

كلية ..... العلوم.....

قسم ..... الكيمياء.....

توصيف مساق : Application of Mathematics in chemistry  
403264

1. معلومات مدرس المساق (Instructor)

اسم (مدرس / منسق) المساق :	Dr. Raed Ghanem
الساعات المكتبية : المكتبية :	10.00-11:00
رقم المكتب والرقم الفرعي :	Chemistry Department
البريد الالكتروني :	<a href="mailto:raedag@aabu.edu.jo">raedag@aabu.edu.jo</a>
مساعد البحث والتدريس/المشرف/الفني (إن وجد):	

2. وصف المساق (Course Description)

Mathematics used widely in chemistry as well as all other sciences This course will introduce the students to various basic mathematical methods for chemists and will illustrate their application to problems drawn from chemistry. Topics include a brief review of ideas from Calculus I and algebra of complex numbers, vectors and matrices, calculus of several variables, basis expansions and integral transforms, ordinary differential equations, partial differential equations, and an introduction to group theory. Emphasizes applications to real chemical problems.

3. بيانات المساق (Course Title)

المستوى: 2	اسم المساق: Application of Mathematics in chemistry	رقم المساق: 403264
وقت المحاضرة: 10:00-11:00	المتطلب السابق / المتزامن: 403102	طبيعة المساق: Theory
عدد الساعات الدراسية: 3	الفصل الدراسي: First	العام الجامعي: 2020/2021

4. أهداف المساق (Course Objectives)

**General Objectives : Understand the mathematical concepts used by chemist to understand chemical concepts which includes: understand the special concepts and application of mathematical tools to tackle common problems in chemistry, including solving ordinary and partial differential equations, performing Fourier transforms, calculating differentials, solving multiple integrals, operating with vectors, matrices, determinants, and eigenvalue equations. Students will also be able to solve basic chemistry-related mathematical problems using the computers software system (optional).**

**4. مخرجات التعلم (Intended Student Learning Outcomes)**  
(المعرفة والمهارات والكفايات)

يفترض بالطالب بعد دراسته لهذا المساق أن يكون قادرا على:

**After completing this course, the student should demonstrate the knowledge and ability to:**

After finishing this course, students will be able to apply mathematical tools to tackle common problems in chemistry, including solving ordinary and partial differential equations, performing Fourier transforms, calculating differentials, solving multiple integrals, operating with vectors, matrices, determinants, and eigenvalue equations. Students will also be able to solve basic chemistry-related mathematical problems using the computers software system (optional).

**5. السياسة العامة والحضور (Course Policies: Attendance Policy)**

Course participants are expected to master the material from Calculus I .

1. This course will require weekly problem sets. A thorough understanding of each problem set will help you master the concepts.
2. The course will have two exams plus a final exam.
3. Classes will involve hands-on worksheets to summarize key ideas/results and to practice new material. Participating in the in-class exercises will help you master the concepts.
4. Students will be expected to prepare course material as indicated in reading assignments.
5. It is your responsibility to get copies of the lecture & recitation material
6. **Attendance at all classes will be recorded and is mandatory.** Please make sure you read and fully understand the University of Al Al Bayte Attendance Policy. This policy will be strictly enforced.

**تنبيه :** في حال التغيب عن اي امتحان لن يكون هناك امتحان تعويضي الا في حالة وجود عذر و حالة طارئة من المستشفى و على الطالب ابراز العذر في فترة لا تتجاوز الثلاثة ايام مه تاريخ الامتحان, و للمدرس الحق في قبول او رفض العذر، و حسب التعليمات

6. محتوى المساق (Course Content)

