University of Mosul
جامعة الموصل

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1. Overview

This catalogue is about the courses (modules) given by the program of Electrical Engineering to gain the Bachelor of Science degree. The program delivers (48) Modules with (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

نظره عامه

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج قسم الرياضيات للحصول على درجة بكالوريوس العلوم. يقدم البرنامج (48) مادة دراسية، و ٢٤٠ إجمالي وحدات أوروبية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2024-2025

Module 1

Code	Course/Module Title	ECTS	Semester
MS 101	Mathematical Foundation (1)	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
Introduction to basics in set theory, union and intersection of Sets, Operation on sets, (Difference and symmetric Difference), Power set. Also we studied Elements of Logic, (Statements, Compound statements, Conjunction, Disjunction and Negation I Biconditional statements, contradictions and Arguments. Order Pairs Cartesian product, Relations, (reflexive Symmetric, transitive), equivalence relation, domain R, Rang R, Inverse relations, properties of inverse relation. Theorems in composition of relation, and Examples of Equivalence classes. We study also, Functions, Examples of functions, Composition of functions, identity function, Injective, surjective and Bijective functions, Invertible, Domain and Range of the function. properties of Composite functions and Inverse Functions. The background of Direct Images and inverse images under functions (union, Intersection, and Difference direct and inverse images).			

Module 2

Code	Course/Module Title	ECTS	Semester
MS 102	Calculus (1)	8	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	93	107

Description

The curriculum includes five main lines under which sub-vocabularies fall

Line 1: Functions and Properties of it.

Relations and functions, domain and range, operations on functions. Inverse functions, special function and graphs. Graphing linear equations, distance between two points and between point and line. The rate of change functions, increasing and decreasing functions. Slope and Equations for lines, functions and their graph.

Line 2 : Limits and continuous.

Limit and continuity, introduction to limit, some properties of limits, limit involving infinity. Formula definition of Limit. The Limits of rational functions. Some important Theorem on limits. Introduction to continuous functions, algebraic operations on continuous functions, properties of continuous functions.

Line 3 : Derivatives.

Derivative of functions, derivative by using definition. Derivative of corner, Differentiation rules. Second and higher order derivatives. Chain rule, implicit differentiation.

Line 4 : Derivative of special functions and L'Hopital's Rules

Derivative of special functions and some properties of Transcendental functions, such as: Trigonometric functions, Natural logarithm function, Exponential function, Exponential and logarithmic function bases other than e, Hyperbolic functions, Inverse of trigonometric functions, Inverse of hyperbolic functions, L'Hopital's Rules.

Line 5 : On derivative applications.

Applications of derivatives: Related rates of change. Slopes and tangent lines with derivatives, Extreme values, Maximum and Minimum Theorems, Rolle's Theorem and Mean Value Theorem, Cauchy's Mean Value Theorem, Monotonicity test (Maximum and Minimum regions) Critical points, concavity and inflections points, Asymptotes, A curve sketching, Graphing Rational functions. Engineering applications. Physical applications, Arithmetic applications, velocity, acceleration with application.

Prof. Dr. Ahmed Mohammed Ali

Module 3

Code	Course/Module Title	ECTS	Semester
MS 103	Miscellaneous Mathematical Methods	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
كيفية حل منظومة المعادلات الخطية وما هي المنظومة القويمة والمنظومة الغير قويمة وكيفية تحويل منظومة المعادلات الخطية الى مصفوفة معاملات وامثلة متنوعة لحل منظومة المعادلات الخطية ويتضمن كذلك وصف المنهاج منظومة المعادلات المتجانسة وكذلك تعريف المصفوفات واهم العمليات الجبرية على المصفوفات مثل الجمع والضرب والطرح والضرب بثابت وكذلك سعات المصفوفة والتعرف على اهم المصفوفات الخاصة مثل مصفوفة الصف والعمود والمصفوفة المربعة والقطرية ومصفوفة الوحدة والقياسية الثابتة والمصفوفة المثلثية العليا والسفلى ، والمصفوفة المتبادلة والمتناظرة عكسياً والمتعامدة والدورية . وكيفية إيجاد منقول (مدور) المصفوفة وأهم خواصه العمليات السطرية الأولية وكيفية إيجاد المعكوس للمصفوفة وطريقة حذف كاوس-جوردان والتعرف على المحددات وكيفية إيجاد المحددات بطريقة النشر وطريقة العوامل المتممة وكيفية حل نظام المعادلات الخطية باستخدام المحددات (قاعدة كرامر) وطريقة إيجاد المعكوس باستخدام طريقة العوامل المرافقة .			

Module 4

Code	Course/Module Title	ECTS	Semester
MS 104	Programming	4	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
لغة الماتلاب (MATLAB) هي لغة برمجة عالية المستوى وبيئة تطوير متكاملة (IDE) يتم استخدامها في الحوسبة العلمية والهندسية. تتميز لغة الماتلاب بقدراتها الفائقة في معالجة البيانات الرقمية، حيث يمكن استخدامها في تحليل وتصميم الأنظمة الديناميكية، وإجراء العمليات الإحصائية والتحليل العاملي والتعلم الآلي . تتضمن لغة الماتلاب العديد من الأدوات والوظائف المتخصصة، مثل الرسم البياني والتحليل العاملي والإحصاء ومعالجة الإشارات والتحكم، وبالإضافة إلى ذلك، فإن لغة الماتلاب تدعم البرمجة الكائنية والبرمجة الوظيفية.			

