TO: The Engineering Faculty

FROM: The Faculty of the School of Mechanical Engineering

RE: Course Revision – ME 35200 Machine Design I

The Faculty of the School of Mechanical Engineering has approved the following course revision. This action is now submitted to the Engineering Faculty with a recommendation for approval.

FROM:

ME 35200 Machine Design I, Sem. 1, 2, SS, Class 3, Lab 1, Cr. 4. Prerequisites: ME 263, ME 274, and ME 323.

Introduction to the principles of design and analysis of machines and machine components. Design for functionality, motion, force, strength, and reliability. The laboratory experience provides open-ended projects to reinforce the design process.

TO:

ME 35200 Machine Design I, Sem. 1, 2, SS, Class 3, Lab 1, Cr. 4. Prerequisites: ME 263, ME 374, and ME 323.

Introduction to the principles of design and analysis of machines and machine components. Design for functionality, motion, force, strength, and reliability. Review of fatigue failure theories and analysis of fatigue stresses. Laboratory experience provides open-ended projects to reinforce the design process.

Reason: Since ME452 is no longer a restricted elective and the design faculty believe that the students graduating from ME should have a background in machine element fatigue, the faculty members believe a review of fatigue failure theories and analysis of fatigue stresses should be included in the core class (ME 352).

James D. Jones, Associate Head/Professor
School of Mechanical Engineering

ME 352
MACHINE DESIGN I

Course Outcomes [Related ME Program Outcomes in brackets]

1. Understand the fundamental *kinematics* and *kinetics of machines*. [A2, A3]
2. Understand the fundamentals of *stress analysis* of beam-like machine parts. [A2, A3]
3. Understand *fatigue failure mechanisms*. [A2, A3]
4. Analyze *fatigue stresses* in machine components. [A2, A3, A7]
5. Enhance *problem-solving* and *communication* skills through short and long design projects. [A2, A3, A5, A7, B3]

Kinematics & Kinetics of Machines (6 wks)

1. Synthesis
2. Vector Loops
3. Position Solutions
4. Velocity Solutions
5. Accel Solutions
6. Point Path, Curvature
7. Rolling Contact
8. Dynamic Force Analysis
9. Equation of Motion

Static & Fatigue Failure Theories (6 wks)

1. Stress Analysis Procedure
2. State of Stress
3. Static Failure Theories
4. S-N Diagrams
5. High Cycle Fatigue
6. Stress Concentration
7. Fully Reversed Loading
8. Non-Zero Mean Stress
9. Combined Loading

Applications (3 wks)

1. Serial Chain Manipulator Mechanisms
2. Intro to Design of Common Machine Components
3. Design of Bolts
4. Design of Shafts

Typical Laboratory Activities

- Product dissection, modeling, & mobility analysis
- Synthesis & analysis of a 4 to 6-bar mechanisms
- EOM for spring-damper mechanisms
- Force analysis in 4-bar mechanism
- Analysis of a crank shaft
- Shape synthesis
- Computational design tool use
- Industry tours and guest speakers
- Broader impacts of engineering design

COURSE NUMBER: ME 352

COURSE TITLE: Machine Design I

REQUIRED COURSE OR ELECTIVE COURSE: Required

TERMS OFFERED: Fall, Spring and Summer

TEXTBOOK/REQUIRED MATERIAL:

Hall, A.S., Jr., *Notes on Mechanism Analysis*, Waveland Press, 1981.

R.G. Budynas and J. Keith Nisbett, *Shigley's Mechanical Engineering Design*, 8th ed, McGraw-Hill, 2007.

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

COURSE DESCRIPTION: Introduction to the principles of design and analysis of machines and machine components. Design for functionality, motion, force, strength and reliability. The laboratory experience provides open-ended projects to reinforce the design process.

COURSE OUTCOMES [Related ME Program Outcomes in brackets]:

1. Understand the fundamental kinematics and kinetics of machines. [A2, A3]
2. Understand the fundamentals of stress analysis of beam-like machine parts. [A2, A3]
3. Understand fatigue failure mechanisms. [A2, A3]
4. Analyze fatigue stresses in machine components. [A2, A3, A7]
5. Enhance problem-solving and communication skills through short and long design projects. [A2, A3, A5, A7, B3]

ASSESSMENTS TOOLS:

1. Weekly homework.
2. Design reports.
3. Laboratory projects.
4. Exams and Quizzes.
5. Comprehensive final exam.

NATURE OF DESIGN CONTENT: Linkages and shafts are designed to meet machine performance requirements. Analytical models are developed to evaluate the generality of the designs; these models are exercised to explore for improved designs.

RELATED ME PROGRAM OUTCOMES:

A2. Engineering fundamentals
A3. Analytical skills
A5. Open-ended design problem solving skills
A7. Work effectively in the global engineering profession
B3. Communication

PROFESSIONAL COMPONENT:

1. Engineering Topics: Engineering Science – 2 credits (50%)
   Engineering Design – 2 credits (50%)

COMPUTER USAGE: Several of the lab projects require students to write computer programs to conduct analysis studies for their design projects.

COURSE STRUCTURE/SCHEDULE:

1. Lecture - 3 days per week at 50 minutes
2. Laboratory - 1 day per week at 160 minutes.

PREPARED BY: Capelleri, Hess, Panchal

REVISION DATE: March 27, 2018