

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                            |                      |                                                                                                                                                                                                                                                     |        |
|------------------------------------|----------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| معلومات المادة الدراسية            |                            |                      |                                                                                                                                                                                                                                                     |        |
| Module Title                       | <b>Electrical Circuits</b> |                      | Module Delivery                                                                                                                                                                                                                                     |        |
| Module Type                        | Core                       |                      | <input checked="" type="checkbox"/> Theory<br><input checked="" type="checkbox"/> Lecture<br><input checked="" type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |        |
| Module Code                        | <b>UoB12345</b>            |                      |                                                                                                                                                                                                                                                     |        |
| ECTS Credits                       | 8                          |                      |                                                                                                                                                                                                                                                     |        |
| SWL (hr/sem)                       | <b>200</b>                 |                      |                                                                                                                                                                                                                                                     |        |
| 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       |      |  |          |
|-----------------------------------|------|--|----------|
| العلاقة مع المواد الدراسية الأخرى |      |  |          |
| Prerequisite module               | None |  | Semester |
| Co-requisites module              | None |  | Semester |

## Module Aims, Learning Outcomes and Indicative Contents

### أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <ol style="list-style-type: none"> <li>To develop problem-solving skills and an understanding of methods of heat transfer through the application.</li> <li>To understand conduction, convection, and radiation heat transfer</li> <li>This course deals with the basic concept of fins.</li> <li>This is an essential subject for all thermal applications.</li> <li>To perform mesh and Node analysis.</li> </ol>                                                                                                                     |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <p>Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks.</p> <ol style="list-style-type: none"> <li>Recognize how the heat is transferred by three methods</li> <li>Define the Fourier's law, Newton's law of cooling and Stefan-Boltzmann law.</li> <li>Explain the general Heat Conduction Equation</li> <li>Summarize what is meant by the Boundary and Initial Conditions</li> <li>Discuss the type of heat exchangers.</li> <li>Describe the convection heat transfer systems</li> </ol> |
| <b>Indicative Contents</b><br>المحتويات الإرشادية                | <p>Indicative content includes the following.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## Learning and Teaching Strategies

### استراتيجيات التعلم والتعليم

|                   |                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Strategies</b> | <p>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 types of simple experiments involving some sampling activities that are interesting to the students.</p> |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Student Workload (SWL)

### الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

|                                                                                |     |                                                                           |   |
|--------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|---|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل       | 109 | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعيا       | 7 |
| <b>Unstructured SWL (h/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 91  | <b>Unstructured SWL (h/w)</b><br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 6 |
| <b>Total SWL (h/sem)</b>                                                       | 200 |                                                                           |   |

|                                       |  |
|---------------------------------------|--|
| الحمل الدراسي الكلي للطالب خلال الفصل |  |
|---------------------------------------|--|

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

| Delivery Plan (Weekly Syllabus) |                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| المنهاج الاسبوعي النظري         |                                                                                                                                                                                                                                                                                                                   |
|                                 | Material Covered                                                                                                                                                                                                                                                                                                  |
| Week 1                          | Introduction - General concepts and definitions - Heat conduction - Convective heat transfer - Thermal radiation                                                                                                                                                                                                  |
| Week 2                          | Conduction heat transfer (general equation) - General heat conduction equation - One-dimensional, steady state, conduction through plane wall, Conduction heat transfer (1-D, steady state) - Composed wall - Cylinder, composed cylinder - Sphere, composed sphere                                               |
| Week 3                          | Conduction heat transfer (1-D, steady state, with heat generation) in - Plane wall - Composed wall - Solid cylinder - Hollow cylinder - Sphere - Critical thickness of insulation,                                                                                                                                |
| Week 4                          | Heat transfer through extended surfaces (fins) - General equation for temperature distribution. - Very long fin - Short fin - End insulated fin - Effectiveness of the fin - Applications for previous subjects                                                                                                   |
| Week 5                          | unsteady state heat conduction equation, lumped system analysis, Transient Heat Conduction In Large Plane Walls, Long Cylinders, and Spheres With Spatial Effects, Formulation of One Dimensional Transient Temperature Distribution. $T(x, t)$ , Approximate Analytical Solution, Approximate Graphical Solution |
| Week 6                          | Transient Heat Conduction In Semi-infinite Solids, Sudden Change In Surface Temperature, Suddenly Imposed Surface Heat Flux, Specified surface heat flux, Suddenly Imposed Convection Boundary condition                                                                                                          |

|                |                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Week 7</b>  | 2-D, Steady state heat conduction - Analytical solution with different boundary conditions - Exact Solution with different boundary conditions - Numerical solution for two-D steady state heat conduction equation (nodes)                                |
| <b>Week 8</b>  | 2-D Unsteady state heat conduction - Analytical solution for the. (lumped system) - Numerical solution                                                                                                                                                     |
| <b>Week 9</b>  | Convective heat transfer - Fluid flow background - Laminar and turbulent flow - Boundary layer growth for external flow and internal flow, Forced convection - Energy equation -                                                                           |
| <b>Week 10</b> | Thermal boundary layer and temperature distribution and heat transfer for: Laminar flow over flat plate Laminar flow through closed conduit - Empirical equation for cross flow for cylinder, sphere and tube bank - Empirical equation for turbulent flow |
| <b>Week 11</b> | Heat exchanger - General concepts - Types of heat exchangers - Heat exchangers performance by LMTD method - Heat exchanger's effectiveness. - NTU method                                                                                                   |
| <b>Week 12</b> | Sinusoidal Forcing, Complex Forcing, Phasors, and Complex Impedance, Sinusoidal Steady State Response                                                                                                                                                      |
| <b>Week 13</b> | Thermal radiation - Introduction to thermal radiation - The electromagnetic waves - The black body - The shape factor - Thermal radiation between: Two parallel plates (gray) Two concentric cylinder                                                      |
| <b>Week 14</b> | Thermal radiation between more than two bodies. -                                                                                                                                                                                                          |
| <b>Week 15</b> | Thermal resistance network - Radiation shields                                                                                                                                                                                                             |
| <b>Week 16</b> | <b>Preparatory week before the final Exam</b>                                                                                                                                                                                                              |

### Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

|               | Material Covered            |
|---------------|-----------------------------|
| <b>Week 1</b> | Lab 1: Thermal conductivity |
| <b>Week 2</b> | Lab 2: Pin Fins             |
| <b>Week 3</b> | Lab 3: Fins                 |
| <b>Week 4</b> | Lab 4: forced convection 1  |
| <b>Week 5</b> | Lab 5: forced convection2   |
| <b>Week 6</b> | Lab 6: Free convection      |
| <b>Week 7</b> | Lab 7: Heat exchangers      |

### Learning and Teaching Resources

مصادر التعلم والتدريس

|  | Text | Available in the Library? |
|--|------|---------------------------|
|--|------|---------------------------|

|                          |                                                                               |     |
|--------------------------|-------------------------------------------------------------------------------|-----|
| <b>Required Texts</b>    | Heat Transfer A Practical Approach, YUNUS A. CENGEL,<br>McGraw-Hill Education | Yes |
| <b>Recommended Texts</b> | <b>Heat Transfer, J. P. Holman</b>                                            | No  |
| <b>Websites</b>          |                                                                               |     |

| <b>Grading Scheme</b><br>مخطط الدرجات                                                                                                                                                                                                                                                                                                                                                |                         |                     |          |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group<br/>(50 - 100)</b>                                                                                                                                                                                                                                                                                                                                                  | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>                                                                                                                                                                                                                                                                                                                                                       | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                         |                     |          |                                       |
| <b>Note:</b> 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. |                         |                     |          |                                       |