Module 5

Code	Course/Module Title	ECTS	Semester
MS 105	Human Rights	2	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	-	33	17
Description			
توصف مادة حقوق الانسان بانها من المواد القانونية في اطارها العام وحقوقية في اطارها الخاص اذ تمزج في آن واحد ماهية الحقوق التي يجب التي يجب ان يتمتع بها الفرد , من حقوق مدنية واساسية مثل حق الحياة وحق المأكل والملبس والمأوى وحقوق اجتماعية تتعلق بحق ممارسة الحياة الاجتماعية حق التعبيرعن الرأي وحق العقيدة وحق الديانة والمعتقد وحقوق سياسية مثل حق الانتخاب والترشيح وغيرها من الحقوق التي تتطور حسب تطور الحياة مثل حق السعادة والعيش في بيئة نظيفة وحق المحافظة على تلك الحقوق من الانتهاك وضمانات منح تلك وضمانات المحافظة عليها من الانتهاك .فالغاية من تدريس هذه المادة هو تنوير الفكر المعرفي والجامعي في التناغم تلك الحقوق مع متطلبات الحياة وعلى جميع الاصعدة .			

Module 6

Code	Course/Module Title	ECTS	Semester
MS 106	General Physics	4	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
This section includes a description of the module, 100-150 words			

Module 7

Code	Course/Module Title	ECTS	Semester
MS 107	Mathematical Foundation (2)	6	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
Introduction to second main branch of foundation Mathematics. The background of equivalent set, cardinal number and example, infinite sets and countable set. Cantors Theorem, find Card(N), Card(Z), Card(P), Card(R), Card(N), and the Cardinal number for P(X). Also we studied Mathematical Induction, Peano axioms, and Arithmetic of Natural numbers. The set of Integer number, properties of these numbers and their relationship with the natural numbers. The set of Rational numbers (Q). Real numbers and Division Algorithm. Also we studied Complex numbers (C); The geometrical representation for C, Conjugate complex number, Polar representation, De Moivre's Theorem, The fundamental Theorem of Algebra Concept of algebraic structure; binary operation; group, Commutative group, Cayley table, non-commutative group, finite and Infinite group.			

Module 8

Code	Course/Module Title	ECTS	Semester
MS 108	Calculus (2)	8	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	93	107
Description			

The curriculum includes five main lines under which sub-vocabularies fall

Line 1: Integrations.

Introduction of Integrations, Types of integrations, Integrations of special functions, such as: Algebraic functions, Trigonometric functions, Natural logarithm function, Exponential function, Exponential and logarithmic function bases other than e, Hyperbolic functions, Inverse of trigonometric functions, Inverse of hyperbolic functions, celling and floor functions.

Line 2 : Techniques of integration.

Integration using substitution, Integration by parts, Integration of Trigonometric (power, product), Trigonometric substitutions, Rational functions and partial fractions,

Rationaling substitutions, Integration of rational function in sine and cosine, Integral by hyperbolic substation, Improper Integral, Comparison test for improper Integrals, King property integration.

Line 3 : Applications of integration.

Definition of Areas and types of areas, Definition Volumes and types of volumes, length of curves in the plane, Areas of Surfaces of revolution.

Line 4 : Types of coordinates and application.

Review the Cartesian coordinates with two dimensions, Polar Coordinates and types of polar equations, Symmetric of polar, Converting between Cartesian and polar, Tangents to polar curves, Area with polar, Arc length of polar curves, Cartesian coordinates with three dimensions, Representations and decrement octanes, distance formula and section formula in three dimensions, graphs , Applications in three dimensions, introduction of cylindrical and spherical coordinates with converting .

Line 5 : Sequences and series.

Introduction about Sequences, formula of sequences, types of sequences, convergent and divergent of sequences, Testing for monotonicity for sequences, Introduction about series and formula of series, geometric series, Test convergence and divergence of series, Introduction of polynomials, Maclaurin polynomial, Taylor polynomial.

Prof. Dr. Ahmed Mohammed Ali

Module 9

Code	Course/Module Title	ECTS	Semester
MS 109	Linear Algebra	6	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
المفاهيم الأساسية وتعريف المصفوفات وانواعها - العمليات الحسابية على المصفوفات (جمع،طرح،ضرب) والخواص على تلك العمليات- اثر المصفوفة وتطبيقاتها في العمليات الحسابية- الاعداد المركبة والعمليات الحسابية عليها مع خواصها- الاعداد المركبة والعمليات الحسابية عليها مع خواصها- الاعداد المركبة والعمليات الحسابية عليها مع خواصها- ايجاد المحددات للمصفوفات ذات السعة الكبيرة- خواص المحددات- المعكوس للمصفوفات(باستخدام التحويلات الابتدائية - الحذف لكاوس)- خواص معكوس المصفوفات- طرق حل أنظمة المعادلات الخطية الغير متجانسة باستخدام طريقة كاوس وكاوس جوردن وكرامر وعندما المحدد للمصفوفة لا يساوي صفر- المصفوفات المتكافئة وأنواع الحل للمعادلات الخطية- ايجاد رتبة المصفوفات باستخدام التكافؤ- الصيغة			

