

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

**MECHANICAL ENGINEERING**

**ME 421 DYNAMICS OF MACHINES**

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

**3. Course Description:** Application of principles of statics, kinematics, and dynamics to analyze and design of mechanisms with rotating or reciprocating masses

**4. Prerequisites:** ME 321, Kinematics of Mechanisms

**5. Text and Materials:** Design of Machinery, 3<sup>rd</sup> edition, R.L. Norton, Mc Graw Hill, 2005.

**6. Course Objectives:** Students will learn current engineering methods used in the analysis and design of dynamic mechanical systems.

Course Outcomes

- the ability to determine static and dynamic forces in mechanisms.
- the ability to formulate and solve differential equations of motion for multimass, single degree of freedom mechanical systems.
- the ability to analyze and design compound and epicyclic gear trains.
- an ability to determine the required inertial effect of flywheels and determine the gyroscopic effects of rotors.
- the ability to analyze the dynamics of cam operated systems.
- the ability to determine critical speeds in machines and to select isolation mounts to reduce motion and transmitted forces in vibrating systems.

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

- Virtual work methods in mechanisms
- Energy methods in formulating equation of motion in mechanisms
- Gear Trains
- Flywheels
- Cam Systems
- Undamped vibrations, rotating unbalance, critical speeds and transmissibility of motion and force in vibrating systems
- Transformation of moments of inertia in rigid bodies
- Gyroscopic effects of flywheels

**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 24 units of technical electives required for the mechanical engineering program.

Engineering Science 1 units  
Engineering Design 3 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:

- a knowledge of computer aided design and simulation software

Skill outcomes:

- an ability to design a system, component, or process to meet desired needs within realistic constraints such

as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)

- 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

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