



## MODULE DESCRIPTOR FORM

### نموذج وصف المادة الدراسية

| Module Information          |                                     |  |                                |
|-----------------------------|-------------------------------------|--|--------------------------------|
| معلومات المادة الدراسية     |                                     |  |                                |
| Module Title                | <b>ELECTRICAL CIRCUITS ANALYSIS</b> | Module Delivery  |                                |
| Module Type                 | CORE                                | ✓ Theory<br>Lecture<br>✓ Lab<br>Tutorial<br>✓ Practical<br>✓ Seminar |                                |
| Module Code                 | <b>UOMU0205034</b>                  |  |                                |
| ECTS Credits                | 5                                   |  |                                |
| SWL (hr/sem)                | <b>125</b>                          |  |                                |
| Module Level                | 2                                   | Semester of Delivery   | 1                              |
| Administering Department    | Electrical Engineering Techniques   | College  | <b>AL-MUSTAQBAL UNIVERSITY</b> |
| Module Leader               | ابراهيم حسن محمد صالح الخرسان       | e-mail   | smrtg809@gmail.com             |
| Module Leader's Acad. Title | استاذ مساعد                         | Module Leader's Qualification  | دكتوراة                        |
| Module Tutor                | None                                | e-mail   | None                           |
| Peer Reviewer Name          | None                                | e-mail   | None                           |
| Review Committee Approval   | 13/06/2023                          | Version Number   | 1.0                            |

## Relation With Other Modules

### العلاقة مع المواد الدراسية الأخرى

|                      |  |          |   |
|----------------------|--|----------|---|
| Prerequisite module  | <b>ADVANCED ELECTRICAL CIRCUITS ANALYSIS</b> | Semester | 2 |
| Co-requisites module | None   | Semester |   |

## Module Aims, Learning Outcomes and Indicative Contents

### أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

|   |  |
|---|--|
| <b>Module Objectives</b><br>أهداف المادة الدراسية | <b>Students will learn the principle of</b> <ol style="list-style-type: none"><li>transient AC and DC circuit</li><li>design the circuits which are used to power electronics, motors, and delay circuits applications.</li><li>Learn how to calculate and analyze voltage and current phasors in AC circuits, including their amplitudes, phases, and frequency relationships.</li><li>Explore the behavior and characteristics of AC circuit elements, such as resistors, capacitors, and inductors, and understand their roles in AC circuit analysis.</li><li>Investigate the concept of impedance in AC circuits and its relationship to resistance, reactance, and frequency.</li><li>Study the principles of AC power and power factor, including real power, reactive power, apparent power, and power factor correction.</li><li>Gain a comprehensive understanding of three-phase AC systems, including the generation, transmission, and distribution of power in three-phase circuits.</li></ol> |
|---|--|

|   |   |
|---|---|
| <p><b>Module Learning Outcomes</b></p> <p>مخرجات التعلم للمادة الدراسية</p> | <ol style="list-style-type: none"> <li>1. Knowledge Acquisition: Students will acquire a comprehensive understanding of the fundamental concepts and principles of Comparison of AC and DC transient circuit</li> <li>2. Circuit Design and Analysis: Students will gain the ability to design and analyze Resonance A.c and Dc circuit heir knowledge of impedance, power factor, and component characteristics. They will learn to calculate voltage and current magnitudes, phase differences, and power relationships in AC circuits.</li> <li>3. Quality Factor, Bandwidth and Half-Power Frequency in resonance circuits.</li> <li>4. Students will be able to construct and interpret bandwidth to visualize and analyze the behavior of voltages and currents in resonance circuits.</li> <li>5. Three-Phase Systems: Students will acquire understanding of three-phase AC systems, including balanced and unbalanced configurations.</li> </ol> <p><b>Laboratory Skills:</b> Students will develop practical skills in using circuit simulation software and laboratory equipment to design, analyze, and verify the performance of TRANSIENT AC and DC circuits.</p> |
| <p><b>Indicative Contents</b></p> <p>المحتويات الإرشادية</p>                | <p>Indicative content includes the following:</p> <ul style="list-style-type: none"> <li>• Part A – Definitions, units, and transient applications<br/>General concept of UNITS and some application of transient system [3 hrs]</li> <li>• Part B – Unit step forcing function<br/>General concept of applying UNIT step function for the electrical circuit [4 hrs]</li> <li>• Part C Transient analysis in DC circuit.<br/>Source free and step response RL and RC circuits in DC system.<br/>Comoplet response of a series and a parallel RLC circuits in DC system. [10 hrs]</li> <li>• Part D Single - phase of AC Circuits.<br/>AC in resistive circuits, current and voltage in inductive circuits, current and voltage in capacitive circuits. Concept of complex impedance and admittance, AC series and parallel circuits. RL, RC and RLC circuit analysis and phasor representation. [14 hrs]</li> <li>• Part E resonance of AC Circuits<br/>Resonance in A.c Series and parallel RLC Circuit ,Quality Factor (Q), Bandwidth and Half-Power Frequency in resonance circuits,Tank circuit and dynamic impedance in RLC circuit [14 hrs]</li> </ul>                   |

