TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Mechanical Engineering

RE: ME 36400 Systematic Engineering Design – Permanent course number

The faculty of the School of Mechanical Engineering has approved a permanent course number (ME 36400) for the course "Systematic Engineering Design." The action is now submitted to the Engineering Faculty with a recommendation for approval.

ME 36400: Systematic Engineering Design
Credits: 3 credits [2 (lectures) +1(lab)]
Offered: Spring, Summer, and Fall
Prerequisite: ME 26400 (Introduction to Manufacturing for Mechanical Design)

Description: The engineering design process including planning and clarification, conceptual design, embodiment design, and detail design. Identification of customer requirements and development of engineering specifications. Concept generation and selection. Rules and guidelines for embodiment design. Design considerations including quality, modularity, manufacturing, assembly, and economics. Detail design to support manufacturing.

Learning Outcomes:

1. Understand and apply a systematic design method.
2. Ability to understand customer needs and translate needs to engineering specifications.
3. Ability to generate concepts and use ideation techniques.
4. Ability to develop layouts using embodiment design techniques.
5. Ability to generate designs that are manufacturable.
6. Communicate design effectively to various stakeholders.
7. Effectively work in a team environment.
8. Ability to acquire and apply new knowledge and tools to support the design process.

Background: The faculty of Mechanical Engineering has determined that basic knowledge of manufacturing and hands-on manufacturing skills are important for all students graduating with BS in Mechanical Engineering, and these skills should be introduced early in the BSME curriculum. To achieve this goal, the current ME 263: *Introduction to Mechanical Engineering Design, Innovation, and Entrepreneurship* will be replaced with the new course ME 264: *Introduction to Manufacturing for Mechanical Design*, which has been approved by the ECC (ref. EFD 58-25). The design-related content in the current ME 263 will be moved to the proposed junior-level design course ME 364: Systematic Engineering Design. Moving the sophomore design course to the junior level would allow students to utilize scientific knowledge learned in other courses to their design projects. This course will be required for all BSME students. The course outline is attached below. This EFD is for the approval of the permanent course number. A separate EFD will be submitted with the new BSME plan of study.

Jitesh Panchal
Associate Head for Undergraduate Studies
Professor of Mechanical Engineering

ME 36400
Systematic Engineering Design

Course Outcomes [Related ME Program Outcomes in brackets]

1. Understand and apply a systematic design method. [2]
2. Ability to understand customer needs and translate needs to engineering specifications. [2]
3. Ability to generate concepts and use ideation techniques. [2]
4. Ability to develop layouts using embodiment design techniques. [1, 2]
5. Ability to generate designs that are manufacturable. [2]
6. Communicate design effectively to various stakeholders. [3]
7. Effectively work in a team environment. [5]
8. Ability to acquire and apply new knowledge and tools to support the design process. [7]

Planning and Clarification of Task

1. Understanding users' needs
2. Generating engineering specifications

Conceptual Design

1. Abstraction to identify essential problems.
2. Function structures
3. Working principles
4. Concept selection

Embodiment Design

1. Layout design
2. Diverse design considerations, such as modularity, quality, sustainability
3. Design guidelines, such as shape synthesis guidelines
4. Virtual and Physical Prototyping
5. Testing

Detail Design

1. Manufacturing considerations, including tolerances, material and process selection
2. Communicating designs to manufacturers
3. Assembly considerations
4. Economic considerations and cost estimation
5. Product lifecycle considerations

Guided Design Projects and Design Case Studies

Typical Examples:

1. Robotic vehicle design
2. Wearables and bio-mechanics design
3. Water filtration system
4. Design of a high-performance racing bicycle
5. HVAC design

COURSE NUMBER: ME 36400 **COURSE TITLE:** Systematic Engineering Design

REQUIRED COURSE OR ELECTIVE COURSE: Required

TERMS OFFERED: Fall, Spring, and Summer

TEXTBOOK/REQUIRED MATERIAL:
TBD

PRE-REQUISITIES:
ME 26400

COORDINATING FACULTY: Jitesh Panchal

COURSE DESCRIPTION: The engineering design process including planning and clarification, conceptual design, embodiment design, and detail design. Identification of customer requirements and development of engineering specifications. Concept generation and selection. Rules and guidelines for embodiment design. Design considerations including quality, modularity, manufacturing, assembly, and economics. Detail design to support manufacturing.

COURSE OUTCOMES [Related ME Program Outcomes in brackets]:

1. Understand and apply with a systematic design method. [2]
2. Ability to understand customer needs and translate needs to engineering specifications. [2]
3. Ability to generate concepts and use ideation techniques. [2]
4. Ability to develop layouts using embodiment design techniques. [1, 2]
5. Ability to generate designs that are manufacturable. [2]
6. Communicate design effectively to various stakeholders. [3]
7. Effectively work in a team environment. [5]
8. Ability to acquire and apply new knowledge and tools to support the design process. [7]

ASSESSMENT TOOLS:

1. Homework
2. Design reviews
3. Peer evaluations

RELATED ME PROGRAM OUTCOMES:

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

COURSE STRUCTURE/SCHEDULE:
Lecture - 2 days per week at 50 minutes
Lab - 2 days per week at 110 and 50 minutes

PREPARED BY: Beth Hess, Min Liu, Francisco Montalvo, Jitesh Panchal **REVISION DATE:** October 30, 2024