GIK INSTITUTE OF ENGINEERING SCIENCES & TECHNOLOGY
FACULTY OF ENGINEERING SCIENCES

Course Outline: Calculus II (MT 202)

Fall, 2024

Pre-Requisite(s): MT 101

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Office Hours: Posted outside office door of course instructor. Also by appointment.

Course Introduction

This course is continuation of MT 101 course. The main objective of the course is to make students proficient in techniques and skills of multivariate and vector calculus. The emphasis will be on application of learned techniques to the solution of problems of science and engineering. The students will learn necessary mathematical skills with an understanding of basic concepts and a working knowledge of applications. It is hoped that, on completion of this course, the students will be trained enough to apply these mathematical tools to solve problems in their area of specialization.

Course Contents

- **Parametric Equations and Polar Coordinates:** Parametric representation of plane curves; Calculus with parametric curves; Polar coordinates; Graphing polar equations; Conic sections in polar coordinates; Areas and arc lengths in polar coordinates.
- **Vector Algebra:** Vectors in three dimensions; Dot and cross product; Lines and planes; Three dimensional quadric surfaces.
- **Functions of Several Variables:** Limits and continuity; Partial derivatives; Increments and differentials; Chain rules; Directional derivatives, gradient; Tangent planes and normal lines to surfaces; Extrema of functions of several variables; Relative extrema, Lagrange multipliers.
- **Multiple Integrals:** Double integrals, definition, and evaluation; Area and volume; Double integrals in polar coordinates; Surface area; Triple integrals in Cartesian, cylindrical and spherical coordinates; Applications.

Mapping of CLOs to PLOs

CLO No	Course Learning Outcomes	PLOs	Blooms Taxonomy
CLO 1	Apply calculus of parametric and polar curves to solve engineering problems related to areas, arc lengths and conics.	PLO 1	C3 (Applying)
CLO 2	Solve problems related to analytic geometry of three dimensions and geometric surfaces of linear and quadratic functions.	PLO 1	C3 (Applying)
CLO 3	Apply the techniques of multivariate differential calculus to geometrical and physical problems in science and engineering.	PLO 1	C3 (Applying)
CLO 4	Apply different techniques of multivariate integral calculus of scalar and vector functions to various applied problems.	PLO 1	C3 (Applying)

CLO Assessment Mechanism

CLOs	Assessment Tools
CLO-1	Quizzes, Assignments, Midterm Exam, Final Exam
CLO-2	Quizzes, Assignments, Midterm Exam, Final Exam
CLO-3	Quizzes, Assignments, Midterm Exam, Final Exam

CLO-4	Quizzes, Assignments, Midterm Exam, Final Exam

Overall Grading Policy

Assessment Items	Percentage
Announced Quizzes	25%
Assignments	10%
Midterm Exam	25%
Final Exam	40%

There will be a total of three quizzes. Two quizzes will be of 10 marks each, one quiz will be of 5 marks.

Text and Reference Books

Textbook:

- **"Thomas' Calculus"** by George B. Thomas, Jr., Maurice D. Weir, Joel R. Hass. 15th Edition 2024. Pearson, USA.

Reference Books:

- **"Calculus: Early Transcendentals"** by James Stewart. 6th Edition 2008. Brooks/Cole USA.
- **"Calculus"** by Swokowski, Olinick, Pence. 6th Edition 1994. PWS, USA.

Administrative Instructions

- According to institute policy, 80% attendance is ***mandatory*** to appear in the final examination.
- All quizzes/examinations will be closed book. No calculators will be allowed.
- ***In any case, there will be no retake of scheduled/surprise quizzes.***
- Assignments must be submitted as per instructions given by the course instructor or mentioned in the assignments.
- Students may work on home assignments in collaboration with each other, but they must submit their own work; no copying from others. Violation of this will adversely affect their quiz/exam results.

Computer Usage

Students are encouraged to solve some assigned homework problems using the available software such as Mathematica and MATLAB.

Lecture Breakdown

Lecture	Topic	Chapter
01	Parametric representation of plane curves. Calculus with parametric curves.	10
02	Parametric representation of plane curves. Calculus with parametric curves.	10
03	Polar coordinate system. Sketching of simple polar curves.	10
04	Some important polar curves	10
05	Conic sections in polar coordinates.	10
06	Conic sections in polar coordinates (continued...).	10
07	Conic sections in polar coordinates (continued...).	10
08	Area and arc length in polar coordinates.	10
09	Vectors in two dimensions and problems.	11
10	Vectors in three dimensions and problems.	11
11	Scalar product.	11
12	Vector product.	11
13	Analytic Geometry of planes.	11
14	Straight lines in three dimensions.	11
15	Quadric surfaces.	11
16	Quadric surfaces (continued...).	11
17	Quadric surfaces (continued...).	11
18	Functions of several variables	13
19	Limit of functions of several variables.	13
20	Continuity of functions of several variables.	13
21	Partial derivatives and related questions.	13
22	Increments, differentials, and chain rules.	13
23	Directional derivatives and gradient.	13

24	Tangent planes and normal planes.	13
25	Extrema of function of several variables.	13
26	Extrema of function of several variables (continued…).	13
27	Lagrange multipliers and their applications.	13
28	Lagrange multipliers and their applications (continued…).	13
29	Double integrals.	14
30	Area and volume by double integrals.	14
31	Area and volume by double integrals (continued…).	14
32	Area and volume by double integrals (continued…).	14
33	Change of variables in double integrals.	14
34	Change of variables in double integrals (continued…).	14
34	Double integral in polar coordinates.	14
36	Surface area and problems.	14
37	Applications of double integrals.	14
38	Triple integrals of all types.	14
39	Volume by triple integrals.	14
40	Volume by triple integrals (continued…).	14
41	Change of variables in triple integrals.	14
42	Triple integrals in cylindrical coordinates.	14
43	Triple integrals in spherical coordinates.	14
44	Volumes by using cylindrical and spherical coordinates.	14
45	Review	

Note: This outline and lecture distribution serves only as rough guidance of the course. It may be changed or modified as and when deemed necessary by the instructor. The instructor is at liberty to best distribute the number of lectures and/or change the sequence of topics to cover the entire course.