King Fahd University of Petroleum & Minerals

Department of Mathematics and Statistics

Math 333 Syllabus, Term 193 (Online)

Coordinator: Dr. Waled Al-Khulaifi

Course Code and Title: Math 333, Methods of Applied Mathematics I

Course Credit Hours: 3-0-3

Textbook: *Advanced Engineering Mathematics* (Fifth Edition) by D.G. Zill and W.S. Wright, International Edition.

Course Objectives: The objective of the course is to introduce students to calculus of vector functions, Laplace and Fourier transforms, Fourier series and partial differential equations.

Course Contents: Special functions. Bessel's functions and Legendre polynomials. Vector analysis including vector fields, divergence, curl, line and surface integrals, Green's, Gauss' and Stokes' theorems. Sturm -Liouville theory. Laplace transforms. Fourier series and transforms. Introduction to partial differential equations and boundary value problems in rectangular, cylindrical and spherical coordinates.

Prerequisites: MATH 201, MATH 202 or MATH 208

Course Learning Outcomes: Upon completion of this course, students should be able to:

1. Recognize the vector fields, find their curl and divergence, and test whether they are conservative.
2. Evaluate the line integral along plane or space curves and the surface integral over surfaces in 3-space.
3. Use Green's, Stokes' and Divergence theorems to relate and evaluate different types of integral.
4. Evaluate the Laplace transform and inverse Laplace transform of a given function.
5. Apply the Laplace transform, inverse Laplace transform, and their operational properties to solve linear initial-value and boundary-value problems.
6. Find the Fourier series, the Fourier cosine and sine series, and the Bessel and Legendre series of a given function.
7. Find the eigenvalues and eigenfunctions for a given Sturm-Liouville boundary-value problem and state their orthogonality relation.
8. Solve separable partial differential equations.
9. Solve boundary-value problems involving the wave, heat and Laplace equations in various coordinate systems.
10. Evaluate the Fourier integral and the Fourier cosine and sine integrals of a given function.
11. Use the Fourier transform, inverse Fourier transform, and their operational properties to solve linear boundary value problems

Grading Policy: 6 Weekly Tests (230 points), Classwork (10 points), Final Exam (60 points). Unless you are told otherwise, the material of each test will be the material covered in the week before according to the syllabus below. The final exam is comprehensive.

Course Passing Grade: A student must score at least 50% to pass.

Upgrade Policy: Upgrading is made automatically if a student is 1 or 2 points short of the next higher grade. If he is 3 points short, the final exam score alone, when scaled out of 300, must lie in the category of the next higher score for an upgrade to be applied. No other circumstances are subject to upgrading.

Exam Questions: The questions of the exams are based on the examples, homework problems, and exercises in the textbook.

Misconduct in Exams: Cheating or attempting to cheat will result in a grade of **F** in the course, along with reporting the incident to the higher university administration. Cheating in exams includes (but is not limited to) receiving help from anyone or any other outside source, disabling webcams, and unauthorized use of books, course notes, calculators, phones, or websites.

Missing an Exam: For the weekly tests, no make-up exam will be given under any circumstances. In case a student misses a test for a legitimate approved reason (such as medical emergencies), his score for that test will be determined based on his performance in the remaining tests. If a student misses the final exam for a legitimate approved reason, a make-up final exam will be given.

Attendance: Students are expected to attend all lectures. KFUPM policy strictly applies including the DN grade.

Pacing Schedule

Week	Date	Section	Topics	Suggested Practice Problems
1	May. 30- June 4	9.1	Vector Functions	1, 12, 16, 17, 21, 26, 33, 41
		9.5	The Directional Derivative	2, 7, 9, 1
		9.7	Curl and Divergence	4, 17, 21, 23, 32, 29
		9.8	Line Integrals	2, 6, 10, 14, 17, 22, 27
2	June 7-11	9.9	Independence of the Path	1, 10, 15, 18, 21, 26
		9.12	Green's Theorem	2, 4, 6, 9, 18, 23, 25
		9.13	Surface Integrals	2, 5, 10, 13, 18, 22, 25, 33
		9.14	Stokes' Theorem	1, 3, 6, 8, 13, 17
3	June 14-18	9.16	Divergence Theorem	2, 4, 7, 11, 14
		4.1	Definition of the Laplace transform	1, 5, 14, 26, 30, 37, 43
		4.2	Inverse Transform, Transforms of Derivatives	2, 10, 19, 22, 24, 32, 35
		4.3	Translation Theorems	2, 8, 13, 20
4	June 21-25	4.4	Additional Operational Properties	1, 10, 16, 22, 27, 31, 38, 46
		4.5	The Dirac Delta Function	1, 4, 8, 12
		12.1	Orthogonal Functions	2, 6, 11, 13
		12.2	Fourier Series	2, 4, 6, 12
5	June 28- July 2	12.3	Fourier Cosine and Sine Series	1, 6, 12, 17, 20
		12.5	Sturm-Liouville Theorem	1, 8, 12, 16, 25, 35, 38
		12.6	Bessel and Legendre Series	2, 4, 6, 8, 15, 20
6	July 5-9	13.1	Separable Partial Differential Equations	2, 8, 12, 16, 22, 26, 27
		13.3	Heat Equation	2, 3, 6
		13.4	Wave Equation	1, 6, 9, 16, 23
		13.5	Laplace's Equation	2, 4, 7, 10, 14
7	July 12-16	14.2	Problems in Cylindrical Coordinates	2, 4, 9, 12
		14.3	Problems in Spherical Coordinates	2, 5, 11, 12
		15.2	Applications of the Laplace Transform	2, 4, 10, 14, 18, 24
		15.3	Fourier Transforms	1, 6, 10, 12, 16
8	July 19		Review and catch up	