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|  | Ministry of Higher Education and Scientific Research - IraqUniversity of DiyalaCollege of EngineeringDepartment of Materials Engineering | D:\منهج بولونيا\تنزيل.jpg |

MODULE DESCRIPTOR

وصف المادة الدراسية

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| **Module Information****معلومات المادة الدراسية** |
| **Module Title** | **Engineering Numerical Methods** | **Module Delivery** |
| **Module Type** | Basic | *
* **Theory**
* **Lecture**
* **Tutorial**
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| **Module Code** | **MAE323‎** |
| **ECTS Credits**  | 3 |
| **SWL (hr/sem)** | 45 |
| **Module Level** | UGx11 1 | **Semester (s) offered**  | 2 |
| **Administering Department** |  |  **College** | Engineering  |
| **Module Leader** |  |  **e-mail** |  |
| **Module Leader’s Acad. Title** |  | **Module Leader’s Qualification** |  |
| **Module Tutor** |  |  **e-mail** |  |
| **Peer Reviewer Name** |  |  **e-mail** |  |
| **Review Committee Approval** |  | **Version Number** | 1.0 |

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| **Relation With Other Modules****العلاقة مع المواد الدراسية الأخرى** |
| **Prerequisite module** | **None** | **Semester** | - |
| **Co-requisites module** | None | **Semester** | - |
| **Module Aims, Learning Outcomes, Indicative Contents and Brief Description****أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر** |
|  **Module Aims****أهداف المادة الدراسية** | This module aims to provide students with an understanding of, and competence in the use of, engineering numerical methods that are relevant to the solution of engineering problems. It will also give students a firm foundation from which to develop solutions to a wider and deeper range of engineering problems that they will encounter throughout their undergraduate engineering program of study. |
| **Module Learning Outcomes****مخرجات التعلم للمادة الدراسية** | 1. Enable the student to solve a system of algebraic equations using numerical methods in materials engineering.
2. Enable the student to manually solve a system of linear and nonlinear equations using numerical methods.
3. Urging the student to solve differential equations individually or as a system of equations and in different ways, compare their results, and determine how to reduce errors.
4. ‎Enable the student to solve a system of ‎ curve fitting and interpolation‎.
5. Numerical integration and differentiation, solution of ordinary and partial differential ‎equations‎.
6. Applications of derivatives: Apply the techniques of differentiation to solve problems involving rates of change, linearization, curve sketching, mean value theorem and Initial value problem.
7. Complex numbers: Demonstrate an understanding of complex numbers with basic operations and their mathematical and graphical representations including Euler's Formula
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| **Indicative Contents****المحتويات الإرشادية** | The topics listed under the indicative content below are the underpinning areas of knowledge and understanding that will be obtained from successful completion of the module. The mathematical topics are illustrated in the context of relevant engineering scenarios.* **Error analysis‎**.
* **Roots of nonlinear algebraic equations,** solution of linear and‎ ‎transcendental simultaneous ‎equations. ‎
* **Numerical integration** and differentiation, solution of ordinary and partial differential ‎equations‎.
* **Ordinary differential equations**
* **Matrix and vector manipulation**, curve fitting and interpolation.‎
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| **Course Description** | This course description provides a summary of the most important characteristics of the course and the learning outcomes that the student is expected to achieve, demonstrating whether he or she has made the most of the learning opportunities available. It must be linked to the program description. |
| **Learning and Teaching Strategies****استراتيجيات التعلم والتعليم** |
| **Strategies** | Begin In Engineering analysis, then employ a range of teaching strategies to ensure third-year engineering students fully grasp the various mathematical concepts. Instructional methods include interactive lectures, where core mathematical principles are explained in detail, and practical problem-solving sessions to provide hands-on learning experiences. Collaborative group work encourages peer-to-peer learning and reinforces understanding through shared insights. Regular formative assessments will be conducted to monitor students' understanding of the material, and feedback will be promptly given to guide their learning process. Instructors will maintain office hours for personalized support, and online resources will be available to supplement classroom instruction. Emphasis will be placed on relating mathematical concepts to real-world engineering applications to make the learning experience more relevant and engaging. These strategies aim to develop students' critical thinking skills, enhance their problem-solving abilities, and prepare them for advanced engineering studies. |

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| **Module Evaluation****تقييم المادة الدراسية** |
| **As** | **Time****(hr)** | **Weight (Marks)** | **Week Due** | **Relevant Learning Outcome** |
| **Formative assessment** | **Quizzes** | 2 | 10% (10) | 3,5, 10, 12, 14 | LO #1, 2, 3, 4 ,5 and 7 |
| **Assignments** | 6 | 20% (20) | 4, 8, 12 | LO # 1, 2, 3, 4, 5 and 6 |
| **Summative assessment** | **Midterm Exam** | 2  | 20% (20) | 7 | LO # 1,4 |
| **Final Exam** | 3  | 50% (50) | 15 | All |
| **Total assessment** | 100% (100 Marks) |  |  |

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| **Delivery Plan (Weekly Syllabus)****المنهاج الاسبوعي النظري** |
| **Week**  | **Material Covered** |
| **Week 1** | Error analysis |
| **Week 2** | Roots of nonlinear algebraic equations, solution of linear and transcendental ‎simultaneous equations‎ |
| **Week 3** | Roots of nonlinear algebraic equations, solution of linear and transcendental ‎simultaneous ‎equations |
| **Week 4** | Matrix and vector manipulation‎ |
| **Week 5** | Matrix and vector manipulation‎ |
| **Week 6** | Curve fitting (Linear Model) |
| **Week 7** | Curve fitting (Multiple Linear Regression) |
| **Week 8** | Polynomial Interpolation‎ |
| **Week 9** | Newton’s Divided Difference Method of Interpolation Linear |
| **Week 10** | Numerical integration‎ |
| **Week 11** | Trapezoidal Rule of ‎Integration |
| **Week 12** | Numerical differentiation‎ |
| **Week 13** | Numerical differentiation‎ |
| **Week 14** | Solution of ordinary and partial differential equations‎ |
| **Week 15** | Exam |

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| **Delivery Plan (Weekly Lab. Syllabus)****المنهاج الاسبوعي للمختبر** |
| **Week**  | **Material Covered** |
| **Week 1** |  |
| **Week 2** |  |
| **Week 3** |  |
| **Week 4** |  |
| **Week 5** |  |
| **Week 6** |  |
| **Week 7** |  |

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| **Learning and Teaching Resources****مصادر التعلم والتدريس** |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | A\_Textbook\_of\_Engineering\_Mathematics\_(Volume\_I) Jain P.C. and Monica Jain, “Engineering ‎Chemistry”, Dhanpat Rai Publishing Company (P) ‎Ltd., New Delhi, (2010).‎ | Yes |
| **Recommended Texts** | Mathews, J.H., 1992. Numerical methods for mathematics, science and engineering (Vol. 10). Prentice-Hall International. | Yes |
| **Websites** |  |

**APPENDIX:**

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|  **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 | **مقبول بقرار** | (45-49) | More work required but credit awarded |
| **F –** Fail | **راسب** | (0-44) | Considerable amount of work required |
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| 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. |