

The Course Code and Name: Math 513, Mathematical Methods for Engineers.

The Course Credit Hours: 3-0-3. (Three lecture sessions per week)

The Course Description: Laplace transforms including the convolution theorem. Error and gamma functions. The method of Frobenius for series solutions to differential equations. Fourier series and Fourier-Bessel series. Boundary value problems. Sturm-Liouville theory. Partial differential equations: Separation of variables, Laplace transforms, and Fourier integrals methods. The heat equation, Laplace equation, and wave equation. Eigenvalue problems for matrices. Diagonalization.

The Course Prerequisite: Math 202. (Not open to mathematics majors. Students cannot receive credit for both MATH 333 and MATH 513.)

Learning Outcomes: After completion of the course, the student should be able to:

1. Represent functions by trigonometric Fourier series under certain general conditions.
2. Learn the various representations of Fourier series such as the half-range expansions, the phase angle forms, and the complex form.
3. Learn the properties of Fourier series, Fourier transforms, Laplace transforms, and eigenfunctions of the classic Sturm-Liouville problem.
4. Represent piecewise continuous functions by series of eigenfunctions.
5. Construct complicated discontinuous functions to describe abrupt changes.
6. Solving ordinary differential equations using Fourier series and Fourier transforms.
7. Solve the wave, heat, and Laplace equations using separation of variables.
8. Solve linear partial differential equations by Fourier and Laplace transforms.
9. Solve Laplace's equation on the upper half-plane using Fourier integrals and convolution.
10. Solve Poisson's equation on a rectangle.
11. Apply vectors and vector operations to facilitate mathematical expressions of diverse topics.
12. Use MATLAB software to solve computational problems.

Textbook: Dean G. Duffy. Advanced Engineering Mathematics With MATLAB, Fourth Edition. CRC Press, 2016.

Optional MATLAB Textbooks and References:

- Desmond J. Higham and Nicholas J. Higham. MATLAB Guide, volume 150. Siam, 3rd edition, 2016.
- Brian R. Hunt, Ronald L. Lipsman, and Jonathan M. Rosenberg. A Guide to MATLAB: For Beginners and Experienced Users. Cambridge University Press, 3rd edition, 2014.
- Online MATLAB Tutorials:
 - [MATLAB® Primer.](#)
 - "Introduction to MATLAB," [MITOpenCourseWare.](#)
 - Christos Xenophontos. [A Beginner's Guide to MATLAB.](#) Department of Mathematical Sciences, Loyola College, 2002.

Online MATLAB Video Tutorials:

[MATLAB Training.](#)

MATLAB Codes:

The Textbook includes a large set of MATLAB codes to illustrate many examples. Community-developed MATLAB codes, examples, tips, and other resources are freely available for download from [MATLAB File Exchange.](#)

Table 1: Tentative Online Classes Pacing Schedule (Subject to Change)

Weeks	Dates	Chapter	Topic
1	Jan. 17-21	3	Linear Algebra
2,3	Jan. 24- Feb. 04	5	Fourier Series
4,5	Feb. 07- Feb. 18	6	The Sturm-Liouville Problem
6,7	Feb. 21- Mar. 04	7	The Wave Equation
8,9	Mar. 07- Mar. 18	8	The Heat Equation
10,11	Mar. 21- Apr. 01	9	Laplace's Equation
12,13	Apr. 04- Apr. 15	11	The Fourier Transform
14,15	Apr. 18- Apr. 29	12	The Laplace Transform
Ramadan & 'Eid break May 02- May 17			
16	May.18- May 20		Preparation for exams

Table 2: The Course Grading Policy

Midterm Exam (written)	30% (90 points)	<p>The questions of the exams are based on the examples, homework problems, and exercises of the Textbook.</p> <p>The classwork consists of 3 quizzes, each worth 15 points (about 5%). The average total classwork grade shall be in the interval [70%, 75%].</p>
Quizzes	15% (45 points)	
Project/HW	15% (45 points)	
Final Exam (comprehensive written)	40% (120 points)	
Course Passing Grade	A student must score at least 50% (150/300) to pass the course.	
Upgrade Policy	<p>The upgrade policy is applied when 3 points are needed to get the next higher grade. For instance, the passing grade D starts at 150/300. If a student gets 149/300 or 148/300, then his grade will automatically upgrade to D. However, if a student gets 147/300, his grade will upgrade to D only if his final exam score is greater than or equal to 50% of the Final Exam grade, i.e., 37.5/75.</p>	

Project Guidelines:

- Late project report submission will not be accepted.
- Electronic submission of the project report.
- You must use MATLAB software for the project assignment.
- Preparing the project report in groups is possible; in this case the maximum number of students forming a group is two students.

Cheating in Exams: Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in an "F" grade in the course along with reporting the incident to the higher university administration. Cheating in exams includes, but not limited to:

- Screen sharing to another computer.
- Using unauthorized advanced electronic devices.
- Keeping notes on smartphones and using mobile apps.
- Faking identities to get third-party assistance.

Missing a Classwork Assignment, Project, or an Exam:

- Classwork Assignments, Project, and Midterm Exam: No make-up assessment will be given under any circumstances. If a student misses any of these assessments for a legitimate reason (such as medical emergencies), he must present an official excuse from the Student Affairs to me no later than a week before the date of the Final Exam. In this case the student grade for this assessment will be the average of all other assignments grades he received in the course during the term, except for the Final Exam grade. If no such official excuse is forwarded to me on time, the student receives ZERO grade.
- Final Exam: If a student misses the Final Exam for a legitimate reason (such as medical emergencies), he will be given a make-up Final Exam.

Attendance: Students are expected to attend all online classes.

- If a student misses a class, he is responsible for any announcement made in that class.
- A student is considered absent if not attending the online class 10 minutes after the class start time. The instructor may also randomly verify attendance during each online class using any appropriate means he finds. In both cases, the student is permitted to attend the remainder of the online class session.
- A student, who has a valid excuse for an absence, must present an officially authorized document to me no later than a week before the date of the Final Exam; no excuses shall be accepted after that date.
- A DN grade will be awarded to any student who accumulates
 - 9 unexcused absences in online classes.
 - 12 excused and unexcused absences in online classes.

Usage of Calculators: Calculators are allowed in all exams.

Usage of Communication Devices: Please turn off your video and mute your microphone when you are not talking unless you have a permission from me to do so. Use a headset when possible. If you own headphones with a microphone, please use them as this improves audio quality. Be in a quiet place when possible. Use the chat window for questions and comments that are relevant to class.

Academic Integrity: All KFUPM policies regarding ethics apply to this course. See the Undergraduate Bulletin on the webpage of the Registrar.

Tips on How to Enhance Your Problem-Solving Skills:

- Make sure you understand the concepts and techniques of each section.
- Take notes during online classes and study your notes, textbook, and my lecture slides before our next class.
- Review the recorded lecture to consolidate your learning and locate any missed points.
- Do all the homework assignments on time.
- Try always to solve the problems on your own first before reading the solution or asking for help.
- Practice more problems than those given in the homework assignments.
- If you find it difficult to solve a certain type of problems, you should try more problems of that type. Try to make good use of my online office hours.
- Solve old exams as part of your preparation for the Midterm and Final Exams.
- Last, but not least, consult me whenever you feel you need help understanding a concept or solving a problem.