MODULE DESCRIPTOR FORM
نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	**NUMERICAL ANALYSIS**	**Module Delivery**	
Module Type	**BASIC**	✓ Theory	
Module Code	ATU23056	**Lecture**	
ECTS Credits	5	✓ Lab	
		Tutorial	
SWL (hr/sem)	125	✓ Practical	
		✓ Seminar	
Module Level	٣	**Semester of Delivery**	1
Administering Department	**DEPARTMENT OF ELECTRICAL ENGINEERING TECHNIQUES**	**College**	**AL-FURAT AL-AWSAT TECHNICAL UNIVERSITY/AL-MUSAIB TECHNICAL COLLEGE**
Module Leader		**e-mail**	
Module Leader's Acad. Title		**Module Leader's Qualification**	
Module Tutor	None	**e-mail**	None
Peer Reviewer Name	None	**e-mail**	None
Review Committee Approval	15/06/2023	**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- Understanding Approximation and Errors: Numerical Analysis helps in understanding the concept of approximation and the types of errors involved in numerical computations. It explores how errors propagate and affect the accuracy of numerical solutions. 2- Studying Numerical Algorithms: Numerical Analysis involves the study and analysis of various numerical algorithms used for solving mathematical problems. This includes algorithms for root finding, interpolation, numerical integration, linear and nonlinear systems of equations, optimization, and differential equations. 3- Analyzing Convergence and Stability: Numerical Analysis investigates the convergence and stability properties of numerical methods. It focuses on understanding when and under what conditions the numerical algorithms produce accurate and reliable results. 4- Implementing Numerical Methods: Numerical Analysis aims to develop practical skills in implementing numerical methods on computers. This involves coding algorithms, using appropriate programming languages and libraries, and understanding computational complexities and efficiency.

	5- Error Analysis and Estimation: Numerical Analysis provides techniques for estimating and analyzing errors in numerical computations. It helps in assessing the accuracy and reliability of numerical solutions and provides insights into improving the computational results.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Knowledge of Numerical Methods: Understand and describe a variety of numerical methods used in solving mathematical problems, including root finding, 2- interpolation, numerical integration, linear and nonlinear systems of equations, 3- optimization, and differential equations. 4- Algorithm Analysis and Selection: Analyze the strengths, weaknesses, convergence properties, 5- computational complexities of numerical algorithms. 6- Evaluate different numerical methods and select the most appropriate algorithm for solving specific mathematical problems.
Indicative Contents المحتويات الإرشادية	The indicative contents of a Numerical Analysis module may include the following topics: - Introduction to Numerical Analysis: Overview of numerical methods and their importance in solving mathematical problems Sources of errors in numerical computations Overview of computer arithmetic and representation of numbers - Root Finding Methods: Bisection method Newton-Raphson method Secant method Fixed-point iteration Comparison and convergence analysis of root finding methods - Interpolation and Approximation: Polynomial interpolation (Lagrange and Newton forms) Divided differences and interpolating polynomials Least squares approximation Splines and piecewise interpolation Error estimation in interpolation and approximation - Numerical Integration: Trapezoidal rule Simpson's rule

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	1-**Hands-on Experiments:** Engage students in practical experiments to deepen their understanding of circuits. 2-**Simulation Software:** Use circuit simulation software for virtual circuit design and analysis. 3-**Problem-solving Exercises:** Include various problem-solving exercises to apply circuit analysis techniques. 4-**Group Projects:** Assign collaborative projects for circuit design and construction. 5-**Real-world Applications:** Discuss practical applications of circuits in different

devices and systems.
5-**Interactive Discussions:** Encourage student participation and critical thinking through open-ended questions.
6-**Conceptual Understanding:** Focus on intuitive understanding alongside mathematical analysis.
7-**Assessment Variety:** Use diverse assessment methods to gauge student understanding.
8-**Office Hours and Support:** Offer individualized assistance through office hours or online support.

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	62	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.133
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**	4	10% (10)	5, 10	LO #1, 2and 6
	Assignments	8	10% (10)	2, 12	LO # 3-5
	Projects / Lab.	0			
	Report	3	10% (10)	2, 12	LO # 5,6
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO # 1-6
	Final Exam	3 hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
١	**Numerical Solution of Linear Algebraic Systems (Direct Methods):** Gaussian Elimination Method/ Gauss Jordan Method
٢	**Numerical Solution of Linear Algebraic Systems (Indirect Methods):** Jacob's Method/ Gauss-Seidel Method
٣	**Numerical Solution of Non-Linear Algebraic Systems:** Graphical Method/ Bisection Method
٤	**Numerical Solution of Non-Linear Algebraic Systems:** False Position Method
٥	**Numerical Solution of Non-Linear Algebraic Systems:** Secant Method
٦	**Numerical Solution of Non-Linear Algebraic Systems:** Newton-Raphson Method
٧	**Numerical Solution of Non-Linear Algebraic Systems:** Modified Newton-Raphson Method for Multiple Roots
٨	**Numerical Differentiation:** Derivatives estimation, Richardson Extrapolation, Newtown forward formula and Sterling Formula
٩	**Numerical Integration:** Trapezoid Rule, and Composite Trapezoid Rule
١٠	**Numerical Integration:** Simpson's Rule, and Composite Simpson's Rule
١١	**Numerical Integration:** Error in Numerical Integration
١٢	**Fourier Series:** Even and odd functions and half-range Fourier series
١٣	**Fourier Series:** A numerical method of harmonic analysis.

١٤	**Curve Fitting**
١٥	**Final Examination**

	Learning and Teaching Resources مصادر التعلم والتدريس	
	Text	**Available in the Library?**
Required Texts	"Numerical Analysis", Ninth Edition. Richard L. Burden and J. Douglas Faires. Editor-in-Chief: Michelle Julet. Publisher: Richard Stratton.	Yes
Recommended Texts	"Analysis of Numerical Methods", by Eugene Isaacson, and Herbert Bishop Keller	No
Websites	https://www.youtube.com/watch?v=UF٣ZyqKbjl٤	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	**التقدير**	**Marks (%)**	**Definition**
Success Group **(٥٠ - ١٠٠)**	**A - Excellent**	امتياز	٩٠ - ١٠٠	Outstanding Performance
	B - Very Good	جيد جدا	٨٠ - ٨٩	Above average with some errors
	C - Good	جيد	٧٠ - ٧٩	Sound work with notable errors
	D - Satisfactory	متوسط	٦٠ - ٦٩	Fair but with major shortcomings
	E - Sufficient	مقبول	٥٠ - ٥٩	Work meets minimum criteria
Fail Group **(٠ – ٤٩)**	**FX – Fail**	مقبول بقرار	(٤٥-٤٩)	More work required but credit awarded
	F – Fail	راسب	(٠-٤٤)	Considerable amount of work required
Note:				

NB Decimal places above or below ٠٫٥ will be rounded to the higher or lower full mark (for example a mark of ٥٤٫٥ will be rounded to ٥٥, whereas a mark of ٥٤٫٤ will be rounded to ٥٤. 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.