Module Information
معلومات المادة الدراسية

Module Title	**Engineering & Numerical analysis**	**Module Delivery**	
Module Type	suport	☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	UOMU0203064		
ECTS Credits	**4**		
SWL (hr/sem)	**100**		
Module Level	UGIII	**Semester of Delivery**	6

Administering Department	**Technical building and Construction**	**College**	Al-Mustaqbal University
Module Leader	Alaa Hussein Abdulameer	**e-mail**	Alaa.hussein.abdulammer@uomus.edu.iq
Module Leader's Acad. Title	Assis. lec	**Module Leader's Qualification**	M.Sc. in in hydrology
Module Tutor	Alaa Hussein Abdulameer	**e-mail**	Alaa.hussein.abdulammer@uomus.edu.iq
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date		**Version Number**	

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 Aims أهداف المادة الدراسية	This course covers interpolation, Newtons forward difference formula. Interpolation, Newtons backward difference formula. Lagrangian Interpolation. Numerical methods in linear algebra, system of linear eq. Gauss elimination. Numerical methods in linear algebra, system of linear eq. Gauss-Jordan elimination. System of linear eq. solution by iteration: Jacobi method iteration, Eigen value and Eigen vector. Numerical methods for differential equation, Euler method, Rung-Kutta method.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	upon completion of this course the students will: 1- Acquire basic knowledge in solving interpolation with equal interval problems by various numerical methods. Estimate the missing terms through interpolation methods. 2- Develop skills in analyzing the methods of interpolating a given data, properties of interpolation with unequal intervals and derive conclusions, approximate a function using an appropriate numerical method. 3- Implement numerical methods for a variety of multidisciplinary applications and a variety of numerical algorithms using appropriate technology. 4- Use relevant numerical techniques for interpolation with equal and unequal intervals by using various central difference formulae and code a numerical method in a modern computer language.

	5- Apply appropriate numerical methods to solve the problem with most accuracy. 6- Be able to derive Least – Squares curve fitting procedures, fitting a straight line, fitting a parabola, nonlinear curve fitting, Curve fitting by a sum of exponentials. 7- Be able to find the derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formulae, Stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function. 8- Be able to derive Trapozoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 – rule, and Weddle's rules from General Quadrature formula and find the Euler – Maclaurin Formula of summation and The Euler transformation. 9- Be able to find the solution of linear systems by using Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method, Method of factorization, Solution of Tridiagonal Systems, 10- Be able to find the find the solution of ordinary differential equation of first order by Euler, Taylor and Runge-Kutta methods 11- Compare different methods in numerical analysis with accuracy and efficiency of solution

Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Interpolation, Newtons forward difference formula [2hrs] Interpolation, Newtons backward difference formula[2hrs] Lagrangian Interpolation [2hrs] Numerical methods in linear algebra, system of linear eq. Gauss elimination [2hrs] Numerical methods in linear algebra, system of linear eq. Gauss- Jordan elimination[2hrs] System of linear eq. solution by iteration: Jacobi method iteration, Eigen value and Eigen vector. [2hrs] Numerical methods for differential equation, Euler method, [2hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Assessment is based on 1-Exams. 2-Student feedback.

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	37	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	0	0		
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hr	20% (20)	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	Systems of linear algebraic equations, row operations, scaling, pivoting, elimination, Direct elimination methods, Cramer's Rule.
Week 2	Systems of linear algebraic equations, Gauss Elimination, Back substitution, Simple elimination, Gauss-Jordan Elimination.
Week 3	The Jacobi Iteration Method, The Gauss-Seidel Iteration Method.
Week 4	Interpolation and curve fitting, Direct Fit Polynomials, Least Squares Approximation, The Straight Line Approximation, High-Degree Polynomial Approximation, Multivariate Polynomial Approximation.
Week 5	Numerical Integration, The simple trapezium rule, The composite trapezium rule.
Week 6	Numerical Integration, Simpson's rule, Engineering Examples.

Week 7	Numerical Differentiation , Solution of a differential equation, single-step methods, step-by-step methods, Initial and boundary conditions, boundary value problem, Picard's Method, Taylor's Series Method, Examples, Exercises.
Week 8	Numerical Differentiation, Euler's Method, Modified Euler's Method, Runge's Method, Examples, Exercises.
Week 9	Numerical Differentiation, Runge-Kutta Method, Examples, Exercises.
Week 10	Numerical Differentiation, Predictor-Corrector Methods, Milne's Method, Adams-Bashforth Method,
Week 11	Numerical Differentiation, Simultaneous First Order Differential Equations, Examples, Exercises.
Week 12	Finite Difference Method, Initial Value ODE's.
Week 13	Optimization, Formulation of Projects, What is Linear Programming, How to Solve Linear Programming Problems, Identifying Variables, Identify the Objective Function, Graphing, Constraints.
Week 14	Optimization, Finding the Maximum, The Vertices, Finding the Minimum, Practice Questions.
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab1:
Week 2	Lab2:
Week 3	Lab3:
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	1. Advanced engineering mathematics/Erwin kreyszig 2. Applied mathematics for engineering and physicists/pipes and harvill 3. Numerical methods for engineers/S.C.Chapra andR.P.	Yes

Recommended Texts		No
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.