

**Faculty of Engineering & Technology**

**Functions of Several Variables and ODE (Math 3)**

**Information :**

**Course Code :** MTH 211

**Level :** Undergraduate

**Course Hours :** 3.00- Hours

**Department :** Department of Mechanical Engineering

**Instructor Information :**

Title	Name	Office hours
Lecturer	Hany Abd El Ghaffar Abd El Aty El Deeb	2
Assistant Lecturer	Basma Magdy Ahmed Mohamed	6
Assistant Lecturer	MOAMEN AHMED GASSER HASSAN KAMEL IBRAHIM KAMEL	
Assistant Lecturer	TAREK ALI ABDALLAH TEAMA	
Teaching Assistant	Bassel Yasser Mohamed Kamel	1
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**Area Of Study :**

Overall aims of the course are:

Enrich students knowledge about several variables, multiple integrals, ordinary differential equations, and vector Analysis.

Develop students skills to apply differential equations on applications related to Mechanical engineering.

**Description :**

Functions of several variables: Limits, Continuity, partial derivatives, Extrema and Constrained Extrema. Multiple integrals in Cartesian and Polar coordinates. Jacobians, Vector analysis: Scalar and vector fields, Gradient, Divergence, Curl and Directional derivative. Line integral, Green's theorem, Gauss's theorems, and Stoke theorem. Ordinary differential equations of the first and higher orders. Complementary and Particular solutions. Undetermined coefficients, and variation of parameters. Euler's equations and system of linear differential equations. Differential Operator method

**Course outcomes :**

**a. Knowledge and Understanding :**

1 -	Define the behavior of the function of several variables, multiple integrals, Vector analysis, and Ordinary differential equations.
2 -	Recognize the Limits, Continuity, and partial derivatives, extrema and constrained extrema of functions of 2 variables, double and triple integrals in Cartesian and Polar coordinates.
3 -	Illustrate the surface integral of scalar and vector fields, Divergence and Stock theorems, Jacobians, line integrals, cylindrical and spherical coordinates and its application,
4 -	Describe Ordinary differential equations, distinguish between the degree and the order, and know various methods of the solution,
5 -	Identify the general and particular solutions of O.D.E of the first order, second order, higher order.

**b. Intellectual Skills :**

1 -	Apply theories, techniques of Vector analysis, Ordinary differential equations to solve Mechanical engineering problems
2 -	Think creatively in solving problems related to Mechanical engineering.

**Course Topic And Contents :**

Topic	No. of hours	Lecture	Tutorial / Practical
Functions of several variables: Limits, Continuity, and partial derivatives, Chain rule. Tangent planes and normal lines, Extrema and Constrained Extrema,.	10	6	4
Multiple integrals: Double integral in Cartesian and Polar coordinates. Triple integrals, Surface integral of scalar functions. Jacobians, Cylindrical and spherical coordinates,	10	6	4
Vector analysis: Scalar and vector fields, Surface integrals of scalar and vector functions, gradient, divergence, curl, directional derivative, Line integrals.	10	6	4
Line integrals, Green's theorem, Gauss's theorem, Stoker's theorem and triple integrals in Cartesian and Polar coordinates.	10	6	4
Ordinary differential equations: Equations of the first order: Separable, Homogenous, nearly Homogenous, Exact, Linear, Bernoulli. Ricatti.	10	6	4
Higher order linear equations. Equations of the second order. Equations reducible to the first order. Complementary, and particular solutions.	10	6	4
Methods of Undetermined coefficients, and variation of parameters. Euler's equation	10	6	4
System of linear differential equations. Differential Operator method.	5	3	2

**Teaching And Learning Methodologies :**

Interactive Lecturing  
Problem solving  
Discussion

**Course Assessment :**

Methods of assessment	Relative weight %	Week No	Assess What
Assignments	5.00		
Final-term Exam	40.00	15	To assess overall understandings, concepts, Knowledge, Problem solving, and mathematical skills delivered by the course,

First Mid Exam	20.00	6	To assess the levels of math skills needed for successful completion of the course, and to improve teaching and learning for all students.
Participation and Performance	10.00		
Quiz Exam	5.00		
Second Mid Exam	20.00	11	To assess comprehension, Knowledge, Problem solving, and mathematical skills delivered by the course after 9 weeks of studying.

**Course Notes :**

**Recommended books :**

- o Earl W. Swokowski, "Calculus with Analytic Geometry
- Peter V. O'Neil, "Advanced Engineering Mathematics"
- o Larson, R, Edwards, B & Falvo, D 2004, Elementary linear algebra, 5th edn, Houghton Mufflin, Boston, Massachusetts.
- o Stewart, J 2005, Calculus: concepts & contexts, 3rd edn, Thomson/Brooks/Cole, Australia.

**Web Sites :**