التشكلية او القمعية- تعريف الفضاء الاقليدي النوني وبعض النظريات الخاصة به- تعريف التركيب الخطي والطول الاقليدي والمسافة الاقليدية بين متجهين في الفضاء الاقليدي النوني –إيجاد الجذور المميزة والمتجهات المميزة

Module 10

Code	Course/Module Title	ECTS	Semester
MS 110	Computer Applications	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
يتضمن مقرر دراسي لبرنامج الوورد تعليم المفاهيم الأساسية للاستخدام الفعال للبرنامج، وكيفية إنشاء مستندات نصية وإدارة الملفات والمجلدات. كما يتطرق المقرر إلى مزايا التنسيق والتصميم في الوورد وإدراج الصور والرسومات والجداول والرموز والفقرات والأشكال. يتضمن المقرر أيضًا تعليم استخدام الخيارات المختلفة للطباعة والحفظ والتصدير ومشاركة المستندات. يهدف هذا المقرر إلى تزويد الطلاب بالمهارات اللازمة لإنشاء وتحرير وتنسيق المستندات بكفاءة باستخدام برنامج الوورد. ويتضمن المقرر أيضًا تعليم الطلاب استخدام الأدوات الإضافية في الوورد والتعامل مع الجداول والمعادلات الرياضية والمخططات والقوائم والفهارس. كما يشمل المقرر دروسًا حول تطبيقات الوورد المتقدمة مثل إنشاء وثائق مشتركة التحرير، وتعديل الصور والرسومات باستخدام أدوات الرسم المختلفة. يتم تدريس هذا المقرر بواسطة محاضرين ذوي خبرة في استخدام الوورد ويعتمد على دروس نظرية وتطبيقات عملية لضمان اكتساب الطلاب للمهارات اللازمة للاستخدام الفعال لبرنامج الوورد.			

Module 11

Code	Course/Module Title	ECTS	Semester
MS 111	Principles of Statistics	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	52
Description			
يتعرف الطالب في هذه المادة على المفاهيم الأساسية لمادة مبادئ الإحصاء التي تتضمن مفهوم الإحصاء تطبيقه في الحياة الواقعية وفي البحوث العلمية وكذل طريقة جمع البيانات وتبويبها والعينات وانواعها وأيضا يتعرف الطالب على البيانات وانواعها ويتعرف الطالب في هذه المادة على المفاهيم الإحصائية مثل الوسط الحسابي والهندسي والتوافقي والتربيعي والعلاقة بين هذه الأوساط ومزاياها وعيوبها وأيضا الوسط الحسابي الموزون وكيفية استخراجها للبيانات غير المبوبة والمبوبة وكذلك التباين والانحراف المعياري وأيضا الوسيط والمنوال للبيانات غير المبوبة والمبوبة وكيفية تمثيل البيانات باستخدام المدرج والمضلع التكراري والدائرة البيانية ويتعرف الطالب على مفهوم التماثل والالتواء لاشكال التوزيع التكراري ويتعلم الطالب التباديل والتوافيق والعلاقة بينهما والذي يشكل مدخلا لموضوع الاحتمالات الذي سيطلع عليه الطالب في المرحلة الثانية			

Module 12

Code	Course/Module Title	ECTS	Semester
MS 112	English Language (1)	2	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	-	33	17
Description			
The general methodological principles adopted for this course are based on integrating all four skills (reading, writing, speaking and listening) into highly motivational activities. Meaningful learning is brought to be through activities are based on the students' interests with the aim of fostering motivation. Another key methodological concept is that of the autonomous learner. Recently, due to the effects of changes in language teaching strategies, great importance has been given to the need for teachers to promote and motivate self study, through continuous evaluation. The student will have constant feedback on his/her progress with the aim of modifying, when necessary, his/her learning. Therefore, course contents will be made up of activities that consolidate the linguistic abilities of students, in such a way that they not only learning theoretical knowledge, but create for students the necessary tools for students to continue their language learning through self study techniques studied along the course.			

Module 13

Code	Course/Module Title	ECTS	Semester
MS 201	Advanced Calculus (1)	8	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	93	107
Description			
This section includes a description of the module, 100-150 words			

Module 14

Code	Course/Module Title	ECTS	Semester
MS 202	Ordinary Differential Equations	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87

Description
Fundamental concepts of Differential equations which includes: definition of ordinary differential equation, the order and the degree of differential equation, the solution of differential equation, kinds of solutions, formulation of differential equation, initial value problem, differential equations of first order and first degree, equations of separation variables, homogenous equations, differential equation with linear coefficients, exact and non- exact equations, linear differential equation and Bernoulli equation, Linear differential equation of n th order with constant Coefficient, linearly dependent functions, linearly independent functions, Wronskian determinate. Operator method, Linear homogenous differential equation with constant coefficients of n-th , Characteristic equation roots, linear non - homogenous differential equation with constant coefficients of n-th, Undetermined Coefficients method , Variation of parameters, Linear differential equations with variable coefficient, Euler equation

Module 15

Code	Course/Module Title	ECTS	Semester
MS 203	Group Algebra	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	87	72
Description			
Definition of semi-group and group with some examples , and Definition of abelian group and cyclic group with some examples , Cyclic group , Some fundamental theorems of group , Dirct product Group .Also we studied Definition of sub-group and center of group with some examples and theorems , Product of two sub-group and some theorems . study Normal sub-group and Quotient Groups , Lagrange theorem's and find index of sub-group .We study also Homomorphisms of Definition and examples , Kernel of function, Isomorphism and basic properties , The fundamental Theorems Factor theorem and First theorem , And Integer group modulo n, (Congruent modulon) groups of Zn and theorems . and study of symmetric group of G with theorems .			

