AME526

Engineering Analytical Methods

M-W, 5:00-6:20 pm, VKC 261

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This syllabus may change from time to time to accommodate changing circumstances.

Course Description: Typical engineering problems discussed on a physical basis. Fourier series; Fourier integrals; Laplace transform; partial differential equations; Bessel function.
Prerequisite(s): None.
Text(s): *Advanced Engineering Mathematics*, 7th Edition. Peter V. ONeil.
Other useful resources : *Fourier Analysis, Eigenfunction Expansions and Differential Equations* , SS Sadhal.

Grade Distribution:

Assignments	25%
Midterm Exam	30%
Final Exam	45%

Remarks:
Some topics in class will be handled very differently from the book. You will be responsible for the way things are done in class. Class attendance is strongly encouraged.

Cellphones, laptops, tablets and anything else electronic are to be turned off during class.

Assignments
Homework will be distributed online each Wednesday and will be due the following Wednesday in class by 5:00 PM. No late work will be accepted.

Academic Integrity
All work that you submit must be solely produced by you. Collaboration with classmates is allowed

only regarding general approaches to problems and comparison of final answers. When actually working out solutions (any time you are writing things down), you must work alone.

Exams

- All examinations will be open book (required text only), notes, homework and handouts. No other sources are allowed. No cellphones, computers, or anything with wireless or internet access may be used.

- Midterm exam will be in late-February during class. The exact date and location will be announced later.
- Final grade will depend entirely on the performance on the above components, and be independent of the financial support requirements (e.g., minimum grade requirement for tuition reimbursement).
- Please schedule your work-related travel during time periods outside of the mid-term and final exams. Accommodation to take exams on different dates will be made for only family emergencies, religious observance and documented illness or health-related emergencies.

Topics

- Review of 1st and 2nd order ordinary differential equations (Chap. 1-2)
- Review of Laplace transforms (Chap. 3)
- Series solutions (Chap. 4)
- Fourier series, integrals and transforms (Chap. 13-14)
- Special Functions (Chap. 15)
  - Eigenfunction expansions and Sturm-Liouville problems
  - Legendre polynomials
  - Bessel functions
- Partial Differential Equations (Chap. 16-18 plus material not covered in text)
  - Separation of Variables
  - Laplace Transform
  - Method of Characteristics

Tentative Course Outline:
The weekly coverage might change as it depends on the progress of the class.

Week	**Content**
Week 1	• Review of Ordinary Differential Equations. Solution of homogeneous equations with constant coefficients. Solution of nonhomogeneous equations by the method of undetermined coefficients.
Week 2	• The method of variation of parameters for general second order equations. Problems with variable coefficients. The method of Frobenius. Legendre's equation and Bessel's equation.
Week 3	• Introduction to Fourier series. Representation of piecewise continuous functions as sine and/or cosine series. Double and multiple Fourier series
Week 4	• Fourier integrals and Fourier transforms
Week 5	• Introduction to Partial Differential Equations. Classification of Partial Differential Equations– parabolic, elliptic and hyperbolic equations. Boundary conditions.
Week 6	• Wave equation, D'Alembert's solution. The method of characteristics.
Week 7	• The method of separation of variables. The diffusion equation. Application of Fourier series to partial differential equations
Week 8	• Sturm-Liouville theory. Orthogonal eigenfunctions. Classification of boundary conditions for orthogonality.
Week 9	• Partial Differential Equations in cylindrical coordinates. Bessel functions. Fourier-Bessel series. Steady-state and time-dependent problems involving cylinders.
Week 10	• Problems in spherical geometry. Legendre polynomials. Fourier-Legendre series. Spherical Bessel functions for time-dependent problems.
Week 11	• Non-homogeneous Partial Differential Equations. Problems in elasticity, heat conduction, electrostatics and fluid mechanics. The method of eigenfunction expansions. Solution to Poisson's equation in rectangular, cylindrical and spherical geometry.
Week 12	• Green's functions for partial differential equations
Final	Wednesday, May 3

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect ones own academic work from misuse by others as well as to avoid using anothers work as ones own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: `http://www.usc.edu/dept/publications/SCAMPUS/gov/`. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: `http://www.usc.edu/student-affairs/SJACS/`.