

# IOWA STATE UNIVERSITY

Department of Ag & Biosystems Engineering

## **TSM 593: Applied math for technologies**

TSM 593. Workshop in Technology. Cr. 3. Repeatable.

Prereq : Graduate classification and permission of instructor.

Note: This is a class that is designed to give technology/engineering related students hands on experience with math concepts through detailed examples. This class will give technology/engineering students the experience of practical math applications through graphical and example based learning.

## **SYLLABUS**

**Catalog Description:** (2-2) Cr. 3.

### **Class Meeting Times & Locations:**

Lecture/Lab: TBD

Lab: TBD

**Instructor:** Prof. D. Grewell

Office: TBD

Office Phone: 294-2036

Email: [dgrewell@iastate.edu](mailto:dgrewell@iastate.edu)

Office Hours: Appointment

### **Teaching & Lab Assistant:**

**Course Text:** Possibly Francis Hildebrand's books if we can find copies

**Lab Fee:** None

**Purpose of the Course:** The purpose of this course is to provide students with fundamental engineering and modeling concepts. These concepts include FEA modeling of multi-physical problems, finite difference, transfer functions, differential equations with practical applications, such as heat and mass transfer.

**Course Objectives:** Upon completing this course, the student will:

1. Use standard analytical techniques in solving problems related to engineering.
2. Become familiar with FEA fundamentals and methods including multi-physical problems with ANSYS
3. Understand some basic governing principles.
4. Derive differential equations for common engineering problems
5. Define boundary conditions for common engineering problems
6. Solve differential equations for common engineering problems

### **Grading:**

<b>Assessment</b>	<b>Points</b>	<b>Weight</b>
Midterm exam	50	50%
Class project	50	50%
<b>TOTAL</b>	<b>100</b>	

A class project will be required by all students at the end of the semester. This project will include:

- 1) Identification of an engineering problem that requires a solution involving differential equations not reviewed in the class (problem must be approved by instructor)
- 2) Deriving and solving the differential equations
- 3) Confirming solution with FEA or other method
- 4) Report and presentation on the problem and solution (30 minutes)

### 5) Percentage Scale for Letter Grades

A	95-above	A-	90-94		
B+	87-89	B	84-86	B-	80-83
C+	77-79	C	74-76	C-	70-73
D+	67-69	D	64-66	D-	60-63
F	59-below				

Extra Credit. No extra credit.

In general AE students will need to derive and solve the differential equations and TSM students are only required to derive and solve limited differential equations.

Week	Activity	Topic/Comments
1 (1/11)	Lecture	Introduction
1	Lecture	Calculus
1	Lab	Mathcad
2 (1/18)	<b>No class</b>	
2	Lecture	Numerical calculations
2	Lab	Mathcad
3 (1/25)	Lecture	Complex numbers
3	Lecture	Finite difference
3	Lab	Ansys
4 (2/1)	Lecture	Linear algebra
4	Lecture	Linear algebra
4	Lab	Ansys
5 (2/8)	Lecture	Fourier transforms
5	Lecture	FEA
5	Lab	Ansys
6 (2/15)	Lecture	DFEQs (sep., trafns)-lumped Para.
6	Lecture	DFEQs (homo, part)-lumped Para
6	Lab	Ansys
7 (2/22)	Lecture	Heat flow (SS)
7	Lecture	Heat flow (transient)
7	<b>3,6 hour labs (R,F,S)</b>	Ansys
8 (3/1)	Lecture	Heat flow (transient)
8	Lecture	Heat flow (point source)
8	Lab	Midterm
9 (3/8)	Lecture	Vibrations
9	Lecture	Vibration with atten.
9	Lab	Ansys
	<b>Spring break</b>	<b>No class</b>
10 (3/22)	Lecture	Fluid flow (continuity)
10	Lecture	Fluid flow (motion)
10	Lab	Ansys
11 (3/29)	Lecture	Fluid flow (pipe)
11	Lecture	Fluid flow (dies)
11	Lab	Ansys
12 (4/5)	Lecture	Fluid flow (non-Newtoian)

12	Lecture	Fluid flow (screw)
12	Lab	Ansys
13 (4/12)	Lecture	Stress (3D)
13	Lecture	Stress (3D)
13	Lab	Ansys
14 (4/19)	Lecture	Cavitation models
14	Lecture	Cavitation models
14	Lab	Class project
15 (4/26)	Lecture	Class project
15	Lecture	Class project
15	Lab	Class project
16		<b>FINAL</b>

5/5-5/9 finals

### **Course Policies:**

Attendance not required but insight into exams are provided during lectures. Labs are required.

Absence from Exams: Make up exams will be provided and administered during off-hours by myself, provided that the absence is excusable.

Absence from Labs: Every 5 unexcused absences will result in a deduction of 5% from your final grade percentage. For example, if you have 5 to 9 absences, you will lose 5% off your final grade percentage; if you have 10 to 14 absences, you will lose 10%. I will contact you personally to discuss any excessive absences. Make-up work or special circumstances will be considered at my discretion, and excused absences will be dismissed.

Late Work Without permission, late homework will not be considered.

Disability Statement. Iowa State University complies with the American with Disabilities Act and Section 504 of the Rehabilitation Act. Any student who requires an accommodation under such provisions should contact me as soon as possible, with the proper documentation from the Disability Resources office. No retroactive accommodations will be provided in this class. See your academic advisor for help with obtaining documentation.

Basic Safety Rules & Concepts. No special requirements

### **Student Requirements (Summary)**

\_\_\_ Printout of lecture notes before each class

\_\_\_ Calculator (for lab and exams)