TO: The Engineering Faculty

FROM: The Faculty of the School of Mechanical Engineering

RE: New elective course - ME 45900 Mechanism and Machine Theory

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

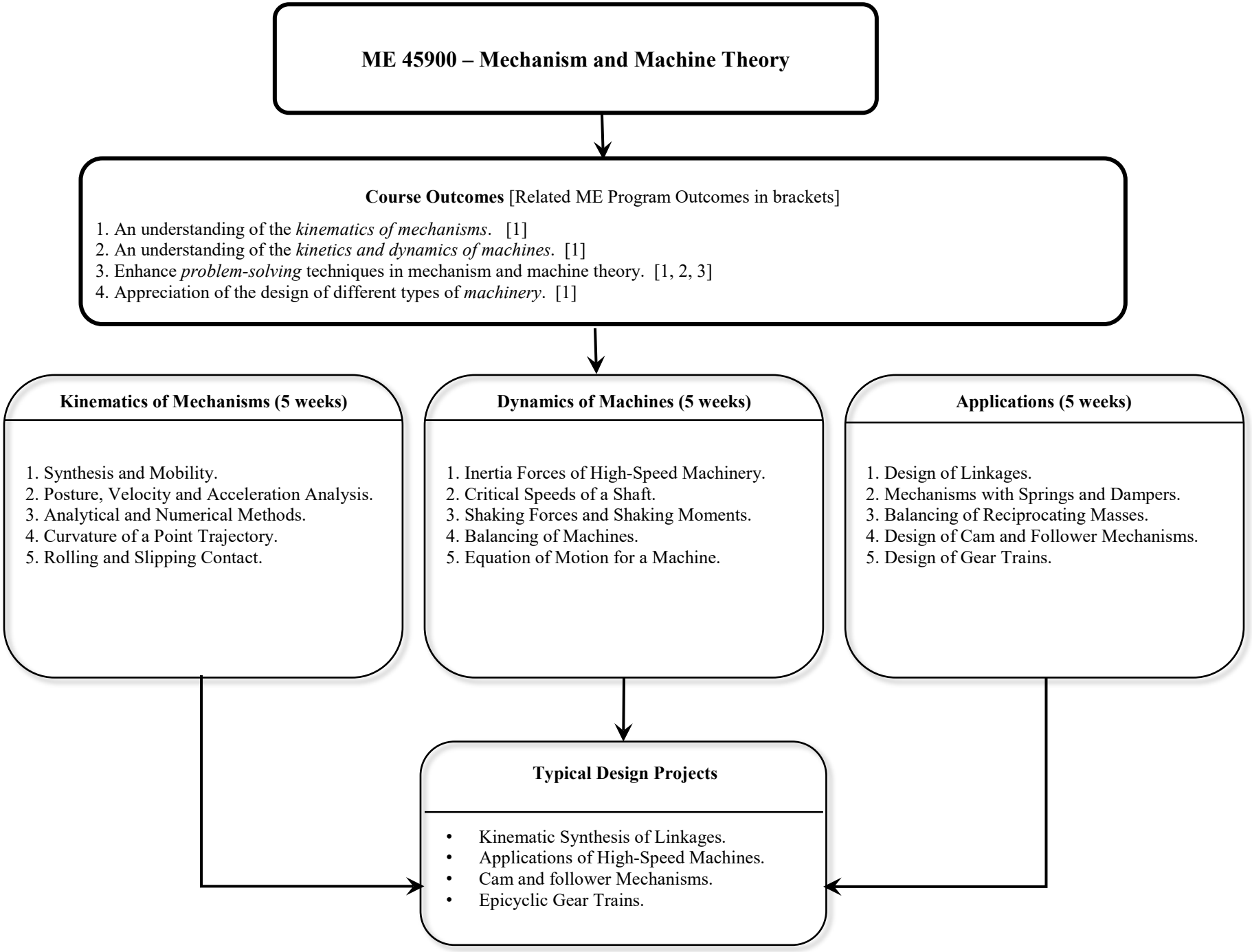
ME 45900 Mechanism and Machine Theory, Fall and Spring, cr. 3. Prerequisites: ME 27400 (Dynamics) and ME 35400 (Machine Design).
Attributes: Upper Division (junior level status).

