MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Mathematical Modeling Systems**			**Module Delivery**	
Module Type	**Basic**			☒ **Theory**	
Module Code	UOMU0207034			☐ **Lecture**	
ECTS Credits	**5**			☐ **Lab**	
SWL (hr/sem)	**125**			☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Level	UGII		**Semester of Delivery**	1	
Administering Department			**College**	UOMUS	
Module Leader	Alaa Mohammed Hussein Wais		**e-mail**	alaa.mohammed@uomus.edu.iq	
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor	Alaa Mohammed Hussein Wais		**e-mail**	alaa.mohammed@uomus.edu.iq	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	30/09/2025		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1- To understand functions of multiple variables, limits, continuity, and partial derivatives. 2- To apply the chain rule, directional derivatives, and gradients. 3- To determine tangent planes, normal vectors, and extrema of functions in two variables. 4- To work with polar, cylindrical, and spherical coordinates. 5- To understand vectors in 3D space, including dot and cross products. 6- To evaluate double and triple integrals over various regions. 7- To apply convergence tests to infinite series. 8- To approximate functions with Maclaurin and Taylor polynomials. 9- To explore power series and their applications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Understanding functions of multiple variables 2- Computing partial derivatives 3- Applying the chain rule in multivariable calculus 4- Calculating directional derivatives and gradients of functions 5- Determining tangent planes and normal vectors to surfaces 6- Finding maxima and minima of functions of two variables 7- Working with polar coordinates and graphing polar equations 8- Calculating areas and lengths in polar coordinates 9- Understanding conic sections and their representation in polar coordinates 10- Working in three-dimensional space 11- Understanding vectors, dot product, cross product, and their applications 12- Describing lines and planes using parametric equations 13- Understanding quadric surfaces and working with cylindrical and spherical coordinates 14- Evaluating double integrals over various regions 15- Calculating surface area and working with parametric surfaces 16- Computing triple integrals in different coordinate systems 17- Applying change of variables and understanding Jacobians in multiple integrals 18- Understanding sequences and series 19- Applying convergence tests and analyzing convergence properties 20- Approximating functions using Maclaurin and Taylor polynomials 21- Understanding power series and their convergence properties 22- Modeling with the Taylor series for various applications
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **1- Multivariable Calculus**: (25 h) • Functions of Two or More Variables • Limits and Continuity • Partial Derivatives • Directional Derivatives and Gradients • Tangent Planes and Normal Vectors **2- Optimization and Extrema**: (9 h) • Maxima and Minima of Functions of Two Variables • Lagrange Multipliers **3- Coordinate Systems and Vectors**: (25 h) • Polar Coordinates • Cylindrical and Spherical Coordinates • Matrices and Determinants • Vectors in Three-Dimensional Space • Dot Product and Cross Product **4- Multiple Integrals**: (25 h) • Double Integrals • Triple Integrals

	• Change of Variables in Multiple Integrals • Surface Area and Volume Calculations **5- Infinite Series and Sequences**: (25 h) • Convergence and Divergence • Taylor and Maclaurin Series • Power Series • Applications of Taylor Series

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Use the following Learning, Teaching, and Assessment strategies Learning Strategies: • Encourage students to actively engage with the material through problem-solving, discussions, and group activities. • Use visual aids like graphs, diagrams, and interactive simulations to help students grasp complex concepts in multivariable calculus and vector calculus. • Connect calculus concepts to real-world scenarios to demonstrate their practical relevance and enhance understanding. • Conduct engaging lectures that involve student participation, discussions, and demonstrations to keep students actively involved. • Incorporate hands-on activities, such as working with software tools for graphing or numerical calculations, to reinforce learning. • Assign challenging problems that require critical thinking and problem-solving skills, promoting a deeper understanding of the material. • Use formative assessments like quizzes, homework assignments, and in-class exercises to provide feedback and monitor student progress. • Present case studies or application problems that require students to apply calculus concepts to analyze and solve real-world problems. • Incorporate peer evaluation in group activities or projects to promote collaboration and peer learning. By incorporating these strategies into the learning and teaching process, students can develop a solid understanding of advanced calculus topics and enhance their problem-solving skills in multivariable calculus, vector calculus, and series expansions.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.1
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 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Homework	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Functions of Two or More Variables, Limits and Continuity, Partial Derivatives
Week 2	The Chain Rule, Directional Derivatives and Gradients.
Week 3	Tangent Planes and Normal Vectors, Maxima and Minima of Functions of Two Variables, Lagrange Multipliers.
Week 4	Polar Coordinates, Graphing Polar Coordinate Equations, Areas and Lengths in Polar Coordinates
Week 5	Conic Sections, Conics in Polar Coordinates
Week 6	THREE-DIMENSIONAL SPACE; VECTORS: Rectangular Coordinates in 3-Space
Week 7	Spheres; Cylindrical Surfaces, Vectors, The Dot Product, The Cross Product
Week 8	Parametric Equations of Lines, Planes in 3-Space, Quadric Surfaces, Cylindrical and Spherical Coordinates
Week 9	MULTIPLE INTEGRALS: Double Integrals, Double Integrals over Nonrectangular Regions,
Week 10	Double Integrals in Polar Coordinates, Surface Area; Parametric Surfaces
Week 11	Triple Integrals, Triple Integrals in Cylindrical and Spherical Coordinates, Change of Variables in Multiple Integrals; Jacobians
Week 12	INFINITE SERIES: Sequences, Monotone Sequences, Infinite Series, Convergence Tests
Week 13	The Comparison, Ratio, and Root Tests, Alternating Series; Absolute and Conditional Convergence
Week 14	Maclaurin and Taylor Polynomials, Maclaurin and Taylor Series; Power Series
Week 15	Convergence of Taylor Series, Differentiating and Integrating Power Series; Modeling with Taylor Series
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Thomas' Calculus 14th edition	Yes
Recommended Texts	Calculus 10th edition by Anton , Bivens , and Davis	Yes
Websites	https://www.lboro.ac.uk/departments/mlsc/student-resources/helm-workbooks/	

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.