

**1. Department, Course Number, and Course Title:**

**MECHANICAL ENGINEERING**

**ME 409 MECHANICAL ENGINEERING ANALYSIS**

**2. Designation:** Required  Elective   
Lower Division  Upper Division

**3. Course Description:** Setup of vibration, heat transfer, fluid flow, and other mechanical engineering systems as ordinary and partial differential equations; analogies between various physical systems. Classical, transform, numerical, and computer-aided methods for solutions.

**4. Prerequisites:** Math 215 and Senior Standing

**5. Text and Materials:** Advanced Engineering Mathematics, 8<sup>th</sup> Edition, E. Kreyszig, John Wiley and Sons, 1999.

**6. Course Objectives:** To teach students some basic concepts needed for analysis and design of mechanical engineering systems

Course Outcomes

- the ability to apply advanced mathematical methods to the analysis and design of engineering systems
- the ability and skill to develop idealized mathematical model of physical systems that capture the salient aspects of the system.
- the ability to apply ordinary and partial differential equations to model engineering systems.
- the ability apply numerical methods and computer-aided engineering software and perform simulation studies.
- an ability to communicate effectively.
- a desire to be a flexible and adaptable team player.

**7. Topics Covered:** (in Order of Presentation)

- First Order Differential Equations
- Linear Differential Equations of Second and Higher Order
- Development of Mathematical Models
- Application of Laplace Transformation Solution of Differential Equations to Mechanical Engineering Systems
- Fourier Analysis
- Partial Differential Equations

**8. Class Schedule:** Number of Sessions per week: 2  
Duration of each session: 1 hour 40 minutes

**9. Contribution of course to meeting the professional component:**

This course is part of the 25 units of upper division technical electives required for the mechanical engineering program.

Engineering Science 4 units

**10. Relationship of course to program objectives:**

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

Knowledge outcomes:

- an ability to apply knowledge of mathematics, science, and engineering (abet a)
- a knowledge of computer aided design and simulation software

Skill outcomes:

- an ability to communicate effectively (abet g)
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
- an ability to think in a logical sequential process

Attitudes Outcome:

- an understanding of responsibility and accountability

**11. Prepared by:** Adel Sharif

05/2005