King Fahd University of Petroleum and Minerals
Department of Mathematics
Syllabus of Math 333-Term 212
<u>**Coordinator**</u>: **Dr. Waled Al-Khulaifi (Email: <u>waled.alkhulaifi@kfupm.edu.sa</u>)**

Course: MATH 333
Title: Methods of Applied Mathematics I
Textbook: Advanced Engineering Mathematics by Zill and Wright (Fifth 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.

Catalog Description: 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
Learning Outcomes: Upon completion of this course, students will be able to:

1. Calculate the line integral along plane or space curves and the surface integral over surfaces in 3D-space.
2. Compute different types of integrals using Green's, Stokes' and Divergence theorems
3. Evaluate Laplace transform, inverse Laplace transform, and Fourier integral of a function.
4. Find Fourier series, Fourier cosine/sine series, Bessel and Legendre series of a function.
5. Evaluate the eigenvalues and eigenfunctions for a given Sturm-Liouville boundary-value problem.
6. Solve boundary-value problems for wave, heat, and Laplace equations in various coordinate systems by variable separable method.
7. Use Laplace, inverse Laplace, Fourier, and inverse Fourier transforms to solve linear initial and boundary-value problems.

<u>**Weekly Distribution of the Material**</u>

Week	Date	Sec.	Topics	Suggested Important Problems
1	**Jan 16-20**	**9.1**	Vector Functions	1, 9, 10, 13, 15, 18, 23, 26, 31, 36, 40, 43
		9.5	Directional Derivative	3, 6, 10, 13, 18, 22, 25, 31, 32, 33, 35
2	**Jan 23-27**	**9.7**	Curl and Divergence	2, 5, 10, 15, 19, 23, 27, 28
		9.8	Line Integrals	2, 5, 10, 11, 15, 19, 22, 29, 30, 34
3	**Jan 30-Feb 03**	**9.9**	Independence of the Path	5, 13, 18, 21, 23, 25
		9.12	Green's Theorem	2, 4, 6, 10, 12, 23, 25
4	**Feb 06-10**	**9.13**	Surface Integrals	2, 5, 6, 7, 10, 18, 22, 25, 30, 33
5	**Feb 13-17**	**9.14**	Stokes' Theorem	1, 3, 5, 6, 8, 13, 15, 17
		9.16	Divergence Theorem	2, 4, 7, 9, 11, 12, 14
6	**Feb 20-24**	**4.1**	Definition of the Laplace transform	1, 5, 8, 14, 25, 30, 35, 37, 39
		4.2	The Inverse Transform and Transforms of Derivatives	4,10, 16, 19, 22, 24, 33, 35, 39
First Major Exam on Wednesday 23rd Feb. Material: Chapter 9				

7	Feb 27- Mar 03	4.3	Translation Theorems	6, 14, 20, 24, 29, 32, 38, 48, 55, 63, 67, 70
		4.4	Additional Operational Properties	1,7, 10, 14, 22, 25, 29, 33, 40, 46
8	Mar 06-10	4.5	The Dirac Delta Function	1, 5, 8, 11, 12
		12.1	Orthogonal Functions	3, 5, 12, 13, 18
9	Mar 13-17	12.2	Fourier Series	2, 6, 14, 17, 20
		12.3	Fourier Cosine and Sine Series	5, 8, 12, 16, 25, 28, 33, 35, 38
10	Mar 20-24	12.5	Sturm-Liouville Theorem	1, 2, 4, 6, 7, 8, 9
		12.6	Bessel and Legendre Series	4, 6, 7, 8, 9, 10, 15, 17, 19, 20
11	Mar 27-31	12.6	Bessel and Legendre Series (Continue)	2,4,6,8,15,20
		13.1	Separable Partial Differential Equations	2, 8, 12, 16, 23, 26, 28
12	April 03-07	13.3	Heat Equation	2, 3, 6, 7
		13.4	Wave Equation	1, 2, 4, 5, 6, 9
Second Major Exam on Saturday 9th April. Material: Chapter 4 and 12				
13	April 10-14	13.5	Laplace's Equation	2, 4, 7, 10, 12, 16
		14.2	Problems in Cylindrical Coordinates	1, 2, 3, 4, 9
14	April 17-21	14.3	Problems in Spherical Coordinates	1, 3, 4, 5, 6
		15.2	Applications of the Laplace Transform	1, 2, 3, 4, 6, 10
	April 24-May 07		**Ramadhan Break**	
15	May 08-12	15.3	Fourier Integrals	1, 4, 8, 10, 12
		15.4	Fourier Transforms	1, 3, 4, 5, 6, 10, 12, 16

Assessment Policy:

Type of Assessment	Percentage	Date	Material
Major Exam 1	25%	Wednesday February 23, 2022	Chapter 9
Major Exam 2	25%	Saturday April 9, 2022	Chapter 4 and12
Final	35%	Check Registrar's Website	Comprehensive
Classwork	15%	Depends on your instructor	

Classwork Interval: The classwork score should be in the interval [70%, 75%].

Misconduct in Exams: The University takes any instances of academic misconduct very seriously. A student who cheats or attempts to cheat will be reported to the university administration for the appropriate course of action

Missing an Exam: In case a student misses an exam (Exam I, Exam II, or the Final Exam) for a legitimate reason (such as medical emergencies), he must bring an official excuse from Students Affairs. Otherwise, he will get zero in the missed exam.

Attendance: Students are expected to attend all lecture classes.

- If a student misses a class, he is responsible for any announcement made in that class.
- A DN grade will be awarded to any student who accumulates more than 20% unexcused absences or 33% excused and unexcused absences.