الأسبوع	الموضوع
Weak 1. (27- 1 ) / 9-10 /2020	<b>Revision and basic concepts</b> <b>Chapter 1 and 5</b> Number, variables, and units Real numbers, factorization factors and factorials, decimals representation of numbers, algebra of real numbers, complex numbers. <b>Chapter 16</b> Vectors Vector algebra, components of vectors, the scalar (dot) product, the vector (cross) product. scalar and vector field, the gradient of a scalar field.
Weak 2. (4-8) / 10/2020	<b>Chapter 2</b> Algebraic functions Graphical representation of functions, factorization and simplification of expressions, inverse functions, polynomials, rational functions, partial functions, solution of simultaneous equations
Weak 3. (11- 15)/ 10/2020	<b>Chapter 3</b> Transcendental Functions Trigonometric functions, inverse trigonometric functions, trigonometric relations, polar coordinates, the exponential functions, the logarithmic functions
Weak 4. (18-22) / 10/2020	<b>Chapter 17</b> Determinants Concepts, determinants of order 3, the general case, the solution of linear equation, properties of determinants, reduction to triangular form.
Weak 5. (25-29) /10/2020	<b>Chapter 18</b> Matrices and linear transformation Concepts, some special matrices, matrix algebra, the inverse matrix, linear transformations, orthogonal matrices and orthogonal transformations, symmetry operations a. Cramer's method b. GaussJordan Elimination method
<b><u>Tuesday 27/10/2020 First Exam</u></b> <b><u>الامتحان الأول</u></b>	
Weak 6. (1-5) /11 /2020	<b>Chapter 19.</b> The matrix eigenvalue problem. Concepts. The eigenvalue problem. Properties of the eigenvectors. Matrix diagonalization. Quadratic forms. Complex matrices
Weak 7. (8-12) /11/2020	<b>Chapter 4</b> Differentiation The process of differentiation, continuity, limits, differentiation from principles, differentiation by rule, implicit functions, logarithmic differentiation, successive differentiation, stationary points
Weak 8. 15-19 /11/2020	<b>Chapter 5</b> Integration The indefinite integrals, definite integral. method of substitution, integration by parts, reduction formulas, rational integrals: method of partial functions, parametric differentiation of integrals

Weak 9. (22-26) /11/2020	<b>Chapter 6</b> Method of integration Use of trigonometric relations.
Weak 10. (29-3) /11/2020	<b>Chapter 9</b> Functions of several variables Partial differentiation, stationary points, the total differential, some differential properties,
<b><u>Sunday 6/12/2020</u>      <u>Second Exam</u> الامتحان الثاني</b>	
Weak 11. (6-10) /12/2020	<b>Chapter 11</b> First order differential equations Solution of a differential equation, separable equations, separable equations in chemical kinetics, first order linear equations
Weak 12. (13-17) /12/2020	<b>Chapter 12</b> Second order differential equations Homogeneous linear equation, the general solution, particular solutions, the harmonic oscillator, the particle in one dimensional box, the particle in a ring
Weak 13. (20-24) /12/2020	<b>Chapter 13</b> Second order differential equations. Some special functions The power series method, the Legendre equation, the Hermite equation,
Weak 14. (27-31) /12/2020	
الامتحان النهائي	

**1. استراتيجيات التعليم والتعلم وطرق التقويم  
(Teaching and learning Strategies and Evaluation Methods)**

ت	مخرجات التعلم	استراتيجيات التدريس	أنشطة التعلم	نوع التقويم/القياس (امتحان/عروض صفية/مناقشة/واجبات)
1	Perform the basic mathematical operations on whole numbers, fractions, and decimals.	Lecture, Presentation, quizzes, Case studies, and in class questions	<b>Class notes - Problem sets and solutions</b> <b>Class Discussions,</b> <b>website development</b>	In class Questions, Presentation, Exam
2	Solve systems of linear equations using various methods including Gaussian and Gauss-Jordan elimination and	Lecture, Presentation, quizzes, Case studies, and in class questions	<b>Class notes - Problem sets and solutions</b> <b>Class Discussions,</b> <b>website development</b>	In class Questions, Presentation, Exam

