King Saud University
College of Science
Integral and Differential Calculus
Course Syllabus
First Semester 1444 (2022-2023)

1. Course General Information:

Course Title: Differential and Integral Calculus	**Course Code: MATH 205**
Course Level: 3	**Course Prerequisite: MATH 106** **Co-requisites for this course (if any): None**
Lecture Time:	**Credit Hours: 3**

2. Faculty Member Responsible for the Course:

Name	Rank	Office Number and Location	Office Hours	Email Address
Dr. Shah Muhammad	Assistant Professor	2A-138	-	skabeer@ksu.edu.sa

3. Course Description:

Students are introduced to the following:

Infinite Series (4 weeks): Sequences, infinite series, Convergent and divergent series, Positive-term series, The Integral, ratio and root tests, Alternating series and absolute convergence, Power Series (radius and interval of convergence), Power series representation of functions, Maclaurin and Taylor Series.

Vectors and Vector-Valued Functions (2 weeks): Vectors, vector algebra, Dot and cross products, Lines and planes, surfaces, Vector-valued functions and applications.

Partial Differentiation (3 weeks): Functions of several variables, Limits and continuity, Partial derivatives, Chain Rule; Gradients, Local extrema of functions of two variables, Lagrange multipliers.

Multiple Integrals (2 weeks): Double Integrals, Double Integrals in polar coordinates, Applications of double integrals (surface area and volumes).

4. Course Academic Calendar

Week	Basic material to be covered
1-4	Sequences, infinite series, Convergent and divergent series, Positive-term series, The Integral, ratio and root tests, Alternating series and absolute convergence, Power Series (radius and interval of convergence), Power series representation of functions, Maclaurin and Taylor Series
5-6	Vectors, vector algebra, Dot and cross products, Lines and planes, surfaces, Vector-valued functions and applications

7-9	Functions of several variables, Limits and continuity, Partial derivatives, Chain Rule; Gradients, Local extrema of functions of two variables, Lagrange multipliers,
10-11	Double Integrals, Double Integrals in polar coordinates, Applications of double integrals (area, surface area and volumes)
12-13	Final Examination

5. Course Objectives:

The main purpose for this course is to introduce the following concepts:

1. Sequences.
2. Infinite series, Convergent and divergent series.
3. Positive-term series, the Integral, ratio and root tests.
4. Alternating series, absolute and conditional convergence.
5. Power Series (radius and interval of convergence), Power series representation of functions, Maclaurin and Taylor Series.
6. Vector algebra, Dot and cross products of two and three vectors.
7. Lines and planes.
8. Surfaces.
9. Vector-valued functions and application.
10. Functions of several variables, Limits and continuity.
11. Partial derivatives, Chain Rule.
12. Gradients and directional derivatives.
13. Local extrema of functions of two and three variables, Lagrange multipliers method for extrema.
14. Double Integrals in Cartesian and polar coordinates.
15. Applications of double integrals (area, surface area and volumes).

6. Course References:

6.1 Textbooks:

Earl W. Swokowski; *Calculus with analytic Geometry.* PWS-Kent Publishing Company, 20 Park Plaza, Boston.

6.2 Essential References Materials (Journals, Reports, etc.)

Anton, H.; *Calculus with analytic geometry*. 2nd Edition, John Wiley, New York.

6.3 Recommended Textbooks and Reference Material (Journals, Reports, etc)

- Hunt, R. A.; *Calculus with analytic geometry.* Harper and Row, New York.
- Zill, D, G.; *Calculus with analytic geometry*. PWS. Boston.

6.4 Websites:

1- Internet sites relevant to the course.

2- LMS e-course.

6.5 Other learning material such as computer-based programs/CD, professional standards or regulations and software.

- Some computer codes in MATLAB and MAPLE exist relevant to course materials'

7. Teaching Methods:

At the beginning of studying each topic some examples will be laid out and discussed with the students encouraging them to discover the relevant concepts:

- At the beginning of each lecture, a discussion is conducted with the students about what has been done in the previous lecture in order to establish a link with the current lecture.
- Discussions in the class
- Homework assignments
- Independent study
- Student's Representation.