Course Description: Introduction to the principles of the analysis and design of mechanisms and machinery. Design for functionality, motion constraints, dynamic forces and inertia force effects, critical speeds, and static and dynamic balancing.

History: Based on the feedback from students, alumni, and the industrial advisory board, the ME faculty decided to convert the required undergraduate ME 35200 "Machine Design I" into a 3-credit elective course with the course number ME 45900. The 4-credit ME 35200 was replaced by two required courses: ME 35400 – Machine Design (3 cr) and ME 35401 – Machine Design Lab (1 cr).

ME 45900 will focus on the kinematics of mechanisms, the dynamics of machines, and the design of machine components. The faculty believe that the topics covered in this course are important to the needs of mechanical engineering graduates. Details of this course are outlined in the appended material below.

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


ME 45900 – Mechanism and Machine Theory
Course Outcomes [Related ME Program Outcomes in brackets]
1. An understanding of the kinematics of mechanisms. [1]
2. An understanding of the kinetics and dynamics of machines. [1]
3. Enhance problem-solving techniques in mechanism and machine theory. [1, 2, 3]
4. Appreciation of the design of different types of machinery. [1]
Kinematics of Mechanisms (5 weeks)
1. Synthesis and Mobility.
2. Posture, Velocity and Acceleration Analysis.
3. Analytical and Numerical Methods.
4. Curvature of a Point Trajectory.
5. Rolling and Slipping Contact.
Dynamics of Machines (5 weeks)
1. Inertia Forces of High-Speed Machinery.
2. Critical Speeds of a Shaft.
3. Shaking Forces and Shaking Moments.
4. Balancing of Machines.
5. Equation of Motion for a Machine.
Applications (5 weeks)
1. Design of Linkages.
2. Mechanisms with Springs and Dampers.
3. Balancing of Reciprocating Masses.
4. Design of Cam and Follower Mechanisms.
5. Design of Gear Trains.
Typical Design Projects
• Kinematic Synthesis of Linkages.
• Applications of High-Speed Machines.
• Cam and follower Mechanisms.
• Epicyclic Gear Trains.

COURSE NUMBER: ME 45900

COURSE TITLE: Mechanism and Machine Theory

REQUIRED COURSE OR ELECTIVE COURSE: An elective course.

SEMESTERS OFFERED: Fall Semester and Spring Semester.

TEXTBOOK/REQUIRED MATERIAL:

Theory of Machines and Mechanisms, Fifth Edition, J.J. Uicker, Jr., G.R. Pennock, and J.E Shigley, Oxford University Press, 2017.

PRE-REQUISITIES: ME 27400 Dynamics and ME 35400 Machine Design.

COORDINATING FACULTY: G. R. Pennock

COURSE DESCRIPTION: Introduction to the principles of the analysis and design of mechanisms and machinery. Design for functionality, motion constraints, inertia force effects, and static and dynamic balancing.

COURSE OUTCOMES [Related ME Program Outcomes in brackets]:

1. An understanding of the kinematics of mechanisms. [1]
2. An understanding of the dynamics of machinery. [1]
3. An understanding of machine theory and design. [1]
4. Enhance problem-solving and communication skills. [1, 2, 3]

ASSESSMENTS TOOLS:

1. Homework and Quizzes.
2. Design Projects.
3. Formal Reports.
4. Final Exam.

NATURE OF DESIGN CONTENT: Design of linkages, cam and follower mechanisms, and gear trains. Design of machinery to meet performance requirements. Analytical and numerical methods are presented to evaluate the design components of a machine. Models are developed to understand the general features of a machine design.

RELATED ME PROGRAM OUTCOMES:

1. Engineering fundamentals.
2. Engineering design.
3. Knowledge acquisition for problem solving.
4. Communication skills.
5. Ethical and Professional responsibilities.

PROFESSIONAL COMPONENT:

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

COMPUTER USAGE: The design projects will require the students to write computer programs and generate spreadsheets to study the kinematics, kinetics, and dynamics of a particular machine.

COURSE STRUCTURE/SCHEDULE:

1. Lectures - 3 lectures per week at 50 minutes per lecture.

PREPARED BY: G. R. Pennock

REVISION DATE: 02-10-2021