

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                              |                               |  |
|------------------------------------|------------------------------|-------------------------------|--|
| معلومات المادة الدراسية            |                              |                               |  |
| Module Title                       | <b>Electromagnetic waves</b> |                               | Module Delivery  |
| Module Type                        | Core                         |                               | <input checked="" type="checkbox"/> Theory<br><input checked="" type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |
| Module Code                        | UOMU031034                   |                               |  |
| ECTS Credits                       | 5                            |                               |  |
| SWL (hr/sem)                       | 125                          |                               |  |
| Module Level                       | 2                            | Semester of Delivery          | 1  |
| Administering Department           | Type Dept. Code              | College                       | Type College Code  |
| Module Leader                      | Sara jalel                   | e-mail                        | E-mail   |
| Module Leader's Acad. Title        |                              | 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 |  |
|---------------------|------|----------|--|

|                             |      |                 |  |
|-----------------------------|------|-----------------|--|
| <b>Co-requisites module</b> | None | <b>Semester</b> |  |
|-----------------------------|------|-----------------|--|

### Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

|  |   |
|--|---|
| <b>Module Objectives</b><br>أهداف المادة الدراسية                | <ol style="list-style-type: none"> <li>1. To understand the ways in which various concepts in electromagnetism come into play in particular situations; to represent these electromagnetic phenomena and fields mathematically in those situations; and to predict outcomes in other similar situations..</li> <li>2. To understand the mathematics to express the phenomena in electromagnetism.</li> <li>3. This course deals primarily with a vector calculus based description of static electric field.</li> <li>4. To understand the polarization, dielectric constant and the boundary conditions at the interface at the two different dielectric media.</li> <li>5. To calculate the electric field by applying Gauss's law for fixed charges and dielectric materials.</li> </ol>   |
| <b>Module Learning Outcomes</b><br>مخرجات التعلم للمادة الدراسية | <ol style="list-style-type: none"> <li>1. Use the mathematics to express the phenomena in electromagnetism.</li> <li>2. Define the electric field, the electric potential, and electric dipole</li> <li>3. Calculate the electrostatic field, electrostatic potential of the charge, dipole and multipoles</li> <li>4. Apply Gauss's law to solve some problems.</li> <li>5. Apply Poisson's equation to solve some problems</li> <li>6. Apply Laplace's equation to solve some problems.</li> <li>7. Define the electric displacement, polarization of the materials, dielectric constant, and electric susceptibility.</li> <li>8. Calculate the electric field outside a dielectric materials.</li> <li>9. Calculate the electrostatic electric and potential fields in dielectric materials, microscopic theory of dielectric and electrostatic energy</li> <li>10. Define the Ferroelectricity phenomena.</li> <li>11. Calculate the energy density of the electrostatic field.</li> <li>12. Calculate the energy of a System of Charged Conductors</li> </ol> |

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| <b>Indicative Contents</b><br>المحتويات الإرشادية | <p>Vector analysis, coordinate system Electric Charge. [6 hrs]</p> <p>Coulomb's law, The Electric Field, Electrostatic Potential ,Conductors &amp; Insulators, Gauss's Law, The Electric Dipole, Multipole Expansion . . [9 hrs]</p> <p>Poisson's Equation, Laplace's Equation, Laplace's Equation in one independent Variable, Laplace's Equation in Spherical Coordinates, Conducting Sphere in Uniform, Cylindrical Harmonics, Electrostatic Images, Point charge &amp; Conducting Sphere, Line charges &amp; Line Images, System of Conductors, Poisson's Equation. . [12 hrs]</p> <p>Polarization, Field Outside of a Dielectric Medium, The Electric Field inside a Dielectric, The Electric Displacement Electric Susceptibility and Dielectric Constant</p> <p>Point Charge in a Dielectric Field, Boundary Conditions on the Field Vector, Boundary Value Problem Involving Dielectrics, Dielectric Sphere in a Uniform Electric Field. .[12 hrs]</p> |
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| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |   |
|--|---|
| <b>Strategies</b>  | <p>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> |