Module 16

Code	Course/Module Title	ECTS	Semester
MS 204	Probability	5	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

2	2	63	62
Description			
مقدمة وتعاريف اساسية لموضوع الاحتمالية والمتغيرات العشوائية (تعاريف +امثله) وامثله عن الاحتماليه ومبرهنه بيز والاحتمالية الشرطيه مع امثله و توزيع ذي الحدين مع المبرهنات و توزيع بواسون والمبرهنات مع امثله وتوزيع كاما وتوزيع الطبيعي مع الامثله والمبرهنات وكذالك توزيع الطبيعي القياسي والامثله والمبرهنات وتوزيع الاسي والتوزيع المنتظم وداله كثافه الاحتمال (تعاريف وامثله) وكذالك داله كتله الاحتمال (تعاريف وامثله) وداله توليد العزوم (تعاريف مع تطبيق الدالة على التوزيعات) وداله كثافه الاحتمال المشتركة (مبرهنات وامثله) وتوزيع برنولي مع المبرهنات و المتغيرات العشوائية (تعاريف وامثله)			

Module 17

Code	Course/Module Title	ECTS	Semester
MS 205	Mathematical Physics	3	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	27
Description			
Mathematical physics combines mathematical methods with the study of physical phenomena to formulate and solve problems in physics. It uses tools from areas such as calculus, differential equations, linear algebra, and probability theory to describe and understand the fundamental laws and behavior of particles, fields, and physical systems. By applying rigorous mathematical techniques, mathematical physics provides a framework for developing mathematical models and equations that accurately represent and explain the principles underlying the natural world. It is essential in areas such as classical mechanics, quantum mechanics, electromagnetism, statistical mechanics, general relativity, and quantum field theory.			

Module 18

Code	Course/Module Title	ECTS	Semester
MS 206	English Language (2)	2	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	-	33	17
Description			
This is a course for students have a solid foundation in the language. They may have recently completed an elementary course or they may be returning to language learning after a break and need to revise key language before being able to progress further. New language is introduced systematically, allowing students to extend and consolidate their			

knowledge of the language. New vocabulary is introduced regularly and this is followed by controlled practice activities, allowing students to immediately activate the language in a supported way. There are also freer practice activities where students can focus on their fluency, so that students feel able to actively participate in conversations and discussions.
The course also aims at helping learners to achieve an overall English language proficiency leading to professing at language, and it also helps developing conversational skills, expressing ideas, and helping learners deal with problems and situations successfully.

Module 19

Code	Course/Module Title	ECTS	Semester
MS 207	Advanced Calculus (2)	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	93	57
Description			
This section includes a description of the module, 100-150 words			

Module 20

Code	Course/Module Title	ECTS	Semester
MS 208	Partial Differential Equations	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
partial differential equation A partial differential equation (PDE) is a mathematical equation that involves multiple independent variables, an unknown function that is dependent on those variables, and partial derivatives of the unknown function with respect to the independent variables. Partial Differential Equations (PDE) are composed of a function and its partial derivatives of several unknown variables. In other words, partial differential equations facilitate the derivation of partial derivatives for functions having several variables. The swirly-d symbol, ∂, often called "del", is used to differentiate partial derivatives from ordinary single-variable derivatives. These equations are considered differential_equations. Many phenomena such as sound, heat, diffusion, electrostatics, electrodynamics, fluid dynamics, elasticity, gravity, and quantum mechanics are represented by it. These are employed in areas like physics, chemistry, economics, and biology for processing models that incorporate the rates of change of the variable.Some PDEs have exact solutions, but many aren't easy to solve as they describe complex systems. In such cases, cumbersome numerical methods have to be used. Numerical methods such as the finite difference method, for instance, work by approximating the			

derivatives in the PDE and then, using a large number of incremental values of the independent variables, calculating the unknown function at each of those values.

Module 21

Code	Course/Module Title	ECTS	Semester
MS 209	Numerical Analysis (1)	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
Numerical errors-Error sources, define the absolute error and relative error, error sources and errors in calculations(addition, subtraction, multiplication and division). Define the root of the equation and determination of roots positions with solving examples. Numerical methods to solve nonlinear equation, Bisection method and False position method, Derivative of the approximation root of Secant method with solving an example, Derivative of the approximation root of Newton-Raphson method, Special cases of Newton-Raphson method, Fixed point method, Aitken method with solving examples and write properities and the algorithms of these methods. Numerical solutions of linear systems- direct methods: Gauss elimination metod and Gauss Jordan method, LU-Decomposition method, iterative methods: Jacobi and Gauss-seidel methods with write the algorithms, Write A review of the language MatLab and the programs of these methods.			