			inverse matrices	
In class Questions, Presentation, Quizzes, Exam	<b>Class notes - Problem sets and solutions</b> <b>Class Discussions,</b> <b>website development</b>	Lecture, Presentation, quizzes, Case studies, and in class questions	Learns transcendental functions and evaluate integrals using techniques of integration	3
In class Questions, Presentation, Quizzes, Exam	<b>Class notes - Problem sets and solutions</b> <b>Class Discussions,</b> <b>website development</b>	Lecture, Presentation, quizzes, Case studies, and in class questions	learn to calculate derivative for various type of functions using definition and rules	4
In class Questions, Presentation, Quizzes, Exam	<b>Class notes - Problem sets and solutions</b> <b>Class Discussions,</b> <b>website development</b>	Lecture, Presentation, quizzes, Case studies, and in class questions	<b>Learn to use concept of integration to evaluate geometric area and solve other applied problem</b>	5
In class Questions, Presentation, Quizzes, Exam	<b>Class notes - Problem sets and solutions</b> <b>Class Discussions,</b> <b>website development</b>	Lecture, Presentation, quizzes, Case studies, and in class questions	L earn to use of partial differentiation method and double integrals	6
In class Questions, Presentation, Quizzes, Exam	<b>Class notes - Problem sets and solutions</b> <b>Class Discussions,</b> <b>website development</b>	Lecture, Presentation, quizzes, Case studies, and in class questions	Solve first and second order differential equations	7
In class Questions, Presentation, Quizzes, Exam	<b>Class notes - Problem sets and solutions</b> <b>Class Discussions,</b> <b>website development</b>	Lecture, Presentation, quizzes, Case studies, and in class questions	Perform standard operations with vector	8
In class Questions, Presentation, Quizzes, Exam	<b>Class notes - Problem sets and solutions</b> <b>Class Discussions,</b> <b>website development</b>	Lecture, Presentation, quizzes, Case studies, and in class questions	Understand determinants and their properties - Find a basis for the row space, column space and null space of a matrix and find the rank and nullity of a matrix	9

### 1. تقييم الطلبة (Assessment)

توزيع الدرجات لكل أسلوب	توقيت التقييم	الأساليب المستخدمة
-	خلال الفصل	1- أعمال الفصل: (تقرير، وظائف، حضور)
25	الأسبوع السابع	2- امتحان تحريري أول

25	الأسبوع الثاني عشر	2-امتحان تحريري ثاني
50	أسبوع الامتحانات النهائية	3-امتحان تحريري نهائي

## 2. الكتاب المقرر (Text Book)

The Chemistry Maths Book	المرجع الرئيس
Erich Steiner	المؤلف
Oxford University Press Inc., New York. 2008	الناشر
2008	السنة
<b>Second edition</b>	الطبعة
<a href="https://1234mathematics.files.wordpress.com/2014/09/erich_steiner-the_second.pdf-book-maths-chemistry">https://1234mathematics.files.wordpress.com/2014/09/erich_steiner-the_second.pdf-book-maths-chemistry</a>	الموقع الالكتروني للمرجع

## 3. المراجع الإضافية (References) (وتشمل الكتب والبحوث المنشورة في الدوريات او المواقع الالكترونية)

<b>Maths for Chemists (Booklet) BY A. Cunningham and R. Whelan, (University of Birmingham and University of Leeds) 2014 .</b> <b>Website: <a href="https://www.birmingham.ac.uk/Documents/college-eps/college/stem/StudentSummer-Education-Internships/Maths-for-Chemists-Booklet.pdf">https://www.birmingham.ac.uk/Documents/college-eps/college/stem/StudentSummer-Education-Internships/Maths-for-Chemists-Booklet.pdf</a></b>	-1
" <i>Mathematics for Physical Chemistry</i> ", 4th Ed., by Robert G. Mortimer, ISBN 978-0124158092.	-2
" <i>Mathematics for Physical Chemistry</i> " by Donald A. McQuarrie, 1st Edition, University Science Books, 2008 (ISBN-9: 1891389564, ISBN-13: 978-1891389566).	-3