University of Anbar

جامعة الانبار

First Cycle – Bachelor's Degree (B.Sc.) - Bachelor's degree in Mathematics

بكالوريوس علوم في الرياضيات

Table of Contents

1. Overview

This catalogue is about the courses (modules) given by the program of Mathematics to gain the Bachelor of Science degree. The program delivers (47) 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 في الرياضيات. يقدم البرنامج (47) مادة دراسية ، مع (6000) إجمالي ساعات حمل الطالب و 240 إجمالي وحدات أوروبية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2023-2024

Module 1

Code	Course/Module Title	ECTS	Semester
ScMath 3101	Calculus1	8	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	94	106
Description			
In Chapter 1. After reviewing the basic trigonometric functions, we present the family of exponential functions using an algebraic and graphical approach, with the natural exponential described as a particular member of this family. Logarithms are then defined as the inverse functions of the exponentials, and we also discuss briefly the inverse trigonometric functions. We fully incorporate these functions throughout our developments of limits, derivatives.			

Module 2

Code	Course/Module Title	ECTS	Semester
ScMath 3102	Linear Algebra1	8	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	94	106
Description			
Linear algebra is a branch of mathematics that deals with linear equations and their representations in the vector space using matrices. In other words, linear algebra is the study of linear functions and vectors. It is one of the most central topics of mathematics. Most modern geometrical concepts are based on linear algebra. Linear algebra facilitates the modeling of many natural phenomena and hence, is an integral part of engineering and physics. Linear equations, matrices, and vector spaces are the most important components of this subject. In this article, we will learn more about linear algebra and the various associated topics. Linear algebra can be categorized into three branches depending upon the level of difficulty and the kind of topics that are encompassed within each. These are elementary, advanced, and applied linear algebra. Each branch covers different aspects of matrices, vectors, and linear functions.			

Module 3

Code	Course/Module Title	ECTS	Semester
ScMath 3103	Foundations of Mathematics1	7	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	94	81
Description			
We will cover some ideas from set theory and we will introduce the concept of mathematical proof. In section 2 we will study an important algebraic structure called a group. We aim to give a thorough grounding in the basics of group theory and to build confidence working with abstract definitions and concepts. In section 3 we will focus on number theory. In particular, we will introduce Z/(n), the integers modulo n, and we will learn methods to solve equations in this new setting. Finally, in section 4 we will study another important algebraic structure called a field which is a generalization of the real numbers			

Module 4

Code	Course/Module Title	ECTS	Semester
UoA 111	Computer Science	3	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	62	13
Description			
1. معرفة الطالب للمبادئ الرئيسية لعلم الحاسوب وتقنية المعلومات 2. فهم انواع مختلفة من اجهزة الحاسوب المستخدمة في مختلف المجالات 3. معرفة اهم مكونات الحاسوب وما هي اجزائه 4. معرفة كيف ادارة وتخزين البيانات داخل جهاز الحاسوب 5. معرفة اهم انظمة التشغيل المستخدمة في اجهزة الحواسيب معرفة اهم التطبيقات الحاسوبية المستخدمة في مختلف المجلات			

Module 5

Code	Course/Module Title	ECTS	Semester
UoA 112	Human Rights and Democracy	2	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	--	32	18
Description			
يعالج الكتاب مواضيع مهمة تتعلق بحقوق الإنسان والديمقراطية. يقدم تعريفًا شاملا لحقوق الإنسان ويشرح خصائصها وأنواعها المختلفة. يتناول أيضًا تاريخ تطور حقوق الإنسان وأهميتها في المجتمع، مع التركيز على التغيرات التي شهدتها مع مرور الزمن. بالنسبة للديمقراطية، يقدم الكتاب تعريفًا شاملا لهذا النظام السياسي الذي يمنح الشعوب حق المشاركة في صنع القرارات. يشرح شروط نجاح الديمقراطية، بما في ذلك الحكم العادل واحترام حقوق الإنسان والمساواة بين الأفراد. يتطرق الكتاب أيضًا إلى أركان النظام الديمقراطي ومكوناته، مثل السلطة التشريعية والتنفيذية والقضائية. كما يتحدث عن مفهوم الانتخابات وأهميتها في تحقيق التمثيل الديمقراطي وتكييفها بما يتوافق مع السياق القانوني والاجتماعي لكل بلد. وأخيرًا، يلقي الضوء على			

جماعات الضغط ودورها في عملية صنع القرار السياسي وتأثيرها في توجيه السياسات العامة. يعتبر الكتاب مرجعًا شاملا لفهم حقوق الإنسان والديمقراطية ويساهم في تعزيز المجتمعات العادلة والمتقدمة.