Module 22

Code	Course/Module Title	ECTS	Semester
MS 210	Ring Algebra	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
Introduction of ring and some example , Definition of Zero divisor and integral domain . study Integral domain and commutative ring with identity with examples . Definitions of Sub-ring and center of rings , Some theorems of rings and sub-rings , definitions of Ideals with examples and theorems such as Prime ideals, maximal ideal and principal ideal , Idempotent elements and nilpotent elements , also we study Jacobson radical of rings and unite elements . Definition Quotient Rings with examples and theorems , Polynomial Rings and Boolean Rings also study Definition of Homomorphisms and isomorphisms, examples and theorems , Definition of fields and sub-fields			

Module 23

Code	Course/Module Title	ECTS	Semester

MS 211	Arabic Language	2	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	-	33	17
Description			
This section includes a description of the module, 100-150 words			

Module 24

Code	**Course/Module Title**	**ECTS**	**Semester**
MS 212	Mathematical Transformations	4	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	52
Description			
يعتبر موضوع التحويلات الرياضية من المواضيع المهمة وخاصة في العلوم الهندسية وعلم الرياضيات حيث تعتبر مادة التحويلات الرياضية احدى الطرق المهمة التي تساعد في حل المسائل وخاصة التي تحتوي على المعادلات التفاضلية سواء الا عتيادية والجزئية والحصول على نتائج مهمة ويتكون المقرر من ثلاث فصول رئيسية يتناول الفصل الاول تحويلات لابلاس وخواصها والمبرهنات المتعلقة بالموضوع مع تطبيقات في حل مسائل متنوعة اما في الجزء الثاني فيتم دراسة تحويلات فوريه وخواصها واهميتها ايضا في حل المسائل المتنوعة واخيرا يتم التطرق الى تحويلات زد والتي تفوم بتحويل الدوال التي بشكل متسلسلات عددية الى حقل الاعداد المركبة وفي نهاية المقرر يكون الطالب قد اكتسب مهارة في حل المسائل الرياضية بالاضافة الى توسيع افق التفيكير لدى الطالب			

Module 25

Code	**Course/Module Title**	**ECTS**	**Semester**
MS 301	Mathematical Analysis (1)	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
Definition of mathematical analysis, its most important applications, The real numbers, the relationship between the field of rational numbers and the field of real numbers, Archimedes property, the set of real numbers, the concept of order, upper and lower bounds, The concept of completeness, the complete ordered field, the density of relative numbers, the density of irrational numbers. Real number sequences, convergent sequences, bound sequences, monotonic sequences, alternating sequences, Real number series, types of series, convergence of series, tests for convergence of infinite series. Metric spaces, topological concepts, convergence in metric spaces, Some tests of convergence, absolute			

convergence and conditional test, multiplication of series.
Compactness, limits of functions and some important theorems in limits.
Continuity, Continuous maps, Real Continuous maps space, Real maps defined on compact spaces, uniform continuity, Mean value property (examples with top applications).
Function sequences and series, point convergence and regular convergence, Infinite series of functions, power series.

Module 26

Code	Course/Module Title	ECTS	Semester
MS 302	Operation Research	4	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
Introduction, Theoretical models for linear programming problems, Numerical procedures for soling linear programming problems, Graphical method, Basic and Basic feasible solution, Simplex method (slack variables), Simplex method (artificial variables), Simplex multipliers method, Introduction, Dual method and Dual theorem, The relationship between the two models solution and what results from them, The inverse basis method. Sensitivity analysis method, Changes in the right side of the constraints, Changes in objective function coefficients, Introduction, find a primary solution, West corner method, least cost method, Vogle's method, Unbalanced transport problems, The total of the sources contains the greatest goals you need, the total of the sources is less than what the ends need, Find the optimal solution to the transport problem, Examples of the optimal solution.			

Module 27

Code	Course/Module Title	ECTS	Semester
MS 303	Mathematical Modeling	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
مادة النمذجة الرياضية تهدف إلى تزويد الطلاب بالمهارات اللازمة لإنشاء وحل النماذج الرياضية في سياق حل المشكلات. حيث يتعلم الطلاب كيفية تحويل المشاكل الواقعية إلى صيغ رياضية قابلة للتحليل، باستخدام التقنيات المثلى والأدوات الرياضية المتاحة. يتم تقديم العديد من التقنيات والطرق المستخدمة في النمذجة الرياضية، مثل البرمجة الخطية والبرمجة العددية والبرمجة التركيبية والتحليل العددي والتحليل الاحتمالي و الإحصائي وغيرها. يشتمل المقرر على جلسات تعليمية وتمارين عملية تساعد الطلاب على تطبيق النماذج الرياضية وحل المشكلات الواقعية. يركز المقرر على تنمية مهارات التحليل الرياضي والتفكير النمذجي وتطوير القدرة على اتخاذ القرارات المستندة إلى النتائج الرياضية. يتم تطبيق المقرر في مجالات متنوعة مثل الاقتصاد، وإدارة الأعمال، والعلوم الطبية، والهندسة.			

Module 28

Code	Course/Module Title	ECTS	Semester
MS 304	English Language (3)	2	5

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	33	17
Description			
Introduction, Study material review. Grammar: Have (got) to, practices. Should/must, questions and answers. Reading. Vocabulary: words that go together, everyday English at the doctors. Time and conditional clauses, practices (when, as soon as). listening and speaking/ life in 2050, Reading and speaking/ the world's first megalopolis. Vocabulary: Hot verbs/ take- get- do and make. Grammar: verb patterns and infinitives, practices. Vocabulary: -ed/ -ing adjective, reading about (Into the wild). Expressions about exclamations with so and such. Grammar: actives and passives voice, practices. Verbs and nouns that go together, practices. Reading: about the discovery of DNA., expressions about(notices).			

