

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

| Module Information | | | |
|------------------------------------|-----------------------------------------|-------------------------------|-------|
| معلومات المادة الدراسية | | | |
| Module Title | Advanced Engineering Mathematics | | |
| Module Type | S | | |
| Module Code | UOMU022041 | | |
| ECTS Credits | 5 | | |
| SWL (hr/sem) | 125 | | |
| Module Level | 2 | Semester of Delivery | Four |
| Administering Department | CET | College | UOMUS |
| Module Leader | | e-mail | |
| Module Leader's Acad. Title | | Module Leader's Qualification | |
| Module Tutor | | e-mail | |
| Peer Reviewer Name | | e-mail | |
| Scientific Committee Approval Date | 1/10/2025 | Version Number | 1.0 |

| Relation with other Modules | | | |
|-----------------------------------|------------|--|----------|
| العلاقة مع المواد الدراسية الأخرى | | | |
| Prerequisite module | UOMU022032 | | Semester |
| Co-requisites module | None | | Semester |

Module Aims, Learning Outcomes and Indicative Contents**أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية**

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| Module Aims أهداف المادة الدراسية | <ol style="list-style-type: none"> 1. To develop problem solving skills complex analysis. 2. To understand power series. 3. To the way around Fourier series. 4. To get the grip on using Laplace transform. 5. To develop a good understanding of ODEs. 6. This course deals with Advanced Engineering Mathematics. |
| Module Learning Outcomes مخرجات التعلم للمادة الدراسية | <ol style="list-style-type: none"> 1. Describe Complex environment. 2. Discuss derivative of Analytic Function. 3. Describe Exponential, Trigonometric and Hyperbolic Functions. 4. Explain Line Integral in the Complex Plane and Cauchy's Integral Formula. 5. Using power Series and how to expand a function 6. Identify elements of Fourier Series. 7. Identify elements of Laplace Transform. 8. Discuss different aspects of First-Order ODEs. 9. Identify Bernoulli Equation and Population Dynamics. 10. Discuss different aspects of Second-Order Linear ODEs. 11. Using Variation of Parameters. 12. Discuss different aspects of Higher Order Linear ODEs. 13. Using Power Series to solve ODE. 14. Explain Fourier Series solution of ODE. 15. Discuss Laplace Transform solution of ODE. |
| Indicative Contents المحتويات الإرشادية | <p><u>Part A – Complex Analysis.</u></p> <p>This part includes Complex Numbers. Polar Form of Complex Numbers. Powers and Roots. Complex variables. Complex Function. Derivative. Analytic Function. Cauchy–Riemann and Laplace's Equation. Exponential, Trigonometric and Hyperbolic Functions. Euler's Formula. Logarithm. Line Integral in the Complex Plane. Cauchy's Integral Formula. Derivatives of Analytic Functions. [12 hrs] + Revision problem classes in weekly tutorials [4 hrs]</p> |

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| | <p><u>Part B – Preliminaries to Methods of solving ODE.</u></p> <p>This part includes Power Series. Functions Given by Power Series. Fourier Series. Arbitrary Period. Even and Odd Functions. Fourier Analysis for Periodic Functions. Fourier series Formula of a function. Differentiation and Integration of Fourier Series Laplace Transform. Transforms of Derivatives and Integrals. Table of Laplace Transforms. inverse Laplace transform [9 hrs] + Revision problem classes in weekly tutorials [3 hrs]</p> <p><u>Part C – ODE.</u></p> <p>This part includes First-Order ODEs. Separable ODEs. Exact ODEs. Integrating Factors. Linear ODEs. Bernoulli Equation. Population Dynamics. Second-Order Linear ODEs. Homogeneous. Homogeneous with Constant Coefficients. Nonhomogeneous ODEs. Solution by Variation of Parameters. Higher Order Linear ODEs. Homogeneous Linear ODEs. Homogeneous Linear ODEs with Constant Coefficients. Nonhomogeneous Linear ODEs. Power Series solution of ODE. Fourier Series solution of ODE. Laplace Transform solution of ODE. [24 hrs] + Revision problem classes in weekly tutorials [8 hrs]</p> |
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| <h3 style="text-align: center;">Learning and Teaching Strategies</h3> <p style="text-align: center;">استراتيجيات التعلم والتعليم</p> | |
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| Strategies | <p>This module will primarily focus on encouraging students to participate in the activities, as well as refining and developing their critical thinking skills. This will be achieved through lectures, tutorials, discussions, and grading activities.</p> |