Module 6

Code	Course/Module Title	ECTS	Semester
UoA 113	Arabic Language	2	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	--	32	18
Description			
مقررات هذه المادة لطلاب المرحلة الأولى من الضرورة بمكان لتزويدهم بمهارات تعبيرية وكتابية من خلال نصوص التراث العربي ومحاولة التأثير فيهم وتطوير مهارات الإلقاء لديهم ، وكذلك تحسين أداءهم الكتابي من خلال تعلم مهارات الإملاء والترقيم والعدد وأحواله وتراكيبه، وكذلك فهم خاصية القصة القصيرة وأحداثها وشخوصها وسياق الحال الذي جاءت فيه، وكذلك معرفة الفنون البلاغية التي تؤثر في المقابل ، لاسيما لغة الجسد كل ذلك من خلال أمثلة نظرية وتطبيق عملي . ولم يغفل المنهج الحكم والأمثال لتزويد الطالب بثقافة عامة فيعرف معنى المثل والحكمة ومغزاهما ومناسبتهما كل ذلك يكون بإحاطة شمولية من شأنها أن تعزز ثقافة الطالب الجامعي برصيد لغوي معرفي بجوانب متعددة.			

Module 7

Code	Course/Module Title	ECTS	Semester
ScMath 3104	Calculus2	8	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	94	106
Description			
five chapters of Culculus2, including the examples and exercises. This approach gives students the opportunity to work early with exponential and logarithmic functions in combinations with polynomials, rational and algebraic functions, and trigonometric functions as they learn the concepts, operations, and applications of single-variable calculus. Later, in Chapter 7, we revisit the definition of transcendental functions, now giving a more rigorous presentation. Here we define the natural logarithm function as an integral with the natural exponential as its inverse. Many of our students were exposed to the terminology and computational aspects of			

calculus during high school. Despite this familiarity, students' algebra and trigonometry skills often hinder their success in the college calculus sequence. With this text, we have sought to balance the students' prior experience with calculus with the algebraic skill development they may still need, all without undermining or derailing their confidence.
We have taken care to provide enough review material, fully stepped-out solutions, and exercises to support complete understanding for students of all levels.

Module 8

Code	Course/Module Title	ECTS	Semester
ScMath 3105	Linear Algebra2	7	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	94	106
Description			
Linear algebra is a branch of mathematics that deals with linear equations and their representations in the vector space using matrices. In other words, linear algebra is the study of linear functions and vectors. It is one of the most central topics of mathematics. Most modern geometrical concepts are based on linear algebra. Linear algebra facilitates the modeling of many natural phenomena and hence, is an integral part of engineering and physics. Linear equations, matrices, and vector spaces are the most important components of this subject. In this article, we will learn more about linear algebra and the various associated topics. Linear algebra can be categorized into three branches depending upon the level of difficulty and the kind of topics that are encompassed within each. These are elementary, advanced, and applied linear algebra. Each branch covers different aspects of matrices, vectors, and linear functions.			

Module 9

Code	Course/Module Title	ECTS	Semester
ScMath 3106	Foundations of Mathematics2	6	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	94	56
Description			
We will cover some ideas from set theory and we will introduce the concept of mathematical proof. In section 2 we will study an important algebraic structure called a group. We aim to give a thorough grounding in the basics of group theory and to build confidence working with abstract definitions and concepts. In section 3 we will focus on number theory. In particular, we will introduce Z/(n), the integers modulo n, and we will learn methods to solve equations in this new setting. Finally,			

in section 4 we will study another important algebraic structure called a field which is a generalization of the real numbers

Module 10

Code	Course/Module Title	ECTS	Semester
UoA 121	Programming Basic	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	62	13
Description			
1. مقدمة إلى MS Word ، البيئة ، المساعدة ، إنشاء وتحرير مستند .Word حفظ المستند ، العمل مع النص: التحديد والتنسيق والمحاذاة والمسافة البادئة. 2. شرح كيفية إدراج الصور والقصاصات الفنية وكائنات الرسم باستخدام .Word Art ضبط حجم الصفحة والهوامش ؛ طباعة المستندات. عملية دمج المراسلات. 3. مقدمة إلى MS Excel ، البيئة ، إنشاء ، فتح ، وحفظ المصنف. مجموعة من الخلايا. تنسيق الخلايا والوظائف: الرياضية والمنطقية والتاريخ والوقت والجمع التلقائي. 4. :MS-Excelالصيغ. الرسوم البيانية: الرسوم البيانية. أنواع وشريط أدوات الرسم البياني. الطباعة: تخطيط الصفحة ، علامة التبويب رأس وتذييل الصفحة. ، البيئة ، إنشاء وتحرير العرض التقديمي ، معالج المحتوى التلقائي ، باستخدام القوالب MS PowerPoint مقدمة إلى .المضمنة			

Module 11

Code	Course/Module Title	ECTS	Semester
CoS 121	General Mechanic	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	62	13
Description			
الفيزياء هي فرع من العلوم الأساسية، وليس العلوم التطبيقية العلوم التطبيقية هي تطبيق المعرفة في أحد حقول العلوم الطبيعية لحل مشاكل عملية. لذلك تعتبر جزء أساسيا من تطوير التقنية تهتم الفيزياء في نفس الوقت بدقة القياس وابتكار طرق جديدة للقياس تزيد من دقتها؛ فهذا هو أساس التوصل إلى التفسير السليم للظواهر الطبيعية. وتقدم الفيزياء ما توصلت إليه من طرق القياس للاستخدام في جميع العلوم الطبيعية والحيوية الأخرى قابلة للاختبار مثل الطب والكيمياء والبايولوجي إضافة إلى مفاهيم أخرى او علوم اخرى يمكن قياسها مثل القوة والسرعة اي انها تفسر الظواهر الطبيعة والقوانين الخاصة بها .			

