Department of Physics

College of Education/ Erbil

University of Salahaddin

Subject: Calculus II

Course Book: Year 1

Lecturer's name: Diyar A. Rasool

Academic Year: 2023

The second semester

Course Book

1. Course name	Calculus
2. Lecturer in charge	Diyar Ali Rasool
3. Department/ College	Physics/ College of Education/ Erbil
4. Contact	**e-mail:** diyar.rasool@su.edu.krd diyarrasool@gmail.com
5. Time (in hours) per week	**Theoretical:** 2 Hours per week
6. Office hours	I will be in my room on Wednesday from 8:30 Am to 1:00 PM. Students can email to make an appointment.
7. Course code	
8. Teacher's academic profile	I did an undergraduate degree at the Department of Physics/ college of Education at Salahaddin University-Erbil between the years of 2006-2010. Since 2010 I got a position in Salahaddin University as a lab demonstrator. I stayed with the job for more than a year before moving to the United Kingdom in 2011 to study master's degree. In 2013, I obtained MSc in Advanced Science (Particle Physics) from the University of Liverpool, United Kingdom. Then, I returned to Salahaddin University and got a position as an assistant lecturer. I have participated in many conferences and published two articles. I was nominated as a PhD candidate in the field of Biophysics at the Salahaddin University since 2019.
9. Keywords	

10. Course overview:

The importance of Calculus is to let students to have information about mathematics. A course designed for all who want a course in calculus with emphasis on **physical** science applications. Topics covered are plane analytic geometry, Limits, continuity, function and their graphs, differentiation, applications of the derivative, integration, and applications.

In addition to these topics, the course emphasizes problem-solving skills and practice setting up functions for typical optimization problems presented in calculus courses. We will illustrate the methods and ideas of calculus by applying them to solve several physical and geometric problems.

11. Course objective:

The aim of this module is to provide students with

- Good understanding of Calculus.
- To give information about Integrations and derivations and how are they used in physics field.
- Helping students to connect mathematics with physics.
- solving mathematical examples in their physics modules.
- better understanding of integration and derivations and the importance of them in physics.

12. Student's obligation

Students must come to the class on time. If a student has a legitimate reason for being excused early from class, then he or she should discuss this with me before class. Cell phones may not be used during class (no texting) and should be silent. Laptops may not be used for anything other than taking notes. You must refrain from excessive talking during lectures as a courtesy to your fellow students.

Students will be divided into groups; each group, including 5 students, will have a leader. At the end of any lecture, home work will be given to them, and they should solve it in group. Homework solutions will be collected one week before the monthly exams. That will take 2 marks.

13. Forms of teaching:

Different forms of teaching will be used to come across with objectives of the course. Power point presentations for the head titles, definitions, graphs and many useful illustrations with summary at the end of each chapter will be presented and discussed.

The power point contains information about new topics and unsolved examples, and then whiteboard will be used to solve them and to let students to see the solutions.

14. Assessment scheme

The maximum mark of this module is (100%). The grading system is based on the summation of two categories of evaluations:

There are three ways of assessing. Firstly, students must take one or two midterm exams; each exam will take 34 marks. Secondly, attendance and solving homework will take 6 marks. Finally, (60%) of the mark is based on final examination that is comprehensive for the whole of the study material reviewed during the academic year and it will be on June.

Monthly Exams 36%

Attendance and Homework 4%

Final Exam 60%
Total 100%

15. Student learning outcome:

After successful completion of the module, students should be able to:

- Understand the meaning of the **derivative** in terms of a **rate** of **change** and local linear approximation, and should be able to use **derivatives** to solve a **variety** of problems.
- understand the meaning of the **definite integral** both as a **limit** of
- **Riemann** sums and as the net accumulation of change, and should be able to use **integrals** to solve a **variety** of problems.
- understand the relationship between the **derivative** and the definite **integral** as expressed in both parts of the Fundamental Theorem of Calculus.
- use **various integration techniques** to obtain anti-derivatives without an integral table or calculator.

16. Course Reading List and References:

1- Calculus with Analytical Geometry, Fourth Edition, By Robert Ellis and Denny Gulick , 1990.
2- Calculus , Fifth Edition, By Stanley I. Crossmay , 1992.
3- Calculus , International Edition, By Thomas' , 2005.
4- Calculus , 11th Edition, By Thomas' , 2013.
5- Understanding Basic Calculus , by S.K. Chung, 2007

17. The Topics:	Lecturer's name
Lecture One: Integral or Anti-derivatives **1-1: Indefinite Integral** **1-2: Initial Value problem and Differential Equations** **1-3: The Substitution Method of Integration** ▪ The Generalized Power Rule in Integral form ▪ Trigonometric Functions ▪ Integrals Involving Multiplication Function **1-4: Integration of Natural Logarithmic Functions** **1-5: Integration of Natural Exponential Functions** **1-6: Integration of General Exponential Functions** **1-7: Integration of General Logarithmic Functions** **1-8: Integration of Inverse Trigonometric Function** **1-9: Integration of Hyperbolic Functions** **1-10: Integration of Inverse Hyperbolic Functions**	Diyar Ali Rasool Weeks: 1. L1 needs 1 and 2 weeks. 2. L2 needs 2 and 3 Weeks. 3. L3 needs 2 and 3 weeks

Lecture Two: Techniques of Integration

2-1: Basic Integration Formulas

- Making a simplifying substitution
- Completing the square
- Expanding a power and using the trigonometric identity
- Eliminating a square root
- Reducing an improper fraction
- Separating a fraction
- Multiplying by a form of 1

2-2: Integration by part

- Integral of natural logarithm
- Solving for the unknown integral
- Definite integral by part

2-3: Integration of rational function by partial fractions

- Distinct linear factors
- Integrating an improper fraction
- Integration with an irreducible quadratic factor in the dominator

2-4: Trigonometric Integrals

- Products of powers of Sines and Cosines
- Eliminating square root
- Integrals of powers of Tan and Sec
- Product of csc and cot functions
- Products of Sines and Cosines

2-5: Trigonometric Substitutions

Substitution by $x = a\ sin\ \theta$

Substitution by $x = a\ tan\ \theta$

Substitution by $x = a\ sec\ \theta$

Lecture Three: Definite Integral

3-1: Definite Integral

- Estimating Areas with Finite Sums
- Rectangular Approximation Method (RAM)

3-2: Definite Integral and Riemann Sums

- Terminology and Notation of Integration
- Area under the Graph of a Nonnegative Function
- Properties of Definite Integrals

3-3: Average Value of a Continuous Function

3-4: Mean Value Theorem for Definite Integrals

3-5: Total Area
3-6: Definite Integrals of Symmetric Functions
3-7: Integration with Respect to y
3-8: Double Integrals
- Properties of Double Integrals
- Areas of Bounded Regions in the Plane
- Average Value in a Plane

3-9: Triple Integrals
- Average Value of a Function in Space
- Properties of Triple Integrals

19. Examinations:

1. Evaluation

Using the substitution $\boldsymbol{x = a\ sin\ \theta}$, evaluate $\int \frac{x^2\ dx}{\sqrt{9-x^2}}$

2. Calculations

For example: Find the integrations of $\int (e^{3x} + 5e^{-x})\ dx$

3. Prove the laws

For example: Prove that $\frac{d}{dx} tanh^{-1} x = \frac{1}{1-x^2}$

4. Verifications

For example Verify that $\frac{d}{dx}$

21. Peer review

پێداچوونەوەی هاوەڵ