The University of Jordan
School of Engineering

Department	Course Name	Course Number	Semester
Mechanical Engineering	Engineering Mathematics	0904708/ 0934731	

2005 Course Catalog Description

Review of Ordinary Differential Equations, Bessel functions and Legendre polynomials, Partial Differential Equations, Fourier series, integrals and transforms, Laplace transformation, Vector calculus, Complex algebra.

Instructors

Name	E-mail	Sec	Office Hours		Lecture Time	
Prof. Dr. Ibrahim Abu-Alshaikh	i.abualshaikh@ju.edu.jo					

Text Books

	Text book 1	Text book 2
Title	Advanced Engineering Mathematics	
Author(s)	Erwin Kreyszig	
Publisher, Year, Edition	John Wiley & Son, Inc., 10th Edition	

References

Books	1. Wylie & Barrett,"Advanced Engineering Mathematics" Edition, 1995, McGraw-Hill Book Company. 2. P. V. O'Nail "Advanced Engineering Mathematics", 5thEdition Thomson, 2003. 3. Complex Variables; Theory and Problems "Schaum's Series". 4. R. V. Churchill & J. W. Brown "*Complex Variables and applications"* McGraw-Hill Fifth Edition 1990 ISBN: 0-07-010905-2 5. **J. W. Brown & R. V. Churchill "Fourier Series and Applications" McGraw-Hill Fifth Edition 1993 ISBN: 0-07-008202-2**
Journals	
Internet links	

Prerequisites

Prerequisites by topic	1. Mechanics and properties of materials 2. Matrix algebra
Prerequisites by course	
Co-requisites by course	
Prerequisite for	

Topics Covered

Week	Topics	Chapter in Text	Sections
	First-Order ODEs	1	
	Second-Order Linear ODEs, Higher Order Linear ODEs	2,3	
	Systems of ODEs.	4	
	Series Solutions of ODEs. Special Functions; Power Series Method, Legendre's Equation. Legendre Polynomials, Extended Power Series Method: Frobenius Method, Bessel's Equation. Bessel Functions	5	
	Laplace Transforms	6	
	Vector Differential Calculus. Grad, Div., Curl	9	
	Vector Integral Calculus. Integral Theorems; Green's Theorem, Divergence Theorem, Stokes's Theorem	10	
	Fourier Analysis; Fourier Series, Fourier Integral, Fourier Transform. Discrete and Fast Fourier Transforms	11	

	Partial Differential Equations (PDEs), Wave & heat Equations (1-D, 2-D, 3-D) with applications	12	
	Complex Numbers and Functions, Complex Differentiation	13	
	Complex Integration	14	
	Power Series, Taylor Series, Laurent Series. Residue Integration	15, 16	
	Conformal Mapping	17	
	Complex Analysis and Potential Theory; Heat Problems, Fluid Flow, Poisson's Integral Formula for Potentials	18	

Course Outcomes

1. learn how to solve ODEs by advanced methods using some special functions; power series method, Legendre polynomials, Frobenius method and Bessel functions
2. Calculate the coefficient of both complex and real Fourier series for a variety of periodic functions, and to use them to solve some realistic models (ordinary differential equations that involve periodic loads).
3. Calculate Fourier integrals and Fourier transforms for a variety of simple problems.
4. Solve the Laplace, heat and wave equations (PDEs) for a variety of boundary conditions by the method of separation of variables.
5. Apply the method of separation of variables to solve two-dimensional heat and wave equations in Cartesian, cylindrical and spherical coordinates.
6. Learn topics related to complex analysis (complex numbers, complex functions; complex integrals etc).
7. Learn topics related to vector calculus and its engineering applications.
8. Be able to use complex analysis and potential theory in solving heat and fluid flow problems.
9. Be able to deal with commercial programs like "**MAPLE**" to solve some of the above problems.

Learning and Teaching Strategies

1. The teaching strategy is a mixture of lectures and problem-solving that make the solution steps to problems as clear and as logical as possible.
2. Interaction and discussion is common so students are encouraged to ask questions.
3. Getting bonus-marks from some (over-level) questions is encouraged.
4. Students should not be hesitated to ask and discuss with the instructor any subject related to this course.
5. We believe that effective learning:
   - Is best supported by a climate of enquiry, in which students are actively engaged in the learning process.
   - Is achieved when the students attend all classes, have prepared effectively for classes through reading previous lecture notes, have made a serious attempt in doing the homework assignment problems.
   - Is achieved when students have a genuine interest in the subject and make a serious effort to master the material, rather than just copy down lecture notes.
   - Avoid Make-up examinations; however, the lack of attendance results in the University Zero grade.

Evaluation

Assessment Tools	Expected Due Date	Weight
Assignments and Research Paper		20%
First Exam		20%
Second Exam		20%
Final Exam		40%

Contribution of Course to Meet the Professional Components

Relationship to Mechanical Engineering Program Objectives (MEPOs)			
MEPO1	**MEPO2**	**MEPO3**	**MEPO4**
Updated by ABET Committee, 2024			