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعاً |    |  |    |
|---|----|--|----|
| <b>Structured SWL (h/sem)</b><br>الحمل الدراسي المنتظم للطالب خلال الفصل  | 60 | <b>Structured SWL (h/w)</b><br>الحمل الدراسي المنتظم للطالب أسبوعياً | 4  |
| <b>Unstructured SWL (h/sem)</b>   | 65 | <b>Unstructured SWL (h/w)</b>  | 25 |

|   |  |  |            |
|---|--|--|------------|
| الحمل الدراسي غير المنتظم للطالب خلال الفصل |  | الحمل الدراسي غير المنتظم للطالب أسبوعيا |            |
| <b>Total SWL (h/sem)</b>                    |  |  | <b>125</b> |
| 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      |
|                         | Report       | 1           | 10% (10)                | 13       | LO #5, #8 and #10         |
| Summative assessment    | Midterm Exam | 2hr         | 20% (20)                | 7        | LO #1 - #7                |
|                         | Final Exam   | 3hr         | 50% (50)                | 16       | All                       |
| <b>Total assessment</b> |              |             | <b>100% (100 Marks)</b> |          |                           |

| Delivery Plan (Weekly Syllabus) |                                     |
|---------------------------------|-------------------------------------|
| المنهاج الاسبوعي النظري         |                                     |
|                                 | Material Covered                    |
| <b>Week 1 + Week2</b>           | Vector analysis, coordinate system. |

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| <b>Week3 +<br/>Week4 +<br/>Week5</b>                 | Electric Charge , Coulomb's law, The Electric Field, Electrostatic Potential ,Conductors & Insulators, Gauss's Law, The Electric Dipole, Multipole Expansion   |
| <b>Week 6</b>  | First exam   |
| <b>Week7 +<br/>Week8 +<br/>Week9 +<br/>Week10</b>    | Poisson's Equation, Laplace's Equation, Laplace's Equation in one independent Variable, Laplace's Equation in Spherical Coordinates, Conducting Sphere in Uniform, Cylindrical Harmonics, Electrostatic Images, Point charge & Conducting Sphere, Line charges & Line Images, System of Conductors, Poisson's Equation.                          |
| <b>Week11 +<br/>Week12 +<br/>Week13 +<br/>Week14</b> | Polarization, Field Outside of a Dielectric Medium, The Electric Field inside a Dielectric, The Electric Displacement Electric Susceptibility and Dielectric Constant, Point Charge in a Dielectric Field, Boundary Conditions on the Field Vector, Boundary Value Problem Involving Dielectrics, Dielectric Sphere in a Uniform Electric Field. |
| <b>Week 15</b>                                       | Second exam  |

| <b>Learning and Teaching Resources</b> |   |                                  |
|--|---|----------------------------------|
| مصادر التعلم والتدریس                  |   |                                  |
|  | <b>Text</b>   | <b>Available in the Library?</b> |
| <b>Required Texts</b>                  | introduction to Electrodynamics by David J. Griffiths, [Prentice-Hall, Inc., 1999], 3rd Edition.                                      | Yes                              |
| <b>Recommended Texts</b>               | Foundations of Electromagnetic Theory by Reitz, John R., Milford, Frederick J., Christy, Robert W. [Addison-Wesley, 2008] 4th Edition | No                               |
| <b>Websites</b>                        | <a href="https://www.khanacademy.org/science/physics">https://www.khanacademy.org/science/physics</a>                                 |                                  |

### Grading Scheme

## مخطط الدرجات

| Group                       | Grade            | التقدير             | Marks %  | Definition                            |
|-----------------------------|------------------|---------------------|----------|---------------------------------------|
| Success Group<br>(50 - 100) | A - Excellent    | امتنان              | 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<br>(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  |
|                             |                  |                     |          |                                       |

**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.