Ministry of Higher Education and
Scientific Research - Iraq
Al-Mustaqbal University
Department of Cyber Security

MODULE DESCRIPTOR FORM
نموذج وصف المادة الدراسية

Module Information		
معلومات المادة الدراسية		
Module Title	NUMERICAL ANALYSIS	**Module Delivery**
Module Type	BASIC	-Theory Lecture -Lab -Practical -Seminar
Module Code	UOMU033034	
ECTS Credits	5	
SWL (hr/sem)	125	

Module Level	2	Semester of Delivery	3
Administering Department	Cyber Security Dept.	**College**	Sciences
Module Leader	Mohammed Jabbar Obaid	**e-mail**	mohammed.jabbar.obaid@uomus.edu.iq
Module Leader's Acad. Title	Assist. lec.	**Module Leader's Qualification**	M.SC.
Module Tutor	None	**e-mail**	None
Peer Reviewer Name		**e-mail**	
Review Committee Approval		**Version Number**	

Relation With Other Modules			
العلاقة مع المواد الدراسية الاخرى			
Prerequisite module	Number Theory	**Semester**	1

Co-requisites module	None	Semester	2

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

Module Aims أهداف المادة الدراسية	1. Explain and apply various numerical methods for mathematical problem-solving. 2. Implement numerical algorithms using MATLAB for solving mathematical problems. 3. Analyze and quantify errors associated with numerical methods. 4. Apply numerical techniques to solve real-world engineering and scientific problems. 5. Communicate results effectively, both orally and in writing.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand and explain fundamental numerical methods. 2. Implement numerical algorithms using MATLAB. 3. Analyze and control errors in numerical computations. 4. Apply numerical techniques to solve engineering and scientific problems. 5. Communicate results of numerical analyses clearly and effectively.

Indicative Contents
 	
المحتويات الارشادية
	1. Introduction to Numerical Methods
	2. Error Analysis and Computer Arithmetic
	   6- Solutions of Equations in One Variable
	3. 7- Interpolation and Polynomial Approximation8- Numerical Differentiation and Integration
	4. 9- Numerical Solution of Initial Value Problems for Ordinary Differential Equations10- Direct Methods for Solving Linear Systems
	5. Iterative Techniques in Matrix Algebra
	6. Approximation Theory and Least Squares Approximation
	   13- Approximation of Eigenvalues and Eigenvectors
	7. Numerical Solution of Boundary Value Problems for Ordinary Differential Equations
	8. Finite Difference Methods for Boundary Value Problems
	   16- Numerical Solution of Partial Differential Equations
	9. Introduction to MATLAB for Numerical Analysis
	10. These contents typically cover a wide range of numerical methods and algorithmscommonly used in mathematical and computational applications.

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The learning outcomes for a Numerical Analysis course include: 1. Understanding and implementing numerical methods for solving mathematical problems, such as root finding, interpolation, and approximation of functions. 2. Analyzing the properties of numerical algorithms including convergence, stability, and accuracy. 3. Applying numerical techniques to solve practical engineering and scientific problems, such as differential equations, optimization, and linear algebraic equations. 4. Developing proficiency in programming and utilizing computational tools like MATLAB, Python, or numerical computation software to implement algorithms and analyze numerical solutions. 5. Critically evaluating the results obtained from numerical methods, including error analysis and comparing with analytical solutions where possible. 6. Exploring advanced topics in numerical analysis, such as finite element methods, numerical integration, and solving eigenvalue problems.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	47	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.7
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**	1	10% (10)	5	LO # 1 and 3
	Practical Seminar(Lab).	2	15% (15)	Continuous	LO # 2 , 4 and 5
Summative assessment	**Midterm Exam**	1 hr	15% (15)	14	LO # 1 to 5
	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 numerical analysis+ Solution of non-linear equations, Newton Raphson method for approximating, Lagrange approximation
Week 2	Numerical differentiation and numerical integration, The Solutions of Integral equations, Trapezoidal method Simpsons method
Week 3	Simpsons method(3/8)
Week 4	numarical differentiation, Euler method, modified Euler method
Week 5	Rung Kutta method, Rung Kutta-merson method
Week 6	Introduction and soiution of Partial differential equations
Week 7	Formation of Partial differential equations And solution of separable first order
Week 8	Types of partial differential equations,wave equation,heat equation
Week 9	Solution sys of linear equation, Elimination and iterative methods
Week 10	Solution sys of linear eq by Cramer's rule, solve by inverse matrix
Week 11	Method of least square
Week 12	introduction to Fourier series
Week 13	Fourier series for odd and even functions, Half range Fourier series
Week 14	Change of interval Fourier series
Week 15	Mid Term Exam and Preparatory Week

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	**Material Covered**
Week 1	Introduction to MATLAB for numerical computations
Week 2	Solving linear systems of equations in matlab
Week 3	Interpolation and curve fitting
Week 4	Numerical differentiation and integration
Week 5	Solution of nonlinear equations

Week 6	**Numerical solutions of ordinary differential equations (ODEs)**
Week 7	**Finite difference methods**
Week 8	**Numerical solutions of partial differential equations (PDEs)**
Week 9	**Optimization techniques** **Error Analysis in Numerical Computations**
Week 10	**MATLAB programming for numerical analysis**
Week 11	**Simple introduction about using matlab program**
Week 12	**Vectors in matlab prog.**
Week 13	**Matrix in matlab prog.**
Week 14	**Application of numerical analysis in matlab**
Week 15	**Final Exam**

Learning and Teaching Resources
مصادر التعليم والتدريس

	Text	**Available in the Library?**
Required Texts	**2. Thomas,G. Calculus and Analytic Geometry,Fifth Edition,Addition Wesly,1999**	No
Recommended Texts	**2. matlab programming language.**	No
Websites	**Any sources take in lectures and examples**	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جداً	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
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.