|  | Ministry of Higher Education and Scientific Research - Iraq<br><br>University of  Warith Al_Anbiyaa....<br>College of Engineering<br>Oil and Gas Department |  |
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# MODULE DESCRIPTOR FORM
# نموذج وصف المادة الدراسية

| **Module Information**<br>معلومات المادة الدراسية |||
|---|---|---|
| **Module Title** | Ordinary and partial differential equations | **Module Delivery** |
| **Module Type** | **Basic** | ☒ **Theory** |
| **Module Code** | ENG212 | ☐ **Lecture** |
| **ECTS Credits** | **5** | ☐ **Lab** |
| **SWL (hr/sem)** | **125** | ☒ **Tutorial** |
|  |  | ☐ **Practical** |
|  |  | ☐ **Seminar** |

| **Module Level** | UGII | **Semester of Delivery** | 1 |
|---|---|---|---|
| **Administering Department** | OGE | **College** | Engineering |
| **Module Leader** | Dr.dheiaa hamadi | **e-mail** | Dheiaa.ha@uowa.edu.iq |
| **Module Leader's Acad. Title** | Lecturer | **Module Leader's Qualification** | Ph.D. |
| **Module Tutor** | 2 | **e-mail** | E-mail |
| **Peer Reviewer Name** | Asst.Lect.Hawraa Majed | **e-mail** | hawraa.majeed@uowa.edu.iq |
| **Scientific Committee Approval Date** | 01/06/2023 | **Version Number** | 1.0 |

| **Relation with other Modules** | | | |
|---|---|---|---|
| العلاقة مع المواد الدراسية الأخرى | | | |
| **Prerequisite module** | CALC123 | **Semester** | 2 |
| **Co-requisites module** | None | **Semester** | |

| **Module Aims, Learning Outcomes and Indicative Contents** | |
|---|---|
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية | |
| **Module Aims**<br><br>أهداف المادة الدراسية | Important objectives of the calculus sequence are to develop and strengthen students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply calculus tools to a variety of problem situations. |
| **Module Learning Outcomes**<br><br>مخرجات التعلم للمادة الدراسية | 1. Find limits of functions (graphically, numerically, and algebraically)<br><br>2. Analyze and apply the notions of continuity and differentiability to algebraic and transcendental functions.<br><br>3. Determine derivatives by a variety of techniques including explicit differentiation, implicit differentiation, and logarithmic differentiation. Use these derivatives to study the characteristics of curves. Determine derivatives using implicit differentiation and use them to study the characteristics of a curve.<br><br>4. Students will use a variety of methods to solve the Laplace and Poisson equations. |

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| | 5. Harmonic function characteristics will be examined by the students.<br><br>6. The heat and wave equations will be solved, and students will examine their characteristics.<br><br>7. The characteristic approach will be used by students to resolve first order partial differential equations.<br><br>8. Students will evaluate conservation laws' characteristics.<br><br>9. Students will examine some other nonlinear PDEs' properties if time allows. |
| **Indicative Contents**<br><br>المحتويات الإرشادية | 1. To model and comprehend scenarios involving exponential growth or decay and second order physical systems, use established DE types.<br><br>2. Use a variety of input functions, such as zero, constants, exponentials, sinusoids, step functions, impulses, and superpositions of these functions, to solve the major equations.<br><br>3. Use the characteristic equation, exponential response formula, Laplace transform, convolution integrals, Fourier series, complex arithmetic, parameter variation, elimination, and anti-elimination methods to solve the differential equations mentioned above.<br><br>4. Be able to solve linear DEs using the fundamental ideas of linearity, superposition, and the existence and uniqueness of DE solutions. |

### Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

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| **Strategies** | • Highlight conceptual comprehension.<br><br>• Assign homework that is difficult and builds on the lessons you gained in class.<br><br>• Cooperative learning strategies ought to be applied. |

