

## Syllabus

### MAE/MSE 502 Partial Differential Equations in Engineering, Fall 2019

Time: M/W 6:00-7:15 PM, Classroom: SCOB 228

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

Office hours: Monday 3-5 PM, Tuesday 3-5 PM, or by appointment

**Course website <http://www.public.asu.edu/~hhuang38/MAE502.html>**

*Note: Items 4-10 in this syllabus are modified from a template provided by FSE to aid compliance with the syllabus requirements of ACD 304-10.*

#### 1. Course Objectives and Expected Learning Outcomes

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

#### 2. Readings, Assignments, Examinations, Special Materials, Required Activities

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. This is a well-written book that is ideal for self-study.

#### *Course Outline*

##### ***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. Fourier transform; Solution of PDE by Fourier transform

###### 6. PDE in non-Cartesian geometry

###### 7. Forced problem and brief introduction to Green's function

##### ***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

Six homework assignments and two exams (midterm and final) are expected. The techniques for solving homework and exam problems will be covered in the lectures.

*Requirement of 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.

### **3. Grading Policies**

Grade will be based on performances in six homework assignments and two exams (midterm and final), weighted as following: Homework 50%, Midterm 20%, Final exam 30%

Specific rules for collaboration on homework will be released 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.

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

### **4. Absence & Make-Up Policies**

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 who have (a) Excused absences due to an emergency, illness, or other unforeseeable events that prevent students from attending class or completing a project within the regularly allocated time ; (b) Excused absences related to religious observance/practices that are in accord with ACD 304-04, "Accommodation for Religious Practices"; (c) Excused absences related to university sanctioned events/activities that are in accord with ACD 304-02, "Missed Classes Due to University-Sanctioned Activities"

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. The preceding policies are based on ACD 304-04, "Accommodation for Religious Practices" and ACD 304-02, "Missed Classes Due to University-Sanctioned Activities."

### **5. Classroom Behavior**

Note-taking using electronic devices such as laptops is permitted as long as the activity does not cause disruption to the lecture or disturbance to other participants in the class. Cellphone and similar communication devices should be turned off or set to silent mode when class is in session. Any violent or threatening conduct by an ASU student in this class will be reported to the ASU Police Department and the Office of the Dean of Students.

## **6. Academic Integrity**

All 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 (<https://provost.asu.edu/academic-integrity/honor-code/>) and the Fulton Schools of Engineering Honor Code (<https://engineering.asu.edu/ira-a-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 to this class, limited collaboration is allowed for homework assignments. Specific rules for collaboration on homework will be given in the individual assignments.

## **7. Copyright**

Course content, including lectures, are copyrighted materials and students may not share outside the class, upload to online websites not approved by the instructor, sell, or distribute course content or notes taken during the conduct of the course (see ACD 304–06, “Commercial Note Taking Services” and ABOR Policy 5-308 F.14 for more information).

You 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.

## **8. Disability Accommodations**

Suitable accommodations will be made for students having disabilities and students should notify the instructor as early as possible if they will require same. Such students must be registered with the Disability Resource Center and provide documentation to that effect.

## **9. Offensive Materials**

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

## **10. Sexual Discrimination**

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, the instructor is obligated to report any information upon becoming aware of alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, <https://eoss.asu.edu/counseling>, is available for students who wish to discuss any concerns confidentially and privately.

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