



Northern Technical University
College of Oil & Gas Techniques
Engineering/Kirkuk
Department of Renewable Energy Techniques
Engineering



MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Mathematics Principles		Module Delivery
Module Type	Core		<input checked="" type="checkbox"/> Theory <input type="checkbox"/> Lecture <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input type="checkbox"/> Seminar
Module Code	COGTEK 100		
ECTS Credits	7		
SWL (hr./sem.)	175		
Module Level	1	Semester of Delivery	
Administering Department	RETE	College	College of Oil & Gas Techniques Engineering/Kirkuk
Module Leader	Ali Jasim Mohammed	e-mail	ali.jasim@ntu.edu.iq
Module Leader's Acad. Title	Assist. Lecturer	Module Leader's Qualification	MSc
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date	01/06/2023	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

<p>Module Aims أهداف المادة الدراسية</p>	<ol style="list-style-type: none"> 1. To provide students with a foundation in basic mathematical concepts, this foundation is essential for further studies in advanced mathematics and its applications. 2. To develop a foundation in mathematical concepts, principles, and problem-solving techniques. 3. To enhance logical reasoning, critical thinking, and analytical skills. 4. To promote mathematical literacy and numeracy among students. 5. To develop students' ability to analyze problems and apply mathematical principles to solve complex problems in various contexts. 6. Mathematics is essential for developing numerical literacy, which involves understanding and working with numbers, data, measurements, and calculations.
<p>Module Learning Outcomes مخرجات التعلم للمادة الدراسية</p>	<ol style="list-style-type: none"> 1. Determinants: <ul style="list-style-type: none"> • Understand the concept of determinants and their properties. • Calculate determinants of matrices of various sizes. Apply determinants in solving systems of linear equations. • Use determinants to find the inverse of a matrix. 2. Trigonometric Functions: <ul style="list-style-type: none"> • Understand and apply the definitions of trigonometric functions such as sine, cosine, tangent, cosecant, secant, and cotangent. • Solve trigonometric equations. Apply trigonometric identities and formulas to simplify expressions and solve problems involving angles and triangles. 3. Vectors: <ul style="list-style-type: none"> • Define and understand vectors in two and three dimensions. • Perform vector operations such as addition, subtraction, scalar multiplication, and dot product. Calculate vector magnitudes and directions. Solve geometric and algebraic problems involving vectors. • Apply vector concepts to physical and engineering problems, including forces, velocity, and displacement. 4. Limits: <ul style="list-style-type: none"> • Understand the concept of a limit. Evaluate limits algebraically and graphically. Apply limit properties and theorems to find limits of functions. • Determine the continuity of a function at a point. Solve problems involving infinite limits and limits at infinity. 5. Derivatives: <ul style="list-style-type: none"> • Define the derivative as the instantaneous rate of change of a function. • Calculate derivatives using various differentiation rules, including the power rule, product rule, quotient rule, and chain rule.



	<ul style="list-style-type: none"> • Apply derivatives to analyze functions, Understand the relationship between the graph of a function and its derivative. • Solve related rates problems using derivatives. <p>6. Integration:</p> <ul style="list-style-type: none"> • Understand the concept of integration. Calculate definite and indefinite integrals using various integration techniques, such as substitution, integration by parts, and trigonometric substitution. • Apply integration to find areas between curves, volumes of solids of revolution, and other applications in physics and engineering. • Use integration to solve differential equations and represent inverse derivatives.
<p>Indicative Contents المحتويات الإرشادية</p>	<p>Indicative content includes the following.</p> <ul style="list-style-type: none"> • Determinants and their properties: This topic involves understanding determinants, their properties, and their applications, including solving linear equations using Cramer's method. • Trigonometric functions: This includes studying the properties and graphs of trigonometric functions, trigonometric relationships and identities, and their applications in solving equations and various other contexts. • Vectors: This topic focuses on vector arithmetic operations in two and three-dimensional spaces, vector projections, orthogonal components, and their applications in finding areas of shapes. • Limits: Understanding the concept of limits of functions, including algebraic and trigonometric functions, as well as limits at infinity. Applications of limits are also explored. • Derivatives: Studying derivatives of algebraic and trigonometric functions, implicit functions, and inverse functions. The chain rule and applications of derivatives, particularly in mechanical engineering, are covered. • Hyperbolic functions: This involves derivatives of hyperbolic functions and inverse hyperbolic functions, drawing graphs, and their applications in physical and mechanical contexts. • Integration: Integration theory, definite and indefinite integration, integration of various functions including trigonometric, logarithmic, exponential, and hyperbolic



