



Ministry of Higher Education and  
Scientific Research – Iraq  
Al-Mustaqbal University College  
College of Sciences



## MODULE DESCRIPTOR FORM

### نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	NUMERICAL ANALYSIS		Module Delivery
Module Type	BASIC		-Theory Lecture -Lab -PracticalSeminar
Module Code	UOMU0304033		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	2	Semester of Delivery	3
Administering Department	Department of Artificial Intelligence	College	College of Sciences
Module Leader	Dr. raidh hamed	e-mail	raidh.h.salman@uomus.edu.iq
Module Leader's Acad. Title	Dr.	Module Leader's Qualification	PhD
Module Tutor	None	e-mail	None
Peer Reviewer Name		e-mail	
Review Committee Approval		Version Number	

## Relation With Other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	MATH112	Semester	1
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Co-requisites module	None	Semester	
<b>Module Aims, Learning Outcomes and Indicative Contents</b> أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية			
<b>Module Aims</b> أهداف المادة الدراسية	<ol style="list-style-type: none"> <li>1. Explain and apply various numerical methods for mathematical problem-solving.</li> <li>2. Implement numerical algorithms using MATLAB for solving mathematical problems.</li> <li>3. Analyze and quantify errors associated with numerical methods.</li> <li>4. Apply numerical techniques to solve real-world engineering and scientific problems.</li> <li>5. Communicate results effectively, both orally and in writing.</li> <li>6.</li> </ol>		
<b>Module Learning Outcomes</b> مخرجات التعلم للمادة الدراسية	<ol style="list-style-type: none"> <li>1. Understand and explain fundamental numerical methods.</li> <li>2. Implement numerical algorithms using MATLAB.</li> <li>3. Analyze and control errors in numerical computations.</li> <li>4. Apply numerical techniques to solve engineering and scientific problems.</li> <li>5. Communicate results of numerical analyses clearly and effectively.</li> <li>6.</li> </ol>		
<b>Indicative Contents</b> المحتويات الإرشادية	<ol style="list-style-type: none"> <li>1- Introduction to Numerical Methods</li> <li>2- Error Analysis and Computer Arithmetic</li> <li>3- Solutions of Equations in One Variable</li> <li>4- Interpolation and Polynomial Approximation</li> <li>5- Numerical Differentiation and Integration</li> <li>6- Numerical Solution of Initial Value Problems for Ordinary Differential Equations</li> <li>7- Direct Methods for Solving Linear Systems</li> <li>8- Iterative Techniques in Matrix Algebra</li> <li>9- Approximation Theory and Least Squares Approximation</li> <li>10- Approximation of Eigenvalues and Eigenvectors</li> <li>11- Numerical Solution of Boundary Value Problems for Ordinary Differential Equations</li> <li>12- Finite Difference Methods for Boundary Value Problems</li> <li>13- Numerical Solution of Partial Differential Equations</li> <li>14- Introduction to MATLAB for Numerical Analysis</li> <li>15- These contents typically cover a wide range of numerical methods and algorithms commonly used in mathematical and computational applications.</li> </ol>		
<b>Learning and Teaching Strategies</b> استراتيجيات التعلم والتعليم			
<b>Strategies</b>	<p>The learning outcomes for a Numerical Analysis course include:</p> <ol style="list-style-type: none"> <li>1. Understanding and implementing numerical methods for solving mathematical problems, such as root finding, interpolation, and approximation of functions.</li> <li>2. Analyzing the properties of numerical algorithms including convergence, stability, and accuracy.</li> <li>3. Applying numerical techniques to solve practical engineering and scientific problems, such as differential equations, optimization, and linear algebraic equations.</li> </ol>		

	<ol style="list-style-type: none"> <li>4. Developing proficiency in programming and utilizing computational tools like MATLAB, Python, or numerical computation software to implement algorithms and analyze numerical solutions.</li> <li>5. Critically evaluating the results obtained from numerical methods, including error analysis and comparing with analytical solutions where possible.</li> <li>6. Exploring advanced topics in numerical analysis, such as finite element methods, numerical integration, and solving eigenvalue problems.</li> </ol>
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### Student Workload (SWL)

الحمل الدراسي للطالب

<b>Structured SWL (h/sem)</b> الحمل الدراسي المنتظم للطالب خلال الفصل	78	<b>Structured SWL (h/w)</b> الحمل الدراسي المنتظم للطالب أسبوعياً	5
<b>Unstructured SWL (h/sem)</b> الحمل الدراسي غير المنتظم للطالب خلال الفصل	47	<b>Unstructured SWL (h/w)</b> الحمل الدراسي غير المنتظم للطالب أسبوعياً	3
<b>Total SWL (h/sem)</b> الحمل الدراسي الكلي للطالب خلال الفصل	125		

### Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
<b>Formative assessment</b>	<b>Quizzes</b>	1	10% (10)	5	LO # 1 and 3
	<b>Practical Seminar(Lab).</b>	2	15% (15)	Continuous	LO # 2 , 4 and 5
<b>Summative assessment</b>	<b>Midterm Exam</b>	1 hr	15% (15)	14	LO # 1 to 5
	<b>Final Exam</b>	3hr	60% (60)	16	All
<b>Total assessment</b>			100% (100 Marks)		

### Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
<b>Week 1</b>	<b>Introduction to numerical analysis+ Solution of non-linear equations, Newton Raphson method for approximating, Lagrange approximation</b>
<b>Week 2</b>	<b>Numerical differentiation and numerical integration, The Solutions of Integral equations, Trapezoidal method Simpsons method</b>
<b>Week 3</b>	<b>Simpsons method(3/8)</b>
<b>Week 4</b>	<b>numerical differentiation, Euler method, modified Euler method</b>

Week 5	Rung Kutta method, Rung Kutta-merson method
Week 6	Introduction and solution 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 matri
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
Week 16	Final Exam

### 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 iin 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	<b>Optimization techniques</b> <b>Error Analysis in Numerical Computations</b>
Week 10	<b>MATLAB programming for numerical analysis</b>
Week 11	<b>Simple introduction about using matlab program</b>
Week 12	<b>Vectors in matlab prog.</b>
Week 13	<b>Matrix in matlab prog.</b>
Week 14	<b>Application of numerical analysis in matlab</b>
Week 15	<b>Final Exam</b>

<b>Learning and Teaching Resources</b> مصادر التعلم والتدريس		
	<b>Text</b>	<b>Available in the Library?</b>
<b>Required Texts</b>	<b>1. Thomas,G. Calculus and Analytic Geometry,Fifth Edition,Addition Wesly,1999</b>	No
<b>Recommended Texts</b>	<b>1. matlab programming language.</b>	No
<b>Websites</b>	<b>Any sources take in lectures and examples</b>	

#### APPENDIX:

<b>GRADING SCHEME</b> مخطط الدرجات				
<b>Group</b>	<b>Grade</b>	<b>التقدير</b>	<b>Marks (%)</b>	<b>Definition</b>
<b>Success Group (50 - 100)</b>	<b>A - Excellent</b>	امتياز	90 - 100	Outstanding Performance
	<b>B - Very Good</b>	جيد جدا	80 - 89	Above average with some errors
	<b>C - Good</b>	جيد	70 - 79	Sound work with notable errors
	<b>D - Satisfactory</b>	متوسط	60 - 69	Fair but with major shortcomings
	<b>E - Sufficient</b>	مقبول	50 - 59	Work meets minimum criteria
<b>Fail Group (0 - 49)</b>	<b>FX – Fail</b>	مقبول بقرار	(45-49)	More work required but credit awarded
	<b>F – Fail</b>	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.

