



School of Engineering  
*Sonny Astani Department  
of Civil and Environmental  
Engineering*

**CE 526: Engineering Mathematical Methods**

**Units:4 29709R**

**Spr2024 Monday, Wednesday 12:00-1:50 PM**

**Location: DMC207**

**Instructor: Prof. Vincent Lee**

**Office:** KAP 230B

**Office Hours:**2 hours per week, time and day TBD

**Contact Info:**Email: [vlee@usc.edu](mailto:vlee@usc.edu)

Phone number: 213-740-0568

**Office hours:** TBD

**Teaching Assistant:** TBD

**Office:**

**Office Hours:**

**Contact Info:**

**IT Help:**TBD

**Hours of Service:**

**Contact Info:**

## Course Description

The materials presented will serve to study methods to solve engineering problems to be discussed on a physical basis, with the mathematical tools to include Fourier series, Fourier and Laplace transforms, solving partial differential equations by separation of variables and by transform methods. To study the wave, heat and Laplace equations in rectangular, cylindrical and spherical coordinates, Calculus of Variations, Complex Functions and Theory of Residues

## Learning Objectives and Outcomes

By the end of the course, the student will be able to:

1. Study and review undergraduate calculus
2. Study and review Fourier series
3. Study eigenvalues and eigenvectors
4. Study and review ordinary differential equations (ODE) and learn system of ODE
5. Study eigenvalues and eigenfunctions, orthogonal functions
6. Study partial differential equation, solution by separation of variables
7. Study 1-D, 2-D homogeneous and non-homogeneous wave, heat and Laplace equations in rectangular coordinates.
8. Study 2-D Laplace, Heat & Wave Equations- Cylindrical Coordinates.
9. Study 3-D Laplace, Heat & Wave Equations - Spherical Coordinates
10. Study Sturm-Liouville problem
11. Study Fourier and Laplace Transforms
12. Study Calculus of Variations

**Prerequisite or Recommended Preparation:** *undergraduate multivariable calculus and ordinary differential equations*

**Co-Requisite(s):** *None*

**Concurrent Enrollment:** *None*

## Course Notes

The class will have letter grade. The class will use the university blackboard website as the primary medium for distribution of course material, including assignments, typed and written lecture notes and for syllabus, announcements and examination dates.

**Technological Proficiency and Hardware/Software Required** N/A

## Textbook and Supplementary Materials

**E. Kreyszig Advanced Engineering Mathematics 10<sup>th</sup> ed. ISBN-13: 978-0470458365**

The above textbook is available for purchase from the USC bookstore. Supplemental reading material will be provided as needed.

## Description and Assessment of Assignments

The points per homework assignment and their % grade in the table below are only approximate.

**All homework assigned are due on the first class of next week**

| Assignment   | Points   | % of Grade |
|--------------|----------|------------|
| 1 to 12      | 60 to 70 | 1.67 each  |
| <b>TOTAL</b> | 1.67 *12 | 20         |

### Grading Scale

Students will be graded based on their total scores (possibly relative to the overall class performance) The following is merely a rough guideline, and is subject to revision depending on the overall class performance.

| Assignment   | Points           | % of Grade |
|--------------|------------------|------------|
| Homework     | 60 to 70 ptseach | 20%        |
| Midterm I    | 100              | 24%        |
| Midterm II   | 100              | 24%        |
| Final        | 100              | 32%        |
| <b>TOTAL</b> |                  | 100%       |

### Assignment Submission Policy

Unless otherwise stated, homework assignments are due at the beginning of the class and/or submitted in DEN dropbox. Solutions will be posted on DEN blackboard shortly after the assignments are turned in.

### Grading Timeline

The homeworks and midterms will be graded and handed back roughly one week after their due date.

### Additional Policies

Late homework will not be accepted. No exceptions except institution-established emergency reasons; credit for such late homework is with the discretion of the instructor.

Reasonable collaboration in solving homework problems is allowed. This includes reviewing and discussing the problems with current CE 471 students, TA or the instructor. Everybody has to write his/her own solution independently and make sure to fully understand it. Exchanging solutions, consulting with people other than class members, finding solutions on the web or elsewhere, etc. are not allowed. Violations result in losing the credit for the entire homework set in addition to a significant percentage of the overall course grade, all with the discretion of the instructor.

All answers should be clearly and fully justified. If the steps are not clear, points will be deducted even if the final answer is correct.

Attendance will be taken in every lecture. The students are expected to be attentive, and in particular refrain from using computers or hand held devices, except for the sole purpose of the class. Non-compliance will result in point deduction from class participation part of the grading, and possibly a percentage of the overall course grade, all with the discretion of the instructor.