Module 12

Code	Course/Module Title	ECTS	Semester
UoA 122	English Language1	2	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	--	32	18
Description			
When using the vocabulary of the English language in - Headway's book for the first stage, where vocabulary and grammar are defined, the use of tenses and verbs, and the application of the four skills of reading, writing, speaking and listening .. and also learning pronunciation and the use of sounds in the English language Developing the student's awareness of the importance of the English language in daily and academic life. -The ability to analyze, conclude, evaluate and pass judgment Contribute to the student's intellectual, personal and professional development Promoting and developing the student's positive attitude towards learning English Developing the student's awareness of foreign culture teaching and learning methods			

Module 13

Code	Course/Module Title	ECTS	Semester
ScMath 3201	Advanced Calculus1	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	79	71
Description			
This module focuses on the following: Introduce basic concepts in sequence and infinite series and its convergence tests, also present the definition of Taylor and Maclurin series and introduce the binomial series for estimating powers and roots of binomial expressions. Study new ways to define curves in the plane. Instead of thinking of a curve as the graph of a function or equation, we consider a more general way of thinking of a curve as the path of a moving particle whose position is changing over time. Then each of the x- and y-coordinates of the particle's position becomes a function of a third variable t. We can also change the way in which points in the plane themselves are described by using polar coordinates rather than the rectangular or Cartesian system. Both of these new tools are useful for describing motion, like that of planets and satellites, or projectiles moving in the plane or space. In			

addition, we review the geometric definitions and standard equations of parabolas, ellipses, and hyperbolas. These curves are called conic sections, or conics, and model the paths traveled by projectiles, planets, or any other object moving under the sole influence of a gravitational or electromagnetic force.

Introduce three-dimensional coordinate systems and vectors. Building on what we already know about coordinates in the xy-plane, we establish coordinates in space by adding a third axis that measures distance above and below the xy-plane. Vectors are used to study the analytic geometry of space, where they give simple ways to describe lines, planes, surfaces, and curves in space. We use these geometric ideas later in the book to study motion in space and the calculus of functions of several variables, with their many important applications in science, engineering, economics, and higher mathematics.

Module 14

Code	Course/Module Title	ECTS	Semester
ScMath 3202	Group Theory1	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	79	71
Description			
Giving a general and comprehensive explanation of logical mathematical operations Study the group and its properties in detail way. Structure mathematical basic to rely on it in various mathematical in the later stages of study. Recognize the conditions which have been satisfied on a non empty set to be subgroup and normal subgroup Construct the quotient group			

Module 15

Code	Course/Module Title	ECTS	Semester
ScMath 3203	Ordinary Differential Equations1	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	86
Description			

The aim is to get acquainted with the ordinary differential equations and methods of solving them and to expand their study because they reflect the important topics in research and applied mathematics, which is the link between the mathematical and engineering sciences.

In this semester, the basic concepts of the ordinary differential equation are studied in terms of order and degree, classification of equations in terms of the number of variables in differential equations, and study the first-order and first-degree differential equations, such as separation of variables, homogeneous, exact, linear, Bernoulli equations, and the integral factor, in addition to the study of homogeneous and nonhomogeneous second order differential equations methods of solving it using the method of changing the variables and the method of variation.

Module 16

Code	Course/Module Title	ECTS	Semester
ScMath 3204	Numerical Analysis1	5	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	62	63
Description			
in the First Course of numerical analysis At the beginning of the teaching, we mention errors and sources of errors which are the absolute and relative errors, and then go to nonlinear equations solutions which include the Bisection Method, Secant Method, False position method, Fixed Point Iteration Method, Newton's Method and otherwise and then go to Lagrange Interpolating polynomials, Divided Differences, Centered Difference, Newton-Gregory Forward Interpolating Formula, Newton-Gregory Backward Interpolating Formula, Newton Divided Difference, Forward difference, Backward difference, and central Interpolating Formula and then go to Solving Nonlinear Systems.			

Module 17

Code	Course/Module Title	ECTS	Semester
ScMath 3205	Vector Analysis	4	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	52
Description			
Developing students' abilities to make the best use of the basic concepts of the subject.			

- Linking the concepts of the studied subjects to the practical reality and involving the students during the lecture to express their ideas their opinions on the subject.

- Giving examples and encouraging students to solve them, discuss them among themselves, and evaluate their answers.

- How to deal with the situations surrounding us and the possibility of converting them into different data with possible characteristics · Dealing with it mathematically depending on what has been gained from the knowledge of the methods used for the solution.