Module 29

Code	Course/Module Title	ECTS	Semester
MS 305	Mathematical Statistics (1)	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
This section includes a description of the module, 100-150 words			

Module 30

Code	Course/Module Title	ECTS	Semester
MS 306	Numerical Analysis (2)	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
Introduction to Numerical integration, derivative of Trapezoidal rule with an error form, derivative of 1/3 and 3/8 Simpson's rule with an error analysis, Midpoint Method, Romberg method, Gauss-Legendre, Closed Newton-Cotes methods with solving different examples and write the algorithms of these methods. Numerical Solution of Ordinary Differential Equations: Derivative of explicit Euler's method with order of the error, implicit Euler's method, Taylor series method, twice and fourth order Runge-Kutta methods and solving examples and write the algorithms of these methods. Introduction to least square approximation ,linear, nonlinear approximation for x and for constants, exponential approximation with solving several examples and write an algorithm. A review of the language MaLab and write the programs of these methods.			

Module 31

Code	Course/Module Title	ECTS	Semester
MS 307	Mathematical Analysis (2)	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
The differentiation, the derivative, the space of differentiable functions, Fermat's principle, Rolle's theorem, mean value theorem, L'Hôpital's law, blancmange function, Taylor series, Taylor's theorem. Riemann integration, definition, Relation between continuous, monotonic functions and Riemann integration, Riemann integral as a positive non-variance monotonic linear transformation, space of Riemann integrable functions. Measure Theory, lengths of bounded open intervals, lengths of bounded open sets, Inner and outer measure of bounded sets, measurable bounded sets, example of an unmeasurable set, measure of unbounded sets, measurable functions, negligible sets, some important characteristics and theories about negligible sets. Lebesgue integration, some weaknesses points of Riemann integration, Lebesgue's theorem of Riemann integration, some properties of Lebesgue integration, the space of Lebesgue integrable functions.			

Module 32

Code	Course/Module Title	ECTS	Semester
MS 308	Number Theory	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
The background of number theory, the natural number, the integer number, the properties of integer numbers, the algebraic operations with integers, the main theorems of integer numbers. The principle of mathematical induction, The integer divisibility, The Division algorithm, The greatest common divisor, the related theorems and examples. The Euclidean algorithm, The prime numbers, the related theorems and examples. Congruencies, The linear Congruencies, the Chinese Remainder Theorem, the related theorems and examples. Euler and Fermat theorem, Fermat’s little theorem, Residue system, Linear Diophantine equations, the related theorems and examples.			

Module 33

Code	Course/Module Title	ECTS	Semester
MS 309	Computer Mathematics	4	6

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	37
Description			
يهدف مقرر Maple إلى تعليم الطلاب المبادئ الأساسية لاستخدام برنامج Maple في حل المسائل الرياضية والعلمية. يشمل المقرر مواضيع مثل تعريف وحساب التعابير والدوال، ورسم الدوال وحل المعادلات والمتباينات، وحساب النهايات والتفاضل والتكامل والمتتابعات والمتسلسلات، والجبر الخطي ويشمل المصفوفات والمتجهات والعمليات المتعلقة بها، ومفاهيم الإحصاء وتحليل البيانات، بما في ذلك المقاييس المركزية ومقاييس التشتت. وأخيرًا، يتعلم الطلاب برمجة الدوال والدارات واستخدام الجمل الشرطية. يتكون المقرر من مجموعة من الدروس النظرية والتمارين العملية التي تمكن الطلاب من تطبيق المفاهيم المكتسبة في الحلول العملية للمسائل الرياضية والعلمية.			

Module 34

Code	Course/Module Title	ECTS	Semester
MS 310	Theory of Differential Equation	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	52
Description			
Definition of Differential equations, solution of differential equation, Cauchy problem (initial value problem) , first order differential equations and the existence of solution theorem (Cauchy – peano th.1), the existence and the uniqness solutions theorem(Cauchy – peano th.2), fixed point theorem, successive approximations method (Picard method), Systems of n differential equations of first order, linearly independent functions, Linear independence theorems, Wronskian determinate, Linear differential equation of n th order with constant Coefficient, Variation of parameters to find the particular solution of higher order differential equation, theorems for particular and second solution , Linear differential systems, linear homogenous differential systems , Eigen values, Eigen vectors, solution for homogenous differential system, distinct Eigen values, repeated Eigen values, The concept of stability , stable solution, asymptotically stable solution, critical points for linear system with constant coefficients. trajectories and phase plane, liapunov's direct method for the nonlinear differential systems			

Module 35

Code	Course/Module Title	ECTS	Semester
MS 311	Mathematical Statistics (2)	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87

Description
This section includes a description of the module, 100-150 words

Module 36

Code	Course/Module Title	ECTS	Semester
MS 312	Fuzzy Mathematics	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
مقدمة في الرياضيات الضبابية: تعريف وخصائص المنطق الضبابي.مقارنة مع المنطق الكلاسيكي والمجموعات الواضحة. الدافع وراء المنطق الضبابي وتطبيقاته. المجموعات الضبابية ووظائفها العضوية:مجموعات ضبابية وتمثيلها. وظائف العضوية وأنواعها (على سبيل المثال ، مثلث ، شبه منحرف ، غاوسي. عمليات على مجموعات ضبابية (اتحاد ، تقاطع ، تكملة).أنظمة المنطق الضبابي:مكونات نظام المنطق الضبابي .القواعد الغامضة ، محرك الاستدلال.الأنظمة المبنية على قواعد غامضة وهيكلها.			

