies. [15 hrs] |

| **Learning and Teaching Strategies**<br>**استراتيجيات التعلم والتعليم** | |
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| **Strategies** | Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students. |

| **Student Workload (SWL)**<br>**الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا** | | | |
|---|---|---|---|
| **Structured SWL (h/sem)** | 109 | **Structured SWL (h/w)** | 7 |

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| الحمل الدراسي المنتظم للطالب خلال الفصل | | الحمل الدراسي المنتظم للطالب أسبوعيا | |
| **Unstructured SWL (h/sem)**<br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 91 | **Unstructured SWL (h/w)**<br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 6 |
| **Total SWL (h/sem)**<br>الحمل الدراسي الكلي للطالب خلال الفصل | 200 | | |

## Module Evaluation
## تقييم المادة الدراسية

| | | Time/Number | Weight (Marks) | Week Due | Relevant Learning Outcome |
|---|---|---|---|---|---|
| Formative assessment | Quizzes | 2 | 10% (10) | 5, 10 | LO #1, 2, 10 and 11 |
| | Assignments | 2 | 10% (10) | 2, 12 | LO # 3, 4, 6 and 7 |
| | Projects / Lab. | 1 | 10% (10) | Continuous | All |
| | Report | 1 | 10% (10) | 13 | LO # 5, 8 and 10 |
| Summative assessment | Midterm Exam | 2 hr | 10% (10) | 7 | LO # 1-7 |
| | Final Exam | 2hr | 50% (50) | 16 | All |
| Total assessment | | | 100% (100 Marks) | | |

## Delivery Plan (Weekly Syllabus)
## المنهاج الاسبوعي النظري

| | Material Covered |
|---|---|
| Week 1 | Introduction - Difference between Circuit Theory and Field Theory |
| Week 2 | Basics of Network Elements |
| Week 3 | Resistance and Resistivity, Ohm's Law and Inductance, Capacitance |
| Week 4 | Review of Kirchhoff's Laws, Circuit Analysis - Nodal and Mesh |
| Week 5 | Linearity and Superposition, Source Transformations, Thévenin and Norton Equivalents |
| Week 6 | Review of Inductor and Capacitor as Circuit Elements, Source-free RL and RC Circuits, Transient Response |
| Week 7 | Mid-term Exam + Unit-Step Forcing, Forced Response, the RLC Circuit |
| Week 8 | Sinusoidal Forcing, Complex Forcing, Phasors, and Complex Impedance, Sinusoidal Steady State Response |
| Week 9 | Nodal and Mesh Revisited, Average Power, RMS, Introduction to Polyphase Circuits |
| Week 10 | Mutual Inductance, Linear and Ideal Transformers, Circuits with Mutual Inductance |

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| **Week 11** | Frequency Response of Series/Parallel Resonances, High-Q Circuits |
| **Week 12** | Complex Frequency, s-Plane, Poles and Zeros, Response Function, Bode Plots |
| **Week 13** | Two Port Networks, Admittance, Impedance, Hybrid, and Transmittance Parameters |
| **Week 14** | Two Port Networks, Admittance, Impedance, Hybrid, and Transmittance Parameters |
| **Week 15** | Two Port Networks, Admittance, Impedance, Hybrid, and Transmittance Parameters |
| **Week 16** | **Preparatory week before the final Exam** |

| **Delivery Plan (Weekly Lab. Syllabus)**<br>**المنهاج الاسبوعي للمختبر** | |
|---|---|
| | **Material Covered** |
| **Week 1** | Lab 1: Introduction to Agilent VEE and PSPICE |
| **Week 2** | Lab 2: Thévenin's / Norton's Theorem and Kirchhoff's Laws |
| **Week 3** | Lab 3: First-Order Transient Responses |
| **Week 4** | Lab 4: Second-Order Transient Responses |
| **Week 5** | Lab 5: Frequency Response of RC Circuits |
| **Week 6** | Lab 6: Frequency Response of RLC Circuits |
| **Week 7** | Lab 7: Filters |

| **Learning and Teaching Resources**<br>**مصادر التعلم والتدريس** | | |
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| | **Text** | **Available in the Library?** |
| **Required Texts** | Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education | Yes |
| **Recommended Texts** | DC Electrical Circuit Analysis: A Practical Approach Copyright Year: 2020, dissidents. | No |
| **Websites** | https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering | |

## Grading Scheme

| مخطط الدرجات | | | | |
|---|---|---|---|---|
| **Group** | **Grade** | التقدير | **Marks (%)** | **Definition** |
| **Success Group (50 - 100)** | **A -** Excellent | **امتياز** | 90 - 100 | Outstanding Performance |
| | **B -** Very Good | **جيد جدا** | 80 - 89 | Above average with some errors |
| | **C -** Good | **جيد** | 70 - 79 | Sound work with notable errors |
| | **D -** Satisfactory | **متوسط** | 60 - 69 | Fair but with major shortcomings |
| | **E -** Sufficient | **مقبول** | 50 - 59 | Work meets minimum criteria |
| **Fail Group (0 – 49)** | **FX –** Fail | **راسب (قيد المعالجة)** | (45-49) | More work required but credit awarded |
| | **F –** Fail | **راسب** | (0-44) | Considerable amount of work required |
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**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. 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.