	<p>functions. Methods of integration, such as integration by parts, partial fractions, and substitution, are also explored. Applications of integration in physics, engineering, and finding areas under curves and volumes of revolution are covered.</p> <ul style="list-style-type: none"> Differential equations: Simplifying differential equations is discussed, along with numerical integration methods like the Trapezoidal Rule and Simpson's Rule, and their applications.
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	<ul style="list-style-type: none"> Clearly define the learning objectives for the unit. Students should understand what they are expected to learn and achieve by the end of the unit. Active learning by engaging students in hands-on activities, problem-solving exercises, and group discussions. This helps students to actively participate in the learning process and enhances their understanding of mathematical concepts. Supported Learning: Build the unit in a way that builds on previously learned concepts. Start with foundational topics and gradually progress to more complex ideas. Provide clear explanations and examples to support students' understanding at each stage. Link mathematical concepts to real-life applications to prove their relevance and practicality. Show students how mathematics is used in various fields and professions, which will enhance their appreciation of the subject. Use technology tools and resources to enhance the teaching and learning experience. Interactive software, online simulations, graphing calculators, and educational apps can help students visualize and explore mathematical concepts.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعاً



Structured SWL (hr./sem.) الحمل الدراسي المنتظم للطالب خلال الفصل	78	Structured SWL (hr./w) الحمل الدراسي المنتظم للطالب أسبوعيا	5.2
Unstructured SWL (hr./sem.) الحمل الدراسي غير المنتظم للطالب خلال الفصل	97	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.46
Total SWL (hr./sem.) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	20% (20)	3, 5, 7, 10 and 13	LO #1, #3, #8, #12, #14
	Assignments	5	15% (15)	2, 4, 6, 12 and 14	LO #2, #4, #6, #8, #10
	Projects / Lab.				
	Report	1	5%(5)	10	LO 7#
Summative assessment	Midterm Exam	2 hr.	10% (10)	7	LO # 1 - 2
	Final Exam	3 hr.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Determinants and their properties - Determinants of n degree - Solving Linear Equations by Cramer's Method - Applications to Determinants.
Week 2	Trigonometric functions - Graph of Trigonometric Functions- Trig. relationships and identities - Trigonometric applications and equations - various applications on trigonometric functions.



Week 3	Vectors - vector arithmetic operations in two and three-dimensional spaces - Vector Projections & Orthogonal Components - orthogonal vectors and unit vectors - Calculate vector scales, scalar and vector projections – Application of vectors to find area of shapes.
Week 4	limits - Limit of a Function -The limits of algebraic and trigonometric functions and the limits of functions At Infinity (∞) - Applications on limits The Limit
Week 5	derivatives- Composite Functions - Derivatives of algebraic and trigonometric functions - Derivatives of Implicit Functions - chain rule - Applications of Derivatives (Mechanical Engineering)
Week 6	Derivative of inverse functions - Derivative of Inverse Trigonometric Functions - Various applications. Derivatives of Logarithmic and Exponential Functions.
Week 7	Hyperbolic functions - Derivatives of Hyperbolic Functions - The derivative of Inverse Hyperbolic Functions - Drawing and Graphs of Hyperbolic Functions and their Inverses relations - Physical and Mechanical applications.
Week 8	Integration - Integration Theory - Definite and Indefinite Integration - Integration of Trigonometric and Inverse Functions.
Week 9	Integration of Logarithmic and Exponential Functions - Integration of Hyperbolic and Inverse Functions - Improper Integral and LHopitals Rule.
Week 10	Methods of integration: Integration by parts - Integration by Partial Fractions -
Week 11	Integration by substituting the trigonometric function - Integration by completing the square ... etc. -
Week 12	Physical and engineering Applications of Integration - The area is under a curve and between two curves.
Week 13	Volume of Revolution - Arc Length of a Curve (Integration Application)
Week 14	simplify differential equations
Week 15	Numerical Integration - Trapezoidal Rule & Simpson's Rule - Numerical Integration Method - Applications.

Learning and Teaching Resources



مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Thomas' Calculus" by George B. Thomas Jr., Maurice D. Weir, and Joel Hass	Yes
Recommended Texts	Advanced Engineering Mathematics" by Erwin Kreyszig	No
	"Calculus" by Michael Spivak	No
Websites	https://www.khanacademy.org	

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.