

**ME 35401
MACHINE DESIGN LABORATORY**

Course Outcomes [Related ME Program Outcomes in brackets]

1. Experiments on static and fatigue failure. [6]
2. Comparison of theory with physical experiments and simulation. [1]
3. Application of failure theories to design of machines. [2]
4. Open ended design projects. [2,3,7]

Static & Fatigue Failure

1. Ductile and Brittle failure
2. Experimental evaluation of Marin factors using RR Moore machine
3. Mechanical properties of notched and un-notched specimen; experiments to analyze the effects of stress concentration.
4. Static and fatigue failure of mechanical components manufactured through different processes (including advanced processes such as additive manufacturing).

Machine Components

1. Component selection
2. Standards

**Mechanical
Systems (Machines)**

1. Machine disassembly
2. Design of machines
3. Modeling real mechanical systems
4. Prototyping

Sample Labs and Design Projects

- Lawnmower engine disassembly
- Using the R.R. Moore machine to investigate the influence of surface roughness, size, geometry (i.e., the considerations included in Marin factors).
- Effects of stress concentration on fatigue failure of ductile and brittle materials
- Fatigue failure of additively manufactured parts
- Investigating 3D manufacturing of parts. Predicting failure (static and/or fatigue) with hand calculations, and/or simulation and comparing these results to experiments
- Design and development of in classroom demonstration test rigs

COURSE NUMBER: ME 35401

COURSE TITLE: Machine Design Laboratory (1 credit)

REQUIRED COURSE OR ELECTIVE COURSE: Required

TERMS OFFERED: Fall and Spring

TEXTBOOK/REQUIRED MATERIAL:

None. Handouts provided by the instructors.

PRE-REQUISITIES:

ME 263 Introduction to Mechanical Engineering Design, Innovation, and Entrepreneurship
ME 274 Basic Mechanics II
ME 323 Mechanics of Materials

COORDINATING FACULTY: TBD

CONCURRENT PRE-REQUISITES:

ME 35400 Machine Design

COURSE DESCRIPTION: Physical experiments on static and fatigue failure of mechanical parts. Application of failure theories to design of mechanical components and systems. Open-ended design projects to reinforce the design process.

COURSE OUTCOMES [Related ME Program Outcomes in brackets]:

1. Experiments on static and fatigue failure. [6]
2. Comparison of theory with physical and virtual experiments. [1]
3. Application of failure theories to design of machines. [2]
4. Open ended design projects. [2, 3, 7]

ASSESSMENTS TOOLS:

- Laboratory reports.
- Project reports.

NATURE OF DESIGN CONTENT: The students are required to design mechanical components and systems.

RELATED ME PROGRAM OUTCOMES:

1. Engineering fundamentals
2. Engineering design
3. Communication skills
4. Ethical/Prof. responsibilities
5. Teamwork skills
6. Experimental skills
7. Knowledge acquisition

PROFESSIONAL COMPONENT:

1. Engineering Topics: Engineering Science – 40%
Engineering Design – 60%

COMPUTER USAGE: The design projects require students to write computer programs to conduct analysis studies.

COURSE STRUCTURE/SCHEDULE:

Laboratory - 1 day per week at 150 minutes.

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