

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 Mechanical Engineering

Instructor Information :

| Title | Name | Office hours |
|--------------------|-----------------------------------|--------------|
| Lecturer | Wael Sayed Abdel Rahman Hassanein | |
| Teaching Assistant | Basma Magdy Ahmed Mohamed | |

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 :

- 1) Laplace transformation
- 2) Fourier analysis
- 3) Numerical methods.

Course outcomes :

a.Knowledge and Understanding: :

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| 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: :

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| 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: :

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| 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 - | 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. |
| 6 - | Understand Least Squares methods and Interpolation. |
| 7 - | Develop skills related to creative thinking, and problem solving. |

d. General and Transferable Skills: :

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| 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 :

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| 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. |

Books :

| Book | Author | Publisher |
|----------------------------------|----------------------------------|---------------------------|
| Advanced Engineering Mathematics | Warren S. Wright, Dennis G. Zill | Jones & Bartlett Learning |

Course Notes :

Handouts

Recommended books :

- 1- Robert T. Smith, Roland B Minton . Calculus: Early Transcendental Functions. 4th. edition. - McGraw – HILL International Edition, 2012.
- 2 – 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