Module 18

Code	Course/Module Title	ECTS	Semester
ScMath 2201	Advanced Computer1	3	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	47	28
Description			

1. معرفة الطالب للمبادئ الرئيسية في الماتلاب وتقنية المعلومات
2. فهم انواع مختلفة من الاوامر المستخدمة في مختلف المجالات
3. معرفة اهم مكونات الماتلاب وما هي اجزائه
4. معرفة كيف ادارة وتخزين البيانات داخل الماتلاب
5. معرفة اهم الاوامر المستخدمة في برنامج الماتلاب

معرفة اهم التطبيقات التب تطبق في الماتلاب و المستخدمة في مختلف المجلات

Module 19

Code	Course/Module Title	ECTS	Semester
ScMath 3206	Advanced Calculus2	7	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	79	96
Description			

This module deal with the following:

Introduce the calculus of vector-valued functions. The domains of these functions are real numbers, as before, but their ranges are vectors, not scalars. We use this calculus to describe the paths and motions of objects moving in a plane or in space, and we will see that the velocities and accelerations of these objects along

their paths are vectors. We will also introduce new quantities that describe how an object's path can turn and twist in space.

Investigate integrals of vector functions and their application to motion along a path in space or in the plane and study the mathematical features of a curve's shape that describe the sharpness of its turning and its twisting.

Extend the basic ideas of single variable calculus to functions of several variables. Their derivatives are more varied and interesting because of the different ways the variables can interact. The applications of these derivatives are also more varied than for single-variable calculus, and in the next chapter we will see that the same is true for integrals involving several variables. Also shows how partial derivatives are defined and interpreted geometrically, and how to calculate them by applying the rules for differentiating functions of a single variable. The idea of differentiability for functions of several variables requires more than the existence of the partial derivatives, but we will see that differentiable functions of several variables behave in the same way as differentiable single-variable functions

Consider the integral of a function of two variables $f(x, y)$ over a region in the plane and the integral of a function of three variables $f(x, y, z)$ over a region in space. These multiple integrals are defined to be the limit of approximating Riemann sums, much like the single-variable integrals presented. Also illustrate several applications of multiple integrals, including calculations of volumes, areas in the plane, moments, and centers of mass.

Module 20

Code	Course/Module Title	ECTS	Semester
ScMath 3207	Group Theory2	7	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	79	96
Description			
Prove and apply some theorems and results in group theory. Verify group homomorphism, isomorphism and automorphism Compute the Kernel of homomorphism . Finding the chains of the groups Discuss the various properties of resistors,			

Module 21

Code	Course/Module Title	ECTS	Semester
ScMath 3208	Ordinary Differential Equations2	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	86
Description			

The aim is to get acquainted with the ordinary differential equations and methods of solving them and to expand their study because they reflect the important topics in research and applied mathematics, which is the link between the mathematical and engineering sciences.

In this semester, homogeneous and inhomogeneous equations of the second order are studied and methods of solving them using the D_factor method in the case that the left side of the equation is not equal to zero is equal to trigonometric functions such as sin, cos or exp or a polynomial function and the study of solving equations by the method of series, in addition study Laplace transforms And methods of finding Laplace transforms for some special functions and studying some important theories in finding Laplace for some functions and studying the inverse Laplace and finally using Laplace transforms in solving ordinary differential equations

Module 22

Code	Course/Module Title	ECTS	Semester
ScMath 3209	Numerical Analysis2	5	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	61
Description			

IN the Second course At the beginning of the teaching we mention solving a linear system of n equations which include the Direct methods (Gauss elimination method ,Gauss elimination method with partial pivoting,Gauss Jordan method,Inverse Matrices method ,The Determinant of Matrix and Matrix Factorization method) and Iterative Techniques in Matrix Algebra (Jacobi's Method and The Gauss-Seidel Method) and go to Numerical Differentiation and Integration.

Module 23

Code	Course/Module Title	ECTS	Semester
ScMath 2202	Advanced Computer2	3	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	48	27
Description			
1. معرفة الطالب كيفية كاتبة البرامج 2. فهم انواع مختلفة من الاوامر المستخدمة في مختلف المجالات 3. معرفة اهم مكونات الماتلاب وما هي اجزائه 4. معرفة كيف ادارة وتخزين البيانات داخل الماتلاب 5. معرفة اهم الاوامر المستخدمة في برنامج الماتلاب معرفة اهم التطبيقات التب تطبق في الماتلاب و المستخدمة في مختلف المجلات			

Module 24

Code	Course/Module Title	ECTS	Semester
ScMath 1201	English Language2	2	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	--	32	18
Description			
When using the vocabulary of the English language in - Headway's book for the first stage, where vocabulary and grammar are defined, the use of tenses and verbs, and the application of the four skills of reading, writing, speaking and listening .. and also learning pronunciation and the use of sounds in the English language Developing the student's awareness of the importance of the English language in daily and academic life. -The ability to analyze, conclude, evaluate and pass judgment Contribute to the student's intellectual, personal and professional development Promoting and developing the student's positive attitude towards learning English Developing the student's awareness of foreign culture teaching and learning methods			

Module 25

Code	Course/Module Title	ECTS	Semester
ScMath 3301	Mathematical Analysis1	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

4	1	79	71
Description			
Starting only with the basic properties of real numbers, rigorous proofs are given of the main results in elementary differential calculus. Topics covered include sequences, series, continuity and differentiability of functions and the properties of the exponential function. the mathematical technique for finding a tangent line to a curve at a given point can also be used to calculate the steepness of a curved hill or the angle through which a moving boat must turn to avoid a collision. Less directly, it is related to the extremely important question of the calculation of instantaneous velocity or other instantaneous rates of change, such as the cooling of a warm object in a cold room.			