### Learning and Teaching Strategies

#### استراتيجيات التعلم والتعليم

|                          |  |
|--------------------------|--|
| <p><b>Strategies</b></p> | <ol style="list-style-type: none"> <li>1-Conceptual Understanding: Explain transient AC and DC circuits, introduce the concept of complete response of RL ,RC circuit, and highlight the significance of RLC series and parallel circuit and phases in AC circuits.</li> <li>2-Mathematical Foundations: Provide a solid mathematical foundation for transient DC and AC circuits. Teach students the use of phasor notation to analyze AC circuits.</li> <li>3-Problem-Solving Skills: Dedicate adequate time to problem-solving exercises and examples.</li> <li>4-Laboratory Experiments: Incorporate laboratory experiments to reinforce theoretical concepts. Allow students to build and analyze AC circuits using oscilloscopes, function generators, and AC power sources.</li> <li>5-Simulation Tools: Introduce simulation MATLAB software tools that allow students to simulate circuits and observe their behavior.</li> <li>6-Review and Assessment: Regularly review key concepts and provide formative assessments to gauge students' understanding. Offer constructive feedback on their performance to help them identify areas for improvement.</li> </ol> |
|--------------------------|--|

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطالب                          |     |  |       |
|--|-----|--|-------|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 63  | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعياً       | 4.2   |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 62  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعياً | 4.133 |
| <b>Total SWL (h/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل              | 125 |  |       |

| <b>Module Evaluation</b><br>تقييم المادة الدراسية |                        |             |                  |            |                           |
|---|------------------------|-------------|------------------|------------|---------------------------|
|   |                        | Time/Number | Weight (Marks)   | Week Due   | Relevant Learning Outcome |
| <b>Formative assessment</b>                       | <b>Quizzes</b>         | 4           | 10% (10)         | 3-10       | LO #3, 2,4,5,7 and 10     |
|   | <b>Assignments</b>     | 6           | 10% (10)         | 2-12       | LO # 3, 4, 6 and 8        |
|   | <b>Projects / Lab.</b> | 2           | 10% (10)         | 3,7        | LO # 3-7                  |
|   | <b>Report</b>          | 16          | 10% (10)         | continuous | LO # 5, 8 and 11          |
| <b>Summative assessment</b>                       | <b>Midterm Exam</b>    | 1 hr        | 10% (10)         | 8          | LO # 1-8                  |
|   | <b>Final Exam</b>      | 3 hr        | 50% (50)         | 15         | All                       |
| <b>Total assessment</b>                           |                        |             | 100% (100 Marks) |            |                           |

