

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 Electrical Engineering

Instructor Information :

| Title | Name | Office hours |
|--------------------|--|--------------|
| Lecturer | Muner Mustafa Abou Hasan . | 2 |
| Assistant Lecturer | Doaa Nabil Sayed Mohamed Elsayed Khodair | |

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 electrical engineering

Description :

Functions of several variables: limits, continuity and partial derivatives, Chain rule, Tangent planes and normal lines, Extrema and constrained extrema, Ordinary differential equations: equations of first order (separable, homogenous, exact, linear and Bernoulli), Orthogonal trajectories, Equations reducible to first order, High order linear equations, The variation of parameters and operation method, Euler's equation, System of linear differential equations, Series and tests of convergence, Taylor and Maclaurin expansion, Multiple integrals: double integral in Cartesian and Polar coordinates, Triple integrals and Jacobians, Line integral, Green's theorem,

Course outcomes :

a.Knowledge and Understanding: :

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| 1 - | By the end of this course the student should be able to: a1. Define the behavior of the function of several variables, multiple integrals, Vector analysis, and Ordinary differential equations. |
| 2 - | a2. 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 - | a3. Illustrate the surface integral of scalar and vector fields, Divergence and Stock theorems, Jacobians, line integrals, cylindrical and spherical coordinates and its application, |
| 4 - | a4. Describe Ordinary differential equations, distinguish between the degree and the order, and know various methods of the solution, |
| 5 - | a5. Identify the general and particular solutions of O.D.E of the first order, second order, higher order. |

b.Intellectual Skills: :

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| 1 - | By the end of this course the student should be able to: |
| 2 - | b1. Apply theories, techniques of Vector analysis, Ordinary differential equations to solve electrical engineering problems |

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| 3 - | b2. Think creatively in solving problems related to electrical engineering. |
| c. Professional and Practical Skills: : | |
| 1 - | Develop a professional attitude and approach to gain conceptual and practical knowledge and understanding Functions of several variables and Ordinary differential equations |
| 2 - | Understand. Limits, Continuity, and partial derivatives, Chain rule. Tangent planes and normal lines, Extrema and Constrained Extrema |
| 3 - | Understand Multiple integrals: Double integral in Cartesian and Polar coordinates, Triple integrals, Surface integral of scalar functions , Jacobians, Cylindrical and spherical coordinates |
| 4 - | Understand Scalar and vector fields, Gradient, Divergence, Curl and Directional derivative. Line integral, Green's theorem, Gauss's theorems, Stokes's theorems |
| 5 - | Understand Ordinary differential equations: Equations of the first order: Separable, Homogenous, nearly Homogenous, Exact, Linear, Bernoulli. Ricatti. And Develop skills related to how to distinguish between them and determine the convenient method |
| 6 - | Understand higher order linear equations. Equations of the second order. Complementary and particular solutions. Undetermined coefficients, variation of parameters. Euler's equation, Equations reducible to the first order |
| 7 - | Understand System of linear differential equations. differential Operator method |
| 8 - | Gain the principle of quality control |
| 9 - | • Develop skills related to creative thinking, and problem solving |
| d. General and Transferable Skills: : | |
| 1 - | Gain the principle of quality control |
| 2 - | Develop skills related to creative thinking, and problem solving |

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, Gradient, Divergence, Curl and Directional derivative. Line integral, Green's theorem, Gauss's theorems, Stokes's theorems | 10 | 6 | 4 |
| First-Exam | | | |
| 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. Complementary and particular solutions. Undetermined coefficients, variation of parameters. Euler's equation, Equations reducible to the first order | 10 | 6 | 4 |
| Second Exam | | | |
| System of linear differential equations. Differential Operator method. | 10 | 6 | 4 |
| Final Exam | | | |

Teaching And Learning Methodologies :

Lectures

Tutorial

Class discussions and activities

Homework and self-study

Course Assessment :

| Methods of assessment | Relative weight % | Week No | Assess What |
|------------------------------|-------------------|---------|---|
| Assignments and Quizzes | 20.00 | 1 | |
| Attendance and Participation | 10.00 | 1 | |
| Final-term Exam | 40.00 | 15 | To assess overall understandings, concepts, Knowledge, Problem solving, and mathematical skills delivered by the course |
| First Mid Exam | 15.00 | 7 | To assess the levels of math skills needed for successful completion of the course, and to improve teaching and learning for all students |
| Second Mid Exam | 15.00 | 12 | To assess comprehension, Knowledge, Problem solving, and mathematical skills delivered by the course after 9 weeks of studying |

Course Notes :

Course notes

Handouts

Recommended books :

(1) Larson, R, Edwards, B & Falvo, D 2004, Elementary linear algebra, 5th edn, Houghton Muffin, Boston, Massachusetts.

(2) Stewart, J 2005, Calculus: concepts & contexts, 3rd edn, Thomson/Brooks/Cole, Australia.

Periodicals :

www.sosmath.com, www.math.hmc.edu

Web Sites :

www.tutorial.math.lamar.edu,
www.web.mit.edu