Module 26

Code	Course/Module Title	ECTS	Semester
ScMath 3302	Partial Differential Equation1	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	86
Description			
The goal is to identify partial equations and methods of solving them and to expand their study because they reflect the important topics in research and applied mathematics, which is the link between mathematical and engineering science The basic concepts of order, degree, and classification of equations were studied in terms of the number of variables in partial differential equations, the formation of equations, and methods of solving partial equations of the first order for several forms of equations, as well as addressing the homogeneous partial equations of the second order for all cases, and the fair is homogeneous when the left side is not equals Zero.			

Module 27

Code	Course/Module Title	ECTS	Semester
ScMath 3303	Ring Theory1	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	86
Description			

The main purpose of this course are:

1. Learning basic facts of rings , which is one most important mathematical structures that allows the student to study other algebraic structures such as modules and vector spaces.
2. To understand the integral domains.
3. To understand the fields of quotient of an integral domain .
4. To understand rings of polynomails over field and their factorizations

Module 28

Code	Course/Module Title	ECTS	Semester
ScMath 3304	The Probability1	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	61
Description			

Defining the concept of probability The concept of probability (in English: Probability) refers to one of the branches of mathematics specialized in analyzing random events. Or hypothetically the most important element for studying probabilities, where the results of its repetition are studied and the differences between them are compared, provided that they are repeated under identical conditions. An example of this is the experiment of throwing a coin, which results in a sample space consisting of two possible outcomes: the image and the writingIn probabilities, some basic concepts and laws are repeated while studying probabilities. Therefore, it is easier to know what each of them means before studying this field, and among the most important of these concepts are the following: Experience: (in English: Experiment); It is the process of obtaining a possible outcome from a set of outcomes; Toss the coin to get a picture or a letter. Sample space: (in English: Sample space); It represents all possibilities together, for example: the sample space for throwing a dice once is from 1 to 6. Event: (in English: Event); It means the occurrence of a specific result or a group of results within the physical space, such as: obtaining the number 3 as a result of throwing the dice, or 9 as the sum of the numbers of the two dice shown. The relative frequency of an outcome: (in English: Relative Occurrence of an outcome); It means the ratio between the frequency of occurrence of a certain result to the number of times the

experiment was carried out, for example: if a coin was thrown 100 times, and the face of the image was obtained 47 times, then the relative frequency of that result is the result of dividing 47 by 100, i.e. 0.47. Equally likely outcomes: (in English: Equally likely outcomes); They are the results whose relative frequency is equal when performing a specific experiment many times, for example: the relative frequency of both the picture and the writing when throwing a coin a large number of times will be equal

Module 29

Code	Course/Module Title	ECTS	Semester
ScMath 3305	Graph Theory1	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	64	61
Description			

Graph Theory is a well-known area of discrete mathematics which deals with the study of graphs. A graph may be considered as a mathematical structure that is used for modelling the pairwise relations between objects. Graph Theory has many theoretical developments and applications not only to different branches of mathematics, but also to various other fields of basic sciences, technology, social sciences, computer science etc. Graphs are widely used as efficient tools to model many types of practical and real-world problems in physical, biological, social and information systems. Graph-theoretical models and methods are based on mathematical combinatorics and related fields.

This module interested in basic concepts of graph such as: finite and infinite graphs - incidence and degree - isolated vertex and pendent vertex - null graph - paths and circuits - isomorphism of graphs - subgraphs - walks, paths and circuits - connected graphs - disconnected graphs. Similar to the definitions of basic set operations, we can define the corresponding basic operations for graphs also. In addition to these fundamental graph operations, there are some other new and useful operations are also defined on graphs.

Directed graphs arise in a natural way in many applications of graph theory. The street map of a city, an abstract representation of computer programs, and

network flows can be represented only by directed graphs, max. flow and min. cut of flow network is present.

Certain graphs derive their names from their diagrams. A “tree” is one such graph. Formally, a connected graph without cycles is defined as a tree. A graph without cycles is called an acyclic graph or a forest. So, each component of a forest is a tree. A forest may consist of just a single tree.

Module 30

Code	Course/Module Title	ECTS	Semester
ScMath 1301	English Language3	2	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	--	32	18
Description			
When using the vocabulary of the English language in - Headway's book for the first stage, where vocabulary and grammar are defined, the use of tenses and verbs, and the application of the four skills of reading, writing, speaking and listening .. and also learning pronunciation and the use of sounds in the English language Developing the student's awareness of the importance of the English language in daily and academic life. -The ability to analyze, conclude, evaluate and pass judgment Contribute to the student's intellectual, personal and professional development Promoting and developing the student's positive attitude towards learning English Developing the student's awareness of foreign culture teaching and learning methods			

Module 31

Code	Course/Module Title	ECTS	Semester
ScMath 3306	Mathematical Analysis2	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	79	71
Description			
Starting only with the basic properties of real numbers, rigorous proofs are given of the main results in elementary differential calculus. Topics covered include sequences, series, continuity and differentiability of functions and the properties of the exponential function.			

the mathematical technique for finding a tangent line to a curve at a given point can also be used to calculate the steepness of a curved hill or the angle through which a moving boat must turn to avoid a collision. Less directly, it is related to the extremely important question of the calculation of instantaneous velocity or other instantaneous rates of change, such as the cooling of a warm object in a cold room

Module 32

Code	Course/Module Title	ECTS	Semester
ScMath 3307	Partial Differential Equation2	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	86
Description			
The goal form study partial differential equation is to identify partial equations and methods of solving them and to expand their study because they reflect the important topics in research and applied mathematics, which is the link between mathematical and engineering sciences. Basic concepts in partial differential equations, formulating equations, and methods for solving partial equations of the second order homogeneous and non-homogeneous were studied, as well as learning about the Fourier series and its transformations and using them in solving partial differential equations, in addition to identifying some important applications in partial differential equations and solving them using transformations Fourier equation for heat conduction and wave equation.			

Module 33

Code	Course/Module Title	ECTS	Semester
ScMath 3308	Ring Theory2	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	86
Description			
The main purpose of this course are:			

1. The curriculum achieves the skills required to develop the student 's scientific thinking and self-learning.
2. Define and recognize different types of ideals
3. Differential between prime ideal and primary ideal.
4. To understand the maximal and minimal ideal in a ring.
5. Recognize the condition which is satisfied on quotient ring to be field.
6. Study Modules and submodules

Module 34

Code	Course/Module Title	ECTS	Semester
ScMath 3309	The Probability2	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	61
Description			

Defining the concept of probability The concept of probability (in English: Probability) refers to one of the branches of mathematics specialized in analyzing random events. Or hypothetically the most important element for studying probabilities, where the results of its repetition are studied and the differences between them are compared, provided that they are repeated under identical conditions. An example of this is the experiment of throwing a coin, which results in a sample space consisting of two possible outcomes: the image and the writingIn probabilities, some basic concepts and laws are repeated while studying probabilities. Therefore, it is easier to know what each of them means before studying this field, and among the most important of these concepts are the following: Experience: (in English: Experiment); It is the process of obtaining a possible outcome from a set of outcomes; Toss the coin to get a picture or a letter. Sample space: (in English: Sample space); It represents all possibilities together, for example: the sample space for throwing a dice once is from 1 to 6. Event: (in English: Event); It means the occurrence of a specific result or a group of results within the physical space, such as: obtaining the number 3 as a result of throwing the dice, or 9 as the sum of the numbers of the two dice shown. The relative frequency of an outcome: (in English: Relative Occurrence of an outcome); It means the ratio between the

frequency of occurrence of a certain result to the number of times the experiment was carried out, for example: if a coin was thrown 100 times, and the face of the image was obtained 47 times, then the relative frequency of that result is the result of dividing 47 by 100, i.e. 0.47. Equally likely outcomes: (in English: Equally likely outcomes); They are the results whose relative frequency is equal when performing a specific experiment many times, for example: the relative frequency of both the picture and the writing when throwing a coin a large number of times will be equal.

Module 35

Code	Course/Module Title	ECTS	Semester
ScMath 3310	Graph Theory2	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	64	61
Description			

This module deal with a planar graph is a graph that can be embedded in the plane, i.e., it can be drawn on the plane in such a way that its edges intersect only at their endpoints. In other words, it can be drawn in such a way that no edges cross each other. Such a drawing is called a plane graph or planar embedding of the graph. A plane graph can be defined as a planar graph with a mapping from every node to a point on a plane, and from every edge to a plane curve on that plane, such that the extreme points of each curve are the points mapped from its end nodes, and all curves are disjoint except on their extreme points. Some theoretical methods for test the graph is planar or not are introduced.

Matrices are an alternate way to represent and summarize network data. Since a matrix contains exactly the same information as a graph, but is more useful for computation and computer analysis. Indeed, with a given graph, adequately labelled, there are associated several matrices. So, some type of matrices that represent the graph are discussed.

An algorithm may be considered as a set of instructions for solving certain mathematical problems when followed step by step will lead to the solutions of that problem. Usually, an algorithm is first written in ordinary language and then converted in to flowcharts and finally, written in a detailed and precise language so that the machine can execute it. An algorithm must not only do what it is

supposed to do, but also must do it efficiently, in terms of the requirements of both memory and computation time requirements as the function of the size of the input. In our case, the input will be graphs with order n and size ε. Connectedness and Components Algorithm, Spanning Tree Algorithm, Kruskal's Algorithm, Prim's Algorithm, Dijkstra's Algorithm are discussed.

Module 36

Code	Course/Module Title	ECTS	Semester
ScMath 1302	Research methodology	2	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	1	32	18
Description			

تختص مادة منهج البحث للمرحلة الثانية بالتعريف اولاً بمفهوم البحث العلمي واستعراض المتطلبات والمستلزمات الضرورية التي تجعل من البحث العلمي جيدا وموفقاً ثم الصفات التي يجب ان يتسم بها الباحث العلمي لكي يكون ناجحا ومؤهلا للبحث والكتابة عن مشكلة او موضوع ما.

تم التطرق في هذه المادة العلمية الى الخطوات المطلوبة ابتداءً بتحديد مشكلة البحث واسئلته والتعريف باهدافه وحدوده مروراً بمراجعة الدراسات السابقة ثم صياغة الفرضيات وتصميم خطة البحث ومنهجيته.

في هذه المادة سيتعرف الطالب على مفهوم الاقتباس ووظائفه وقواعده وانواعه وطريقة كتابة النص المقتبس والاشارة الى المصادر. كذلك التعريف بمناهج البحث العلمي ومجتمع البحث والعينة سواء اكانت احتمالية او غير احتمالية فضلا عن التطرق الى خطوات البحث العلمي التي تسير باتجاه جمع البيانات وتحليلها من خلال العمليات الاحصائية واخيراً التعرف على اصول كتابة البحث العلمي ومكونات تقرير البحث.

Module 37

Code	Course/Module Title	ECTS	Semester
ScMath 3401	Topology1	7	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

4	--	64	111
Description			
Definition of the concept of Topology spaces and how to construct Topology space Study the Topology concepts which related set and continuous functions The student must be teach that the Topology is extension of set theory Recognize the Topological properties under the homomorphism To teach the student the stable inherited properties under the influence of subspaces			

Module 38

Code	Course/Module Title	ECTS	Semester
ScMath 3402	Complex Analysis1	7	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	111
Description			
Distinguishing between real and complex numbers. Realizing the concept and meaning of complex numbers and how to represent and clockwork. Expressing of the physical and natural phenomena in the form of a boat quantities Knowledge of analytic functions and harmonic functions Understanding some knowledge of complex functions-study the continuity and derivation complex functions.			

Module 39

Code	Course/Module Title	ECTS	Semester
ScMath 3403	Mathematical Statistics1	7	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	111
Description			
Statistics is one of the broad branches of mathematics with wide applications. Statistics is concerned with collecting, summarizing, representing and finding conclusions from the available data set, trying to overcome problems such as heterogeneity and divergence of data. All this makes it of wide application			

importance in various fields of science, from physics to social sciences and even humanity. It also plays a role in politics and business. The key terms of statistics mainly involve the concepts of probability theory: population, sample, sampling unit, probability. The first step in any statistical process is to collect data through the process of sampling within the huge statistical community or by recording responses to a treatment in an experiment (experimental design), or by observing a repeated process over time (time series). Then, drawing digital and graphical abstracts using what is called descriptive statistics. The patterns within the data are combined (modeling) to make inferences about large communities, so the sample size must be studied so that it is representative of the statistical population drawn from it. This process takes place within what is called inferential statistics to take into account the randomness and accuracy of the observations (measurements). Statistical inferences often take the form of answers to yes/no questions (so-called hypothesis testing), estimation of numerical characteristics (estimation), prediction of future observations or measurements, description of correlations (correlation), or modeling. Relationships (regression). All operations, procedures, and statistical branches described above fall within the framework of what is called applied statistics, which is matched by mathematical statistics or statistical theory, which is one of the branches of applied mathematics that uses probability theory and mathematical analysis to put statistical practice on a solid theoretical basis.

Module 40

Code	Course/Module Title	ECTS	Semester
ScMath 3404	Functional Analysis1	7	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	111
Description			

Elementary analysis mostly studies real-valued functions on the real line R or on n-dimensional space R n . Functional analysis, by contrast, shifts the point of view: we collect all the functions of a given class (for instance, all bounded continuous functions) into a space of functions, and we study that space (and operations on it) as an object in its own right.

Since spaces of functions are nearly always infinite-dimensional, we are led to study analysis on infinite-dimensional vector spaces, of which the most important cases are Banach spaces and Hilbert spaces. This course provides an introduction to the basic concepts of functional analysis. These

concepts are crucial in the modern study of partial differential equations, Fourier analysis, quantum mechanics, probability and many other fields

Module 41

Code	Course/Module Title	ECTS	Semester
ScMath 1401	English Language4	2	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	--	32	18
Description			
When using the vocabulary of the English language in - Headway's book for the first stage, where vocabulary and grammar are defined, the use of tenses and verbs, and the application of the four skills of reading, writing, speaking and listening .. and also learning pronunciation and the use of sounds in the English language Developing the student's awareness of the importance of the English language in daily and academic life. -The ability to analyze, conclude, evaluate and pass judgment Contribute to the student's intellectual, personal and professional development Promoting and developing the student's positive attitude towards learning English Developing the student's awareness of foreign culture teaching and learning methods			

Module 42

Code	Course/Module Title	ECTS	Semester
ScMath 3405	Topology2	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	86
Description			
Study the Topology concepts which related set and continuous functions. The student must be teach that the Topology is extension of set theory. Recognize the Topological properties under the homomorphism. To teach the student the stable inherited properties under the influence of subspaces.			

Module 43

Code	Course/Module Title	ECTS	Semester
ScMath 3406	Complex Analysis2	6	8

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
4	--	64	86

Description

The aim of this course is to give an introduction to complex integration and an important integral formulas.

Study the finite series such as Taylor series and Taylor theorem which gives an approximation of k-time differentiable function a round a given point by k-th order Taylor polynomial.

Study Cauchy integral formula and General Cauchy integral formula to find the complex integral in directly without compute the methods of integral.

Module 44

Code	Course/Module Title	ECTS	Semester
ScMath 3407	Mathematical Statistics2	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	86

Description

Statistics is one of the broad branches of mathematics with wide applications. Statistics is concerned with collecting, summarizing, representing and finding conclusions from the available data set, trying to overcome problems such as heterogeneity and divergence of data. All this makes it of wide application importance in various fields of science, from physics to social sciences and even humanity. It also plays a role in politics and business. The key terms of statistics mainly involve the concepts of probability theory: population, sample, sampling unit, probability. The first step in any statistical process is to collect data through the process of sampling within the huge statistical community or by recording responses to a treatment in an experiment (experimental design), or by observing a repeated process over time (time series). Then, drawing digital and graphical abstracts using what is called descriptive statistics. The patterns within the data are combined (modeling) to make inferences about large communities, so the sample size must be studied so that it is representative of the statistical population drawn from it. This process takes place within what is called inferential statistics to take into account the randomness and accuracy of the observations (measurements). Statistical inferences often take the form of answers to yes/no questions (so-called hypothesis testing), estimation of numerical characteristics (estimation), prediction of future observations or

measurements, description of correlations (correlation), or modeling. Relationships (regression). All operations, procedures, and statistical branches described above fall within the framework of what is called applied statistics, which is matched by mathematical statistics or statistical theory, which is one of the branches of applied mathematics that uses probability theory and mathematical analysis to put statistical practice on a solid theoretical basis.

Module 45

Code	Course/Module Title	ECTS	Semester
ScMath 3408	Functional Analysis2	5	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	61
Description			

Elementary analysis mostly studies real-valued functions on the real line R or on n-dimensional space R n . Functional analysis, by contrast, shifts the point of view: we collect all the functions of a given class (for instance, all bounded continuous functions) into a space of functions, and we study that space (and operations on it) as an object in its own right.

Since spaces of functions are nearly always infinite-dimensional, we are led to study analysis on infinite-dimensional vector spaces, of which the most important cases are Banach spaces and Hilbert spaces. This course provides an introduction to the basic concepts of functional analysis. These concepts are crucial in the modern study of partial differential equations, Fourier analysis, quantum mechanics, probability and many other fields.

Module 46

Code	Course/Module Title	ECTS	Semester
ScMath 3409	Operations Research	5	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	--	64	61
Description			

اول ما نقدم في تدريس المادة نعرض مقدمة في البحوث العمليات (نبذة تاريخية في بحوث العمليات - ماهي اهمية بحوث العمليات - عملية صنع القرار في البحوث العمليات) وبعد ذلك نعرض

اسباب الحاجة الى اساليب بحوث العمليات و استخدام النماذج في البحوث العمليات (خطوات التحليل الكمي --تكوين النموذج الرياضي- جمع البيانات- حل النموذج)

البرمجة الخطية (الصياغة الرياضية) التي تتظمن (مفهوم البرمجة الخطية- مجالات تطبيق البرمجة الخطية- خواص البرمجة الخطية - البرمجة الخطية(البياني)- حل البرمجة الخطية بطريقة السمبلكس) وكذلك نقدم مشكلة النقل(عناصر مشكلة النقل - طريقة ايجاد تكاليف النقل) ومن ثم نقدم اتخاذ القرار(مشكلة اتخاذ القرار- معايير ظروف القرار- خصائص حالات اتخاذ القرار) وكذلك شبكات الاعمال (ادارة المشاريع- اساليب شبكات الاعمال- الهدف من استخدم اساليب شبكات الاعمال) وكذلك تحليل ما ركوف.

Module 47

Code	Course/Module Title	ECTS	Semester
ScMath 1402	Research Project	2	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
--	2	30	20
Description			
All Internal Medicine residents are required to complete a research project during their residency. A research project is a scientific endeavor to answer a research question. Research projects may include: case series, case control study, cohort study, randomized, controlled trial, survey, and secondary data analysis such as decision analysis, cost effectiveness analysis or meta-analysis. Each resident must work under the guidance of a faculty mentor. Depending on your area of research interest or your research topic, you may be able to identify a mentor on your own, or if needed, you will be assigned one. You are also provided with a step-by-step guide to simplify the process and a suggested timeline for research project completion to ensure that you meet your requirement in a timely manner.			

Contact

Program Manager:

Malath R. Jassim | Ph.D. in Mathematics | Lecturer

Email: sc.malathrj@uoanbar.edu.iq

Mobile no.: 07805951973

Program Coordinator:
Safwat A. Hamad | Msc. in Computer Science | Assistant Lecturer
Email: mcssafr@uoanbar.edu.iq
Mobile no.: 07831886409