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| | • Submit intelligent queries. |
| | • Put your focus on logical reasoning and practical problem-solving. |
| | • Use a range of assessment techniques. |

## Student Workload (SWL)

### الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

| Structured SWL (h/sem) <br> الحمل الدراسي المنتظم للطالب خلال الفصل | 75 | Structured SWL (h/w) <br> الحمل الدراسي المنتظم للطالب أسبوعيا | 5 |
|---|---|---|---|
| Unstructured SWL (h/sem) <br> الحمل الدراسي غير المنتظم للطالب خلال الفصل | 72 | Unstructured SWL (h/w) <br> الحمل الدراسي غير المنتظم للطالب أسبوعيا | 5 |
| Total SWL (h/sem) <br> الحمل الدراسي الكلي للطالب خلال الفصل | 150 | | |

## 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 |
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| **Week 1** | - Exponential and logarithm functions, Application of Exponential and logarithm functions |
| **Week 2** | - The relationship between the Exponential function and the logarithm function, Trigonometric functions |
| **Week 3** | - The inverse of Trigonometric functions, Hyperbolic functions |
| **Week 4** | - The inverse of Hyperbolic functions, Limits |
| **Week 5** | - Derivative, Implicit differentiation, Exponential functions derivative |
| **Week 6** | - The logarithm functions derivative, Derivative of hyperbolic functions |
| **Week 7** | - Mid-Term Exam |
| **Week 8** | - Applications of differentiation, Increasing and decreasing functions, Maximum and Minimum using Derivatives |
| **Week 9** | - Introduction to PDE and classification, Special functions: (Gamma function, Bessel function, Exponential integral function, Error function) |
| **Week 10** | - Fourier series and analysis (Definition, General Formula, Euler-Fourier Coefficient, Periodic Functions, Odd and Even Functions). |
| **Week 11** | - Fourier Transform (General Formula, Fourier Transform Theorems, Fourier Transform Pairs, Inverse of Fourier Transform, Inverse of Fourier Transform Theorems) |
| **Week 12** | - Methods of Solving PDE: (Direct integration method, Variables separable, Fourier Transform, Laplace Transform, ODE methods) |
| **Week 13** | - One Dimension Heat Equation, Two Dimension Heat Equation (Laplace equation) |
| **Week 14** | - One Dimension Wave Equation, Wave Equation: D. Alembert's formula |
| **Week 15** | - Single Phase Fluid Flow Equation Solution |
| **Week 16** | - **The preparatory week before the Final Exam** |
| **Learning and Teaching Resources** | |
| مصادر التعلم والتدريس | |

| | Text | Available in the Library? |
|---|---|---|
| **Required Texts** | 1- George B. Thomas, "THOMAS' CALCULUS ", Eleventh Edition 2011, Dorling Kindersley (India).<br>2- Spiegel, M. R. Schaums outline series, theory and problems of Lablace transform, copy write 1965 by Mc Graw-Hill Inc.<br>3- Spiegel, M. R. Schaums outline series, theory and problems of Fourier analysis with application to boundary value problem, copy write 1974 by Mc Graw-Hill Inc. | |
| **Recommended Texts** | 1- Ford , S.R. and Ford , J.R. " Calculus " , (1963) McGraw-Hill.<br>2- K.Back house and S.P.T. Houldsworth " Pure Mathematics a First Course " (1979) , S1 Edition , Longman Group .<br>3- Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons. Inc., 9th ed., 2006. | |
| **Websites** | 1- https://en.wikipedia.org/wiki/Differential_equation<br>2- https://byjus.com/maths/differential-equation/ | |

| **Grading Scheme** | | | | |
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| **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 |

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| | **E - Sufficient** | مقبول | 50 - 59 | Work meets minimum criteria |
| **Fail Group** | **FX – Fail** | راسب (قيد المعالجة) | (45-49) | More work required but credit awarded |
| **(0 – 49)** | **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.