Module 37

Code	Course/Module Title	ECTS	Semester
MS 401	Complex Analysis (1)	8	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	93	107
Description			
The complex analysis is one of the branches of mathematics that investigates the functions of numbers. The curriculum includes four main lines under which sub-vocabularies fall			

Line 1

Complex Numbers, Sums and Products, Basic Algebraic Properties, Further Algebraic Properties, Vectors and Moduli, Triangle Inequality Complex Conjugates, Exponential Form, Products and Powers in Exponential Form, Arguments of Products and Quotients Roots of Complex Numbers Examples Regions in the Complex Plane.

Line 2

Analytic Functions, Functions and Mappings, The Mapping, *li*mits, Theorems on Limits, Limits Involving the Point at Infinity, Continuity, Derivatives, Rules for Differentiation, Cauchy–Riemann Equations, Examples, Sufficient Conditions for Differentiability, Polar Coordinates, Analytic Functions, Further Examples, Harmonic Functions, Uniquely, Determined Analytic Functions, Reflection Principle

liner 3

Elementary Functions, The Exponential Function, The Logarithmic Function, Examples, Branches and Derivatives of Logarithms, Some Identities Involving Logarithms, The Power Function, Examples, The Trigonometric Functions sin *z* and cos *z*ero's and Singularities of Trigonometric Functions, Hyperbolic Functions, Inverse Trigonometric and Hyperbolic functions.

line 4

Integrals, Derivatives of Functions *w(t), Definite* Integrals of Functions *w(t), Contours*

Contour Integrals, Some Examples, Examples Involving Branch Cuts, Upper Bounds for Moduli of Contour Integrals, Antiderivatives, Proof of the Theorem, Cauchy–Goursat Theorem, Proof of the Theorem, Simply Connected Domains, Multiply Connected Domains, Cauchy Integral Formula, An Extension of the Cauchy Integral Formula, Verification of the Extension, Some Consequences of the Extension, Lowville's Theorem and the Fundamental Theorem of Algebra, Maximum Modulus Principle

Prof. Dr. Abdulghafoor Jasmin Salim

Module 38

Code	Course/Module Title	ECTS	Semester
MS 402	Topology (1)	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

2	2	63	87
Description			
In mathematical a topological space is a branch of set theory the goal in this course we learn about the topological space and the study of topological concepts, which relate to the study of continuous, open and closed sets and functions, its theories and how to form a topology. is defined as a set together with collection subsets is called open sub-sets satisfies some conditions, we used this concept to study some fundamental concepts of topology, such as limit points, closed set, closure of set, interior, exterior and boundary points, sub-spaces, continuity, compactness, and connectedness, which can be defined in terms of open sets. As well as we give some examples and fundamental theorems of this terms. Finally, teaches a student that the development of topology as an extension of set theory.			

Module 39

Code	Course/Module Title	ECTS	Semester
MS 403	Functional Analysis (1)	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
Functional Analysis is an essential module designed to introduce undergraduate students to the fundamental concepts and theories of vector spaces, normed spaces, and operators. In Part A, we delve into the definition, properties, and examples of vector spaces, covering topics such as linear combinations, spans, linear independence, and the distinction between finite and infinite dimensions. We then explore subspace operations, including summation, intersection, and direct summands, while also investigating important inequalities and properties of normed spaces. Additionally, we study metric spaces, convergent and Cauchy sequences, and examine the concepts of open and closed sets within Banach spaces. In Part B, the focus shifts to operators, exploring their domains, ranges, null spaces, and composite operations. The module concludes with an examination of Sylvester's Law, the Finite Dimension Theorem, continuity, boundedness, and the definition and examples of linear functionals.			

Module 40

Code	Course/Module Title	ECTS	Semester
MS 404	Graph Theory	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	37
Description			
An introduction to graph theory and its importance in other sciences. Basic concepts in graph theory: sub graphs, isomorphic and identical graphs. Directed graphs and some special graphs. The connected			

and Distance in graph theory, Trees.
An Embedding of graphs. Planer graphs. Oriented Closed Surfaces. The thinckness , genus and crossing number. Kuratowski 's Theorem. The duality.
Coloration of graphs. Some applications in graph theory. Use the identical trees in organic chemistry. A means of evaluating and reviewing programs.

Module 41

Code	Course/Module Title	ECTS	Semester
MS 405	Dynamical Systems	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	52
Description			
Basic definition of D.S.: fixed points, periodic points, orbits, attraction and repelling. Study some examples in D.S. with special families. Definitions of SDIC, Density, Topological Transitive. Examples for these concepts. Definition of Bifurcation in general with examples.P.D. bifurcation, S.N. bifurcation, Hoph bifurcation, and others.Examples for these types. Definition of chaotic maps.The famous chaotic families.More examples for chaotic families of maps.The relations between Chaotic maps & bifurcation. Higher dimensional D.S.Complex D.S. : Julia and Fatou sets.Examples for these sets. Mandelbrot sets with basic examples			

Module 42

Code	Course/Module Title	ECTS	Semester
MS 406	Methodology of Scientific Research	2	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2		33	17
Description			
العلم والمعرفة، البحث العلمي وانواعه، خصائص البحث العلمي وتحديد مشكلة البحث، تقييم مشكلة البحث وصياغة الفرضية، تحديد منهج البحث. تجميع وتصنيف البيانات، تبويب وإدارة البيانات، انواع مصادر البيانات (أولية، ثانوية)، التحليل وعرض نتائج البيانات. قراءة مصادر البحث، الاساليب والقواعد العلمية في كتابة البحث، طرائق التثبيت والكتابة للهوامش، معنى الحاشية للبحث وإعداد قائمة المصادر، الملاحق والإعدادات، ملخص البحث			

Module 43

Code	Course/Module Title	ECTS	Semester
MS 407	Complex Analysis (2)	8	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	93	107
Description			

The complex analysis is one of the branches of mathematics that investigates the functions of numbers. The scientist Murray Ralph described complex analysis as one of the most beautiful and useful types of mathematics

The curriculum includes four main lines under which sub-vocabularies fall

Line 1

Sequence and Series, Convergence of Sequences, Convergence of Series, Taylor Series, Proof of Taylor's Theorem, Examples

Negative Powers of *(z − z0), Laurent* Series, Proof of Laurent's Theorem: Examples, Absolute and Uniform Convergence of Power Series, Continuity of Sums of Power Series, Integration and Differentiation of Power Series

Uniqueness of Series Representations, Multiplication and Division of Power Series

Line 2

Residues and Poles, Isolated Singular Points, Residues, Cauchy's Residue Theorem, Residue at Infinity

The Three Types of Isolated Singular Points, Examples, Residues at Poles, Examples, Zeros of Analytic Functions, Zeros and Poles, Behavior of Functions Near Isolated Singular Point

line 3

Applications of Residues, Evaluation of Improper Integrals, Example, Improper Integrals from Fourier Analysis, Jordan's Lemma, An Indented Path, An Indentation Around a Branch Point, Integration Along a Branch Cut, Definite Integrals Involving Sines and Cosines, Argument Principle, Roche's Theorem, Inverse Laplace Transforms

line 4

Preservation of Angles and Scale Factors, Further Examples, Local Inverses, Harmonic Conjugates, Transformations of Harmonic Functions, Transformations of Boundary Conditions

Prof. Dr. Abdulghafoor Jasmin Salim

Module 44

Code	Course/Module Title	ECTS	Semester
MS 408	Topology (2)	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
In mathematical a topological space is a branch of set theory the goal in this course we learn of advanced topological concepts such as topological properties and hereditary properties. To			

teach the student Separation Axioms in topological space. Also, to teach the student important special spaces such as T3, T4 and others. Finally, to teach the student the first and second axiom countability.

Module 45

Code	Course/Module Title	ECTS	Semester
MS 409	Functional Analysis (2)	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	78	72
Description			
The Functional Analysis module introduces undergraduate students to the fundamental concepts and theories within the realm of inner product spaces and Hilbert spaces. In Part A, students delve into the properties of inner product spaces, exploring definitions, examples, and theorems. They investigate important concepts such as the Schwarz inequality, parallelogram equality, and polarization identity, along with various applications. The module further covers orthogonal elements and sets, providing definitions, examples, and theorems to enhance understanding. Part B introduces the Gram-Schmidt process and its theorem through practical examples. Students then explore Riesz's Theorem, sesquilinear forms, and the representation of Riesz. Lastly, the module delves into Hilbert-adjoint operators, self-adjoint, unitary, and normal operators, emphasizing definitions, examples, and theorems. This module equips students with a solid foundation in functional analysis, preparing them for advanced mathematical studies.			

Module 46

Code	Course/Module Title	ECTS	Semester
MS 410	Research Project	2	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2		33	17
Description			
This section includes a description of the module, 100-150 words			

Module 47

Code	Course/Module Title	ECTS	Semester
MS 411	English Language (4)	2	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

2		33	17
Description			
Introduction: about the study materials. Passive and active voices, practices. Grammar: Verbs and nouns. Second conditional, practices, questions and short answers. Grammar: might, If I were you. Vocabulary: phrasal verbs. social expressions, practices. Present perfect continuous, practices. Words formation, adverbs, reading. Everyday English (telephoning), practices. Past perfect practices, grammar and pronunciation. Report statement, practices. Vocabulary: hot verbs (bring, take, come, go). Social expressions (saying goodbye). Review the study units.			

Module 48

Code	**Course/Module Title**	**ECTS**	**Semester**
MS 412	Optimization	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	63	87
Description			
Methods of One variable unconstrained optimization problem,Dichotomous method, introduction , Algorithm, examples, Newton method ,introduction ,flowchart, the advandge and examples, Interval halving method , with examples. Fibonacci method, introduction , Golden section method , introduction , Algorithm, examples. Taylor' s series expansions with examples. Define Hessian matrix and test the matrix (positive ,negative or indefinite). Determine the function for many examples is convex or concave or stritly convex or stritly concave. Define constrained optimization with some therom and Lagrange method with examplesfor minima function . Lagrange method with examplesfor maxmine and maximun function . Kuhn –Tucker condition with examplesfor minima and maximun function .			