| <h3 style="text-align: center;">Student Workload (SWL)</h3> <p style="text-align: center;">الحمل الدراسي للطالب موزع على (15) أسبوع</p> | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------|------|
| Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل | 48 | Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً | 3.2 |
| Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل | 77 | Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً | 5.13 |
| Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل | 125 | | |

| Module Evaluation | | | | | |
|-----------------------|-----------------|-------------|------------------|------------|---------------------------|
| تقييم المادة الدراسية | | | | | |
| | | Time/Number | Weight (Marks) | Week Due | Relevant Learning Outcome |
| Formative assessment | Quizzes | 2 | 10% (10) | 5, 10 | LO #1-4, LO #5-9 |
| | Assignments | 2 | 20% (10) | 3, 11 | LO # 1,2 , LO# 3-10 |
| | Projects / Lab. | N/A | | | |
| Summative assessment | Report | 1 | 10% (10) | Continuous | LO#1-14 |
| | Midterm Exam | 2 hr | 10% (10) | 8 | LO # 1-7 |
| Final Exam | | 3hr | 50% (50) | 16 | All |
| Total assessment | | | 100% (100 Marks) | | |

| Delivery Plan (Weekly Syllabus) | |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| المنهاج الأسبوعي النظري | |
| | Material Covered |
| Week 1 | Complex Numbers. Polar Form of Complex Numbers. Powers and Roots. Complex variables. |
| Week 2 | Complex Function. Derivative. Analytic Function. Cauchy–Riemann and Laplace's Equation. |
| Week 3 | Exponential, Trigonometric and Hyperbolic Functions. Euler's Formula. Logarithm. |
| Week 4 | Line Integral in the Complex Plane. Cauchy's Integral Formula. Derivatives of Analytic Functions |
| Week 5 | Power Series. Functions Given by Power Series. |
| Week 6 | Fourier Series. Arbitrary Period. Even and Odd Functions. Fourier Analysis for Periodic Functions. Fourier series Formula of a function. Differentiation and Integration of Fourier Series |
| Week 7 | Laplace Transform. Transforms of Derivatives and Integrals. Table of Laplace Transforms. inverse Laplace transform |
| Week 8 | Midterm Exam |
| Week 9 | First-Order ODEs. Separable ODEs. Exact ODEs. Integrating Factors. Linear ODEs. Bernoulli Equation. Population Dynamics. |
| Week 10 | Second-Order Linear ODEs. Homogeneous. Homogeneous with Constant Coefficients. |
| Week 11 | Nonhomogeneous ODEs. Solution by Variation of Parameters. |
| Week 12 | Higher Order Linear ODEs. Homogeneous Linear ODEs. Homogeneous Linear ODEs with Constant Coefficients. Nonhomogeneous Linear ODEs. |
| Week 13 | Power Series solution of ODE. |
| Week 14 | Fourier Series solution of ODE. |
| Week 15 | Laplace Transform solution of ODE. |

Delivery Plan (Weekly Tutorial)

المنهاج الاسبوعي الاضافي

Material Covered

Each week, a question sheet related to the material presented in the theoretical lecture will be solved and debated.

Learning and Teaching Resources

مصادر التعلم والتدریس

| | Text | Available in the Library? |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Required Texts | "Advanced Engineering Mathematics ", Erwin Kreyszig, Wiley, 10th edition (August 16, 2011), ISBN-13: 978-0470458365. | Yes |
| Recommended Texts | "Differential Equations for Engineers and Scientists", Yunus Cengel, William Palm, McGraw Hill, 1st edition (January 31, 2012), ISBN-13: 978-0073385907. | No |
| Websites | https://www.coursera.org/learn/differential-equations-engineers | |

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 | 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.