

MECH - 448 - Vehicle Design Project
Winter Term 2003
Required

2001 Catalog Data: Credit 4 (0 - 4 - 4)

Prerequisites: Senior standing

This course deals with a comprehensive vehicle design experience progressing from problem definition through ride, handling, chassis design, performance analysis to sketches, alternate design, general design, layout drawings, part's list of the chassis, body, suspension powertrain and culminating with small scale model of the vehicle and its subsystems.

Textbook(s): Handbook by the instructor

References: Fundamentals of machine components design by Robert C. Juvinall second edition Product design fundamentals and method by Roozenburg and Eakels John Willey
SAE vehicle design regulations (Published every year)

Coordinator(s): Prof. Pinhas Barak, Prof. Basem Alzahabi

Course Learning Objectives:

Objective 1: Work in teams and manage open-ended design projects with strict deadlines. ME-PO [D, G, Q]

- 1.1 Students will use project-planning tools to plan task, timing and coordinate design activities. [Q]
- 1.2 Students will function as members of a design team. [D]
- 1.3 Students will present design concepts graphically and orally, while documenting their work according to an established set of professional engineering publication guidelines. [G]

Objective 2: Think creatively and apply the steps involved in a typical design process. ME-PO [B, C]

- 2.1 Students will conduct brainstorming sessions and think creatively to achieve alternate design solutions. [C]
- 2.2 Students will practice design as a process rather than observe design as an event. [B]
- 2.3 Students will differentiate and execute the various steps of a typical design process in a structured fashion. [B]

Objective 3: Identify product attributes and design criteria. *ME-PO [C]*

- 3.1 Students will use a systematic design process to analyze the conceptualized product attributes and transfer these attributes to design criteria and engineering targets. *[C]*
- 3.2 Students will design for manufacturing considerations. *[C]*

Objective 4: Apply scientific tools for design generation, evaluation/selection, and development. *ME-PO [E, O]*

- 4.1 Students will use design tools such as an objective tree to properly define design goals, constraints, and scope. *[E]*
- 4.2 Students will use design tools such as brainstorming, concept tree, abstraction, etc. to generate design concepts. *[E]*
- 4.3 Students will use design tools such as Pugh's decision matrix to select from a pool of design concepts. *[E]*
- 4.4 Students will use computational tools to simulate the conceptualized product in the intended environment and synthesize to achieve targets and attributes. *[O]*

Objective 5: Understand the societal impact of design decisions and also understand the design restrictions/requirements/standards as specified by appropriate regulatory body. *ME-PO [F, J, K]*

Prerequisite by topic:

1. The design process model (Problem definition, synthesis, analysis refinement decision, evaluation, implementation)
2. Forces and loads based upon static equilibrium and FBD's
3. Stress and failure