| <b>Delivery Plan (Weekly Syllabus)</b><br>المنهاج الاسبوعي النظري |   |
|---|---|
|   | Material Covered  |
| <b>Week 1</b>   | <b>Definitions, units, and transient applications</b>                               |
| <b>Week 2</b>   | <b>Unit step forcing function.</b>  |
| <b>Week 3,4</b>   | <b>Source free series and parallel RLC circuits in DC system.</b>                   |
| <b>Week 5</b>   | <b>Comoplet response of a series and a parallel RLC circuits in DC system.</b>      |
| <b>Week 6</b>   | Resonance in A.c Series and parallel RLC Circuit                                    |
| <b>Week 7</b>   | <b>Quality Factor (Q), Bandwidth and Half-Power Frequency in resonance circuits</b> |
| <b>Week 8</b>   | <b>Tank circuit and dynamic impedance in RLC circuit</b>                            |
| <b>Week 9,10</b>  | <b>Sinusoids, phasors diagram for circuit elements.</b>                             |
| <b>Week 11</b>  | Balanced three-phase circuits: (wye –wye, delta-delta, connections).                |
| <b>Week 12</b>  | Balanced three-phase circuits: (wye-delta, delta-wye connections).                  |

|            |                                      |
|------------|--------------------------------------|
| Week 13,14 | <b>Unbalanced three phase system</b> |
| Week 15    | <b>Final Examination</b>             |

| <b>Delivery Plan (Weekly Lab. Syllabus)</b><br>المنهاج الاسبوعي للمختبر |  |
|---|--|
|   | Material Covered   |
| Week 1  | Lab 1: Introduction to Matlab Model Power circuit design   |
| Week 2  | Lab 2: unit step forcing function  |
| Week 3  | Lab 3: Simulation of free source series RLC (over ,critical, under damped)                       |
| Week 4  | Lab 4: Simulation of free source parallel RLC (over ,critical, under damped)                     |
| Week 5  | Lab 5: Simulation of complete response of series and parallel RLC (over, critical, under damped) |
| Week 6  | Lab 6: simulation of the Resonance in series RLC Circuit   |
| Week 7  | Lab 7: simulation of the Resonance in parallel RLC Circuit                                       |
| Week 8  | Lab 8: simulation of the sinusoidal steady state system  |
| Week 9  | Lab 9: simulation The sinusoidal transient analysis  |
| Week 10   | Lab 10:simulation of three phase wye to wye connection   |
| Week 11   | Lab 11:simulation of three phase delta to delta connection                                       |
| Week 12   | Lab 12:simulation of three phase wye to delta connection   |
| Week 13   | Lab 13:simulation of three phase unbalanced wye to wye connection                                |
| Week 14   | Lab 14: Review   |

| <b>Learning and Teaching Resources</b><br>مصادر التعلم والتدريس |  |                           |
|---|--|---------------------------|
|   | Text   | Available in the Library? |
| Required Texts  | Charles K. Alexander, Matthew N.O. Sdiku<br>Fundamentals of Electrical Engineering, 4th Edition, 2009    | Yes                       |
| Recommended Texts   | Tony R. Kuphaldt, Lessons In Electric Circuits,<br>Volume II - AC 5th edition, 2002                      | No                        |
| Websites  | AC circuits<br><a href="https://byjus.com/physics/ac-circuit/">https://byjus.com/physics/ac-circuit/</a> |                           |

**APPENDIX:**

| <b>GRADING SCHEME</b><br>مخطط الدرجات |                  |         |           |                                  |
|---------------------------------------|------------------|---------|-----------|----------------------------------|
| Group                                 | Grade            | التقدير | Marks (%) | Definition                       |
| <b>Success Group<br/>(50 - 100)</b>   | 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      |

|                                |                  |             |         |                                       |
|--------------------------------|------------------|-------------|---------|---------------------------------------|
| <b>Fail Group<br/>(0 – 49)</b> | <b>FX – Fail</b> | مقبول بقرار | (45-49) | More work required but credit awarded |
|                                | <b>F – Fail</b>  | راسب        | (0-44)  | Considerable amount of work required  |
|                                |                  |             |         |                                       |

**Note:**

NB 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.