MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Calculus 4	**Module Delivery**	
Module Type	Basic learning activity	☒ Theory	
Module Code	ENG009	☒ Lecture	
ECTS Credits	6	☐ Lab	
SWL (hr/sem)	150	☐ Tutorial	
		☐ Practical	
		☐ Seminar	

Module Level	UGII	**Semester of Delivery**	4
Administering Department	CV101	**College**	Civil Engineering College
Module Leader	Dr.Jamal A. Khalaf	**e-mail**	Jamal.khalaf@uoanabr.edu.iq
Module Leader's Acad. Title	senior lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor	Dr. Mohammed Raji Mohammed	**e-mail**	moh.raji@uoanbar.edu.iq,
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	ENG009 Calculus 3	**Semester**	3
Co-requisites module	None	**Semester**	

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

Module Aims أهداف المادة الدراسية	The laws of nature are expressed as differential equations. Scientists and engineers must know how to model the world in terms of differential equations, and how to solve those equations and interpret the solutions. This course focuses on linear differential equations and their applications in science and engineering. Understand and solve problems using Fourier Series, Solve differential equations using the theory of Laplace transform
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the course students will be able to: 1. Model a simple physical system to obtain a first order differential equation. 2. Test the plausibility of a solution to a differential equation (DE) which models a physical situation by using reality-check methods such as physical reasoning, looking at the graph of the solution, testing extreme cases, and checking units. 3. Visualize solutions using direction fields and approximate them using Euler's method. 4. Understand and solve problems using Fourier Series 5. Solve differential equations using the theory of Laplace transform
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **Chapter one** Introduction to first order differential equations : Definitions and reviews, methods of solving first order differential equations, Variable separable , Homogenous, Equations reducible to homogeneous form, Exact, Linear , equation reducible to linear form (Bernoulli's equation) - [20 hrs] **Chapter Two** Application of First order differential equations, Tank filled with flowed, body falls in a medium, Structural Applications [10 hrs]

	Chapter Three
	Second Order Ordinary Differential Equations, Solution of Homogeneous Linear D.Es with constant coefficients, Initial Value and Boundary Value Problems, Solutions of Nonhomogeneous Linear D.E with constant coefficients, The Method of Undetermined Coefficients, Method of Variation of Parameters, [15 hrs]
	Chapter Four
	Applications of Second Order Linear Differential Equations with constant, Free Oscillation spring, Damped Oscillation, Column Buckling: [15 hrs]
	Chapter Five
	Fourier series, Introduction, Functions with Period 2Pi, Functions with Period 2L [15 hrs]
	Chapter Six
	Laplace Transforms, Introduction, Definition of Laplace transforms, Laplace transforms for derivatives, Properties of Laplace Transforms, Inverse of Laplace transforms, Properties of Inverse of Laplace transform , Solution of Ordinary D.E's by Laplace transforms, D.E's with constant coefficients , D.E's with variable coefficients , Simultaneous Linear D.E's , [20 hrs]

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	Mathematics engineering courses require effective learning and teaching strategies to ensure students develop a strong understanding of complex concepts and their practical applications. The range of strategies that can enhance the learning experience for students in Mathematics engineering courses. These strategies include lecture-based teaching, practical applications, problem-solving assignments, group work and discussions, technology integration, assessments and feedback, continuous learning, and encouraging self-directed learning. By incorporating these strategies, educators can create an engaging and comprehensive learning environment that equips students with the knowledge, skills, and critical thinking abilities necessary for success.

Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.8
Total SWL (h/sem)	150		

		الحمل الدراسي الكلي للطالب خلال الفصل			

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	10% (10)	3, 6,10,14	LO #1, 3,5, and 7
	Assignments	2	5% (5)	2, 12	LO # 4 and 7
	Projects / Lab.	1			
	Report	1	5% (5)	13	LO # 2,6 and 7
Summative assessment	**Midterm Exam**	2 hr	20% (20)	7	LO # 1-7
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to first order differential equations : Definitions and reviews, methods of solving first order differential equations
Week 2	Variable separable , Homogenous, reducible to homogeneous form,
Week 3	Exact, Linear , equation reducible to linear form (Bernoulli's equation)
Week 4	Application of First order differential equations, Tank filled with flowed, body falls in a medium, Structural Applications
Week 5	Second Order Ordinary Differential Equations, Solution of Homogeneous Linear D.Es with constant coefficients, Initial Value and Boundary Value Problems
Week 6	Solutions of Nonhomogeneous Linear D.E with constant coefficients, The Method of Undetermined Coefficients
Week 7	Method of Variation of Parameters
Week 8	Applications of Second Order Linear Differential Equations with constant, Free Oscillation spring, Damped Oscillation, Column Buckling
Week 9	Fourier series, Introduction, Functions with Period 2Pi
Week 10	Fourier series, Functions with Period 2L
Week 11	Laplace Transforms, Introduction, Definition of Laplace transforms, Laplace transforms for derivatives
Week 12	Properties of Laplace Transforms,

Week 13	Inverse of Laplace transforms, Properties of Inverse of Laplace transform
Week 14	Solution of Ordinary D.E's by Laplace transforms, D.E's with constant coefficients
Week 15	Solution of Ordinary D.E's with variable coefficients , Simultaneous Linear D.E's
Week 16	**Preparatory week before the final Exam**

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

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	• Differential Equations with Boundary-Value Problems, seventh edition. Dennis G. Zill, Michael R Cullen. Copyright 2009, Brooks/Cole. ISBN-13: 978-0-495-10836-8	Yes
Recommended Texts	• Differential Equations with Boundary-Value Problems Student Solutions Manual. Warren S. Wright, Dennis G. Zill, Carol D. Wright. Copyright 2009, Brooks/Cole Publishing Company. ISBN 978-0-495-38316-1.	Yes
Websites	https://www.uoanbar.edu.iq/Bank-Section.php	

<table>
<tr><td colspan="5">Grading Scheme
مخطط الدرجات</td></tr>
<tr><td>Group</td><td>Grade</td><td>التقدير</td><td>Marks (%)</td><td>Definition</td></tr>
<tr><td rowspan="5">Success Group
(50 - 100)</td><td>A - Excellent</td><td>امتياز</td><td>90 - 100</td><td>Outstanding Performance</td></tr>
<tr><td>B - Very Good</td><td>جيد جدا</td><td>80 - 89</td><td>Above average with some errors</td></tr>
<tr><td>C - Good</td><td>جيد</td><td>70 - 79</td><td>Sound work with notable errors</td></tr>
<tr><td>D - Satisfactory</td><td>متوسط</td><td>60 - 69</td><td>Fair but with major shortcomings</td></tr>
<tr><td>E - Sufficient</td><td>مقبول</td><td>50 - 59</td><td>Work meets minimum criteria</td></tr>
<tr><td rowspan="2">Fail Group
(0 – 49)</td><td>FX – Fail</td><td>راسب (قيد المعالجة)</td><td>(45-49)</td><td>More work required but credit awarded</td></tr>
<tr><td>F – Fail</td><td>راسب</td><td>(0-44)</td><td>Considerable amount of work required</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
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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.