

**King Fahd University of Petroleum and Minerals**  
**Department of Mathematics**  
**Syllabus of Math 333-Term 211**  
**Coordinator: Dr. Muhammad Yousuf**

**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 given function.
4. Find Fourier series, Fourier cosine/sine series, Bessel and Legendre series of a given 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.

**Weekly Distribution of the Material**

Week	Date	Sec.	Topics	Suggested Important Problems
1	Aug 29-Sep 02	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	Sep 05-09	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	Sep 12-16	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	Sep 19-22	9.13	Surface Integrals	2, 5, 6, 7, 10, 18, 22, 25, 30, 33
<b>National Day Holiday Sep 23</b>				
5	Sep 26-30	9.14	Stokes' Theorem	1, 3, 5, 6, 8, 13, 15, 17
		9.16	Divergence Theorem	2, 4, 7, 9, 11, 12, 14
6	Oct 03-07	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

7	<b>Oct 10-14</b>	<b>4.3</b>	Translation Theorems	6, 14, 20, 24, 29, 32, 38, 48, 55, 63, 67, 70
		<b>4.4</b>	Additional Operational Properties	1,7, 10, 14, 22, 25, 29, 33, 40, 46
	<b>October 17</b>		<b>Student Break</b>	
8	<b>Oct 18-21</b>	<b>4.5</b>	The Dirac Delta Function	1, 5, 8, 11, 12
		<b>12.1</b>	Orthogonal Functions	3, 5, 12, 13, 18
9	<b>Oct 24-28</b>	<b>12.2</b>	Fourier Series	2, 6, 14, 17, 20
		<b>12.3</b>	Fourier Cosine and Sine Series	5, 8, 12, 16, 25, 28, 33, 35, 38
10	<b>Oct 31-Nov04</b>	<b>12.5</b>	Sturm-Liouville Theorem	1, 2, 4, 6, 7, 8, 9
		<b>12.6</b>	Bessel and Legendre Series	4, 6, 7, 8, 9, 10, 15, 17, 19, 20
11	<b>Nov 07-11</b>	<b>12.6</b>	Bessel and Legendre Series (Continue)	2,4,6,8,15,20
		<b>13.1</b>	Separable Partial Differential Equations	2, 8, 12, 16, 23, 26, 28
12	<b>Nov 14-18</b>	<b>13.3</b>	Heat Equation	2, 3, 6, 7
		<b>13.4</b>	Wave Equation	1, 2, 4, 5, 6, 9
13	<b>Nov 21-25</b>	<b>13.5</b>	Laplace's Equation	2, 4, 7, 10, 12, 16
		<b>14.2</b>	Problems in Cylindrical Coordinates	1, 2, 3, 4, 9
	<b>Nov 28-Dec 02</b>		<b>Midterm break</b>	
14	<b>Dec 05-09</b>	<b>14.3</b>	Problems in Spherical Coordinates	1, 3, 4, 5, 6
		<b>15.2</b>	Applications of the Laplace Transform	1, 2, 3, 4, 6, 10
15	<b>Dec 12-16</b>	<b>15.3</b>	Fourier Integrals	1, 4, 8, 10, 12
		<b>15.4</b>	Fourier Transforms	1, 3, 4, 5, 6, 10, 12, 16
16	<b>Dec 19-20</b>		<b>Normal Thursday Class</b>	

**Assessment Policy:**

Type of Assessment	Percentage	Date	Material
Midterm 1	25%	Wednesday October 06, 2021	Chapter 9
Midterm 2	25%	Wednesday November 20, 2021	Chapter 4, 12
Final	35%	To be announced later	Comprehensive
Classwork	15%		Will be announced in the class

**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:** No make-up quiz will be given under any circumstances. In case a student misses a quiz for a legitimate approved reason (such as medical emergencies), his score for that quiz will be determined based on his performance in the remaining quizzes. If a student misses a midterm exam, his score will be calculated based on his performance in the other exam. If a student misses the final exam for a legitimate approved reason, a make-up final exam will be given.