

**Syllabus**  
**MAE/MSE 502 Partial Differential Equations in Engineering**  
Spring 2022 M/W 6:00-7:15 PM, In-Person, Classroom: LSE 106

**1. Contact Information**

Instructor: Huei-Ping Huang (hp.huang@asu.edu), ERC 359

**2. Office Hours**

Monday 3-5 PM, Tuesday 3-5 PM, or by appointment. The office hours will provide opportunities of discussion on course material with instructor.

**3. Course Description**

Development and solution of partial differential equations in engineering. Applications in solid and fluid mechanics, vibrations, and heat transfer.

**4. Enrollment Requirements**

Graduate Engineering student; Credit is allowed for only MAE 502 or MSE 502.

**5. Course Objectives**

This course will derive partial differential equations relevant to scientific and engineering applications and discuss the methods for their solutions.

**6. Expected Learning Outcomes**

- Derivation of partial differential equations in engineering
- Solution of elementary linear partial differential equations
- Analysis of partial differential equations in engineering applications

**7. Grade Policies**

Grade will be based on performances in homework (5-6 assignments expected), and two exams, as weighted in the following: Homework 55%, Midterm 20%, Final exam 25%

The expected thresholds for letter grades are: A = 90%, B = 80%, C = 70%, D = 60%, E = Below 60%. These thresholds are subject to adjustments depending on the distribution of the total scores for the class.

## **8. Absence and Attendance Policies**

### *(a) General Policy*

Instructor will arrange make-up exams, extension of deadline for projects, and/or assignment of alternative projects for students who are excused from class with proper reasons. This policy will accommodate students with the following circumstances:

**a.** Excused absences related to religious observances/practices that are in accord with ACD 304–04, “Accommodation for Religious Practices”

**b.** Excused absences related to university sanctioned events/activities that are in accord with ACD 304–02, “Missed Classes Due to University-Sanctioned Activities”

**c.** Excused absences related to missed class due to military line-of-duty activities that are in accord with ACD 304–11, “Missed Class Due to Military Line-of-Duty Activities,” and SSM 201–18, “Accommodating Active Duty Military”

Students who expect to miss class due to officially university-sanctioned activities should inform the instructor early in the semester. Alternative arrangements will generally be made for any examinations and other graded in-class work affected by such absences.

### *(b) Attendance*

Instructor does not plan to take attendance for class participation on a regular basis. Students are strongly encouraged to attend all classes to acquire the knowledge and skills that are needed to succeed in this class.

## **9. Faculty recording of class sessions**

Faculty may record class meetings to make an archived recording available to enrolled students, instructors, or support personnel. Creation of recordings for groups beyond these requires consent from students who are recorded.

For this class, lectures will not be recorded on a regular basis. However, recordings or similar supplementary material will be made if needed to assist students who are absent for illness or other legitimate personal reasons.

## **10. Readings, Assignments, Examinations, Special Materials, Required Activities**

### *(a) Course Outline*

Textbook: Applied Partial Differential Equations, 5th Edition, by R. Haberman, Pearson, Required

Additional recommended book: Partial Differential Equations for Scientists and Engineers, by S. J. Farlow, Dover.

*Topics to cover:*

### **I. Analytic solution of linear PDE**

1. Overview of PDE; Commonly encountered PDEs in engineering and science; Types of PDEs, the physical phenomena they represent, and boundary conditions
2. Method of separation of variables; Eigenfunction expansion
3. Sturm-Liouville system and orthogonal representation
4. Fourier series; Solution of PDE by Fourier series expansion
5. Forced problem and non-homogeneous system
6. PDE in non-Cartesian geometry
7. Fourier transform; Solution of PDE by Fourier transform (will be discussed if time permits)

### **II. Additional topics**

8. Brief introduction to nonlinear PDE; Examples of nonlinear PDEs for real world phenomena; Behavior of their solutions; Conservation laws
9. Method of characteristics; Solution of first order PDE

*Programming using Matlab or equivalent:* Although this course will focus on analytic solutions, some lengthy computations in homework assignments will require programming using Matlab (or other programming languages/tools such as Fortran, C++, Python, Java, R). A beginner's guide for Matlab will be posted to the class website.

### **11. Policy regarding expected classroom behavior**

Adhering to ASU guideline, any violent or threatening conduct by a student in this class will be reported to the Office of the Dean of Students.

### **12. Academic Integrity**

Students in this class must adhere to ASU's academic integrity policy, which can be found at <https://provost.asu.edu/academic-integrity/policy>). Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. In addition, all engineering students are expected to adhere to both the ASU Academic Integrity **Honor Code** and the Fulton Schools of Engineering **Honor Code**. All academic integrity violations will be reported to the Fulton Schools of Engineering

Academic Integrity Office (AIO). The AIO maintains record of all violations and has access to academic integrity violations committed in all other ASU college/schools. Specific rules for collaboration on homework and projects will be released separately in the beginning of the semester. A violation of the rule(s) may lead to lowering of the score for the assignment, in addition to consequences of a violation of ASU's Academic Integrity Policy.

### **13. Copyright**

Students must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement. The contents of this course, including lectures and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions is authorized only for the use of students enrolled in this course during their enrollment in this course. Recordings and excerpts of recordings may not be distributed to others. (see [ACD 304–06](#), “Commercial Note Taking Services” and ABOR Policy [5-308 F.14](#) for more information).

### **14. Policy against threatening behavior, per the Student Services Manual, [SSM 104–02](#)**

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services (see [SSM 104-02](#), <https://www.asu.edu/aad/manuals/ssm/ssm104-02.html>). Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on-or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students

### **15. Warning of Offensive Class Materials**

Participants of this class who find any course material objectionable may consult with the instructor or MAE Program Chair to identify appropriate accommodations.

### **16. Disability Accommodations**

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with the ASU Disabilities Resource Center and provide documentation of that registration to the instructor. Students should communicate the

need for an accommodation in sufficient time for it to be properly arranged. See [ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities](#).

## **17. Harassment and Sexual Discrimination**

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information. Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at <https://sexualviolenceprevention.asu.edu/faqs>. As a mandated reporter, instructor is obligated to report any information that instructor becomes aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available if students wish discuss any concerns confidentially and privately.

## **18. Update of Syllabus**

Any information in this syllabus may be subject to change with reasonable advance notice.