MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Numerical Methods**			**Module Delivery**	
Module Type	**Basic**			☒**Theory** ☒**Lecture** ☐ **Lab** ☒ **Tutorial** ☐**Practical** ☒**Seminar**	
Module Code	**SCI-103**				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		**Semester of Delivery**	3	
Administering Department	com		**College**	science	
Module Leader	Iraq ali hussein		**e-mail**	iraqali@uodiyala.edu.iq	
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	24/08/2024		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**Computational mathematics**	**Semester**	1
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The main objectives of the course are to: ● Provide an understanding of numerical methods for solving mathematical problems. ● Develop skills in implementing numerical algorithms. ● Introduce the application of numerical methods to real-world engineering problems. ● Focus on error analysis and computational stability of algorithms. ● Teach students how to develop and analyze their own numerical algorithms.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	After completion of the course students are expected to be able to: 1. Understand the fundamental principles of numerical methods. 2. Analyze the accuracy and stability of numerical solutions. 3. Implement numerical algorithms in a programming environment. 4. Apply numerical methods to solve practical engineering and scientific problems. 5. Critically evaluate the performance of different numerical methods.
Indicative Contents المحتويات الإرشادية	1. Introduction to Numerical Methods and Error Analysis. 2. Solutions of Nonlinear Equations. 3. Numerical Differentiation and Integration. 4. Numerical Solutions of Ordinary Differential Equations. 5. Numerical Linear Algebra. 6. Interpolation and Curve Fitting. 7. Optimization Techniques. 8. Stability and Convergence of Algorithms.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• Lectures, Lab Tutorials, Practical Exercises, and Assignments

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	66	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	48	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.2
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)	2,6 and 9,11	LO #2, #6 and #9, #11
	Assignments	2	10% (10)	3,5 and 10,12	LO #3, #5 and #10, #12
	Home Works	1	10% (10)	2,5 and 8,11	LO #2, #5 and #8, #11
	Report	1	10% (10)	13	LO #13
	Projects / Lab.	2	10% (10)	Continuous	All
Summative assessment	**Midterm Exam**	2hr	10% (10)	8	LO #8
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Numerical Methods * Definitions and classifications * Importance and applications * Overview of error analysis
Week 2	Solutions of Nonlinear Equations * Bisection method * Newton-Raphson method * Secant method
Week 3	Numerical Differentiation and Integration * Trapezoidal rule * Simpson's rule * Numerical differentiation formulas
Week 4	Numerical Solutions of ODEs * Euler's method * Runge-Kutta methods * Stability of ODE solutions
Week 5	Numerical Linear Algebra * Gaussian elimination * LU decomposition * Iterative methods
Week 6	Interpolation * Lagrange interpolation * Newton's divided difference * Spline interpolation
Week 7	Midterm Exam

Week 8	Optimization Techniques * Unconstrained optimization * Constrained optimization * Applications in engineering
Week 9	Stability and Convergence * Analysis of numerical algorithms * Convergence criteria * Practical examples
Week 10	Case Studies and Applications * Application of numerical methods in engineering * Discussion of case studies
Week 11	Introduction to Numerical Methods * Definitions and classifications * Importance and applications * Overview of error analysis
Week 12	Solutions of Nonlinear Equations * Bisection method * Newton-Raphson method * Secant method
Week 13	Numerical Differentiation and Integration * Trapezoidal rule * Simpson's rule * Numerical differentiation formulas
Week 14	Numerical Solutions of ODEs * Euler's method * Runge-Kutta methods * Stability of ODE solutions
Week 15	Numerical Linear Algebra * Gaussian elimination * LU decomposition * Iterative methods

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Weeks 1 and 2,3	Introduction to Numerical Software * Overview of software tools used for numerical analysis * Setting up the environment * Basic operations
Weeks 4 and 5,6	Nonlinear Equations * Implementing bisection method * Implementing Newton-Raphson method * Comparison of methods
Weeks 7,8 and 9	Numerical Integration * Implementing trapezoidal and Simpson's rule * Numerical differentiation * Error analysis

Weeks 9 and10 ,11	Ordinary Differential Equations * Implementing Euler's method * Implementing Runge-Kutta methods * Solving real-world problems
Weeks 12,14 and 14	Linear Algebra * Implementing Gaussian elimination * LU decomposition * Solving systems of linear equations

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	● Burden, R. L., & Faires, J. D. (2011). Numerical Analysis (9th Edition). Cengage Learning. ● Chapra, S. C., & Canale, R. P. (2015). Numerical Methods for Engineers (7th Edition).	
Recommended Texts	● Sauer, T. (2012). Numerical Analysis. Pearson. ● Atkinson, K. E. (1989). An Introduction to Numerical Analysis (2nd Edition). Wiley.	
Websites		

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.