## Course Schedule: A Weekly Breakdown

|                              | Topics/Daily Activities   | Posted Lecture Notes | Deliverable                               |
|------------------------------|---|----------------------|---|
| <b>Week 1</b><br>Jan 8,10    | Review: undergraduate Calculus<br>Some Math Paradox   | L00, L00             | Homework 1 assigned                       |
| <b>Jan 15</b>                | <b>Monday, Martin Luther King Day</b>   | <b>USc Holiday</b>   |   |
| <b>Week 2</b><br>Jan 17      | Fourier series & methodology<br>extended to orthogonal series,<br>Eigenvalues & Eigenvectors  | <b>L01, L02</b>      | Homework 2 assigned                       |
| <b>Week 3</b><br>Jan 22,24   | Eigenvalues & Eigenfunctions,<br>Orthogonal Series Expansion,<br>System of Ordinary Diff.<br>Equations                                    | L02, L03             | Homework 3 assigned;                      |
| <b>Jan 26</b>                | <b>Last Day to add Last day to change to Pass/No Pass</b>   |                      |   |
| <b>Week 4</b><br>Jan 29,31   | Partial Differential equations<br>(PDE) 1-D wave equation   | L04, L05             | Homework 4 assigned                       |
| <b>Week 5</b><br>Feb 5,7     | 1-D Wave & Beam Equations<br><b>Mid-Term #1</b>   | L06                  |   |
| <b>Week 6</b><br>Feb 12,14   | 2-D Wave equation – Rectangular<br>Coordinates  | L07                  | Homework 5 assigned                       |
| <b>Week 7</b><br>Feb 19,21   | 1-D, 2-D Heat Equations –<br>Rectangular Coordinates,   | L08                  | Homework 6 assigned                       |
| <b>Feb 23</b>                | <b>Last day to drop without a mark of "W" Last day to change Pass/No Pass to Letter grade .</b>   |                      |   |
| <b>Week 8</b><br>Feb 26,28   | <b>Non-homogeneous PDE of<br/>the Laplace, heat and wave<br/>equations</b>  | L08, L09             | Homework 7 assigned                       |
| <b>Week 9</b><br>Mar 4, 6    | 2-D Laplace, Heat & Wave<br>Equations- Cylindrical<br>Coordinates   | L09, L10             | Homework 8 assigned                       |
| <b>Week 10</b>               | <b>Mar 11-15 Spring Break</b>   |                      |   |
| <b>Week 11</b><br>Mar 18,20  | <b>3-D Laplace, Heat &amp; Wave<br/>Equations - Spherical<br/>Coordinates, Mid-Term #2</b>  | L11                  |   |
| <b>Week 12</b><br>Mar 25-27  | 3-D Heat & Wave Equations -<br>Spherical Coordinates  | L12                  | Homework 9 assigned;                      |
| <b>Apr 5</b>                 | <b>Last day to drop with a mark of "W"</b>  |                      |   |
| <b>Week 13</b><br>Apr 1, 3   | Fourier Transform, Applications<br>to PDE   | L13                  | Homework 10 assigned                      |
| <b>Week 14</b><br>Apr 8, 10  | Laplace Transform, Applications<br>to PDE   | L14                  | Homework 11 assigned                      |
| <b>Week 15</b><br>Apr 15, 17 | <b>Sturm-Liouville<br/>Problem, Calculus of Variations<br/>1: Euler-Lagrange Equations,<br/>Extreme of Integrals under<br/>Constraint</b> | L15                  | Homework 12 assigned<br><b>Class Ends</b> |
| <b>Week 16</b><br>Apr 22 24  | <b>Calculus of Variations 2:<br/>Hamilton Principles</b>  | L16                  |   |
| <b>FINAL TBD</b>             | Date: For the date and time of the final for this class, consult the USC <i>Schedule of Classes</i> at                                    |                      |   |

## Statement on Academic Conduct and Support Systems

### Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

### Support Systems:

*Student Health Counseling Services - (213) 740-7711 – 24/7 on call*  
[engemannshc.usc.edu/counseling](http://engemannshc.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*  
[suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call*  
[engemannshc.usc.edu/rsvp](http://engemannshc.usc.edu/rsvp)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED) | Title IX - (213) 740-5086*  
[equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu)

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

*Bias Assessment Response and Support - (213) 740-2421*  
[studentaffairs.usc.edu/bias-assessment-response-support](http://studentaffairs.usc.edu/bias-assessment-response-support)

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

*The Office of Disability Services and Programs - (213) 740-0776*  
[dsp.usc.edu](http://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Support and Advocacy - (213) 821-4710*  
[studentaffairs.usc.edu/ssa](http://studentaffairs.usc.edu/ssa)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.