Faculty of Engineering & Technology

Transformation and Numerical Analysis (Math 4)

Information :

Course Code :	MTH 212	**Level :**	Undergraduate	**Course Hours :**	3.00- Hours
Department :	Department of Petroleum Engineering				

Area Of Study :

Laplace transformation: Properties and theorems, Inverse transform, Solution of Ordinary differential equations and integral equations, Heaviside function and related theorems, Periodic functions and Dirac delta functions, Applications. Fourier series and transform: Usual and arbitrary period, Fourier series of odd and even functions, applications.
Numerical Analysis: Systems of linear and nonlinear algebraic equations, Ordinary differential equations : Euler, Modified Euler and Runge- Kutta methods , Least square methods and Interpolation.

Description :

Laplace transformation: definitions, properties and theorems, Inverse transform, Solution of ordinary differential and integral equations by Laplace transform, Heaviside function and related theorems, Periodic functions and Dirac delta functions, Applications, Vector analysis: scalar and vector fields, Directional derivative, gradient, divergence and curl, Gauss's and Stokes's theorems, Fourier series: usual and arbitrary period, Fourier series of odd and even functions, Definitions and properties of Fourier transform with applications, Partial differential equations: definitions, types- D'fflambert solution of wave problem, Separation of variables for heat, wave, Laplace's equations in different systems of coordinates.

Course outcomes :

a.Knowledge and Understanding: :	
1 -	Provide a through understanding and working knowledge of mathematics relevant to this course.
2 -	Develop techniques for solving problems that may arise in everyday life.
b.Intellectual Skills: :	
1 -	Demonstrate knowledge of Laplace transforms, Fourier series and transforms, and Numerical 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: :	
1 -	Develop a professional attitude and approach to gain conceptual and practical knowledge and understanding of Mathematical Transforms And and application to Differential equations
2 -	Understand. Properties and theorems, Inverse Laplace transform, Calculating of Laplace and Inverse Laplace Transforms. Unit-step functions and Dirac delta functions.

3 -	solve Initial value problems, and integral equations by Laplace transforms.
4 -	Understand Fourier series for periodic and non-periodic Functions. Fourier series of odd and even functions. And study the Convergence Theorem.
5 -	Understand Fourier Integrals and Fourier transform. Finite Fourier transforms with Applications to Initial and Boundary values Problems.
6 -	find the Numerical solution of nonlinear equations, Newton's method. Secant method and be able to find Numerical solution of Initial Value problems.using Euler, Modified Euler, and Runge Kutta methods.
7 -	Understand Least Squares methods and Interpolation.
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
Laplace Transforms. Definition. Properties and theorems. Inverse Laplace transforms.	10	6	4
Calculating of Laplace transforms, Periodic functions, unit-step functions, and Dirac delta functions. Laplace Transforms of derivatives.	10	6	4
Calculating of Inverse Laplace Transforms. Solution of Initial value problems and integral equations by Laplace transforms.	10	6	4
First-Exam			
Fourier series. Periodic and non-periodic Functions. Series of odd and even functions. Half intervals Fortier Series Convergence Theorem.	5	3	2
Fourier Integrals and Fourier Transforms. Definitions and properties of Fourier integrals and transforms. Finite Fourier transforms. Applications to partial differential equations.	10	6	4
Second Exam			
Numerical solution of nonlinear equations, Newton's method. Secant method.	5	3	2
Numerical solution of Initial Value problems. Euler, Modified Euler, and Runge Kutta methods.	5	3	2
Least Squares methods. Interpolation.	5	3	2
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		
Attendance and Participation	10.00		
Final-term Exam	40.00	16	To assess overall understandings, concepts, Knowledge, Problem solving, and mathematical skills delivered by the course,
First Mid Exam	15.00	6	To assess the levels of math skills needed for successful completion of the course, and to improve teaching and learning for all students.
Second Mid Exam	15.00	12	To assess comprehension, Knowledge, Problem solving, and mathematical skills delivered by the course after 11 weeks of studying. 1.4. Final Exam:

Course Notes :

Handouts

Recommended books :

1- Robert T. Smith, Roland B Minton . Calculus: Early Transcendental Functions. 4th. edition. - McGraw ï HILL International Edition, 2012.
2 ï Erwin Kreyszig. "Advanced Engineering Mathematics", 10 edition, John Wiley& Sons, INC
3- Essential books (text books)
(i) Earl W.Swokowski, "Calculus with Analytic Geometry, Prindle, Weber & Schmidt
(ii) Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson.

Periodicals :

www.sosmath.com, www.math.hmc.edu,
www.tutorial.math.lamar.edu,
www.web.mit.edu