

**Faculty of Engineering & Technology**  
**Functions of Several Variables and ODE (Math 3)**

**Information :**

<b>Course Code :</b>	MTH 211	<b>Level :</b>	Undergraduate	<b>Course Hours :</b>	3.00- Hours
<b>Department :</b>	Department of Petroleum Engineering				

**Area Of Study :**

To familiarize students with the basic concepts of MTH 211 and to make them able to develop an understanding of mathematical concepts that provide a foundation for the mathematics encountered in Engineering. The course allows students to work at their own level thereby developing confidence in mathematics and general problem solving. On successful completion of this course the student will be able to:

1. demonstrate a sound understanding of a number of mathematical topics that are essential for studies in Engineering;
2. interpret and solve a range of problems involving mathematical concepts relevant to this course ;
3. Effectively communicate the mathematical concepts and arguments contained in this course.

**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 - | i. Provide a through understanding and working knowledge of mathematics relevant to this course. |
| 2 - | ii. Develop techniques for solving problems that may arise in everyday life.                     |

**b. Intellectual Skills: :**

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| 1 - | ~Demonstrate knowledge of the theory, concepts, of Functions of several variables , Ordinary differential equations, and vector Analysis at the intellectual level required of this course |
| 2 - | ~Think logically.  |
| 3 - | ~Analyze and solve problems.   |
| 4 - | ~Organize tasks into a structured form.  |
| 5 - | ~Evaluate the evolving state of knowledge in a rapidly developing area   |
| 6 - | ~Transfer appropriate knowledge and methods from one topic within the subject to another.  |

**c. Professional and Practical Skills: :**

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| 1 - | ~Develop a professional attitude and approach to gain conceptual and practical knowledge and understanding Functions of several variables and Ordinary differential equations. |
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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 -	(i) Gain the principle of quality control.
2 -	(ii) 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 :**

Recommended books

- (1) Larson, R, Edwards, B & Falvo, D 2004, Elementary linear algebra, 5th edn, Houghton Mufflin, Boston, Massachusetts.
- (2) Stewart, J 2005, Calculus: concepts & contexts, 3rd edn, Thomson/Brooks/Cole, Australia.

### **Periodicals :**

[www.sosmath.com](http://www.sosmath.com), [www.math.hmc.edu](http://www.math.hmc.edu),

### **Web Sites :**

[www.tutorial.math.lamar.edu](http://www.tutorial.math.lamar.edu),  
[www.web.mit.edu](http://www.web.mit.edu)