8. Learning Outcomes:

8.1 Knowledge and Understanding:

After studying this course, the student will acquire the following knowledge and be able to:

- Define and recognize sequences in different forms, determine whether a sequence converges or diverges.
- Define and recognize finite and infinite series, determine sum of convergent series if possible, analyze whether an infinite positive series converges or diverges, define and identify alternating series and determine whether they converge absolutely, conditionally, or diverges, understand the concept of power series and find radius and interval of convergence of power series, express different functions in terms of power series using properties of differentiation and integration of series and functions, write the Maclurin and Taylor series of functions.
- Understand the concepts of vector algebra, find dot and cross products of two vectors, find scalar and vector triple products of three vectors and use them in different applications for area and volumes.
- Write down and recognize the equations of lines and planes, find the distance between lines and planes, identify various surfaces from their equations and graphs
- Explain the concept of vector valued functions and use it to find position, velocity, speed, and acceleration.
- Define the concept of functions of two variables, find limits and continuity of functions of two and three variables, understand the concept of partial derivatives and chain rule, understand and use the concept of directional derivatives and gradients of functions of two and three variables, understand the concept of extrema of functions of two and three variables, find extrema and saddle points of functions of two and three variables, constrained extrema and Lagrange's multipliers.
- Evaluate the double integrals in cartesian and polar coordinates, find area and volume (of solids) using double integrals, find surface area of solids.

8.2 Cognitive Skills (Thinking and Analysis):

After studying this course, the student will able to:

- Represent sequences in various forms and determine their convergence and divergence using different methods.
- Apply methods for analyzing convergence and divergence of positive term and alternating series, find interval and radius of convergence of power series, represent various functions in the form of a power series, particularly representation of functions in terms of Maclaurin and Taylor series.
- Apply the properties and results of vector algebra to solve various vector algebra problems, use scalar and vector products of two and three vectors in different applications.
- Analyze various forms of equations of lines and planes and solve exercises related with the lines and planes (e.g., distance and angle between two lines, distance of a plane from a line, etc.)
- Recognize and analyze equations and shapes of various surfaces like planes, cylinders, cones, paraboloid, etc.
- Find domain and range of vector valued functions, determine the position, velocity, speed, and acceleration of moving objects using vector-valued functions.
- Determine the domain and range of functions of two and three variables, find limits and continuity of functions of two and three variables.
- Find the partial derivatives and use them to solve various exercises, use the chain rule for finding partial derivatives of functions of two and more variables.
- Understand the concept of extrema and saddle point of functions of two and three variables and use them to find extrema ad saddle points of given functions, understands the concept of constrained extrema and use Lagrange's multipliers to find extrema of functions of two and three variables.
- Evaluate double integrals in Cartesian and polar coordinates and use double integrals for solving problems about finding area of plane regions, volume, and surface area of solids.

8.3 Interpersonal Skills and Responsibility:

After studying this course, the student is expected to:

- To participate in the discussion
- Study, learn and work independently.
- Work effectively in teams.
- Meet deadlines and manage time properly.
- Exhibit ethical behaviour and respect different points of view.

8.4 Communication, Information Technology and Numerical Skills

After studying this course, the student is expected to be able to:

- Present mathematics to others, both in oral and written form clearly and in a well-organized manner.
- Use IT facilities as an aid to mathematical processes and for acquiring available information.
- Use library to locate mathematical information.

9. Methods of Assessment:

Course Assessment	Mark
Tutorials	10
Midterm exam	30
Quizzes (2)	20
Final Examination	40
Total	**100**

10. Course Policies:

- All exams are closed book.
- The final exam will be comprehensive.

11. Attendance Policy:

Absence from lectures and/or tutorials shall not exceed 25%. Students who exceed the 25% limit without an accepted medical or emergency excuse shall not be allowed to take the final examination and shall receive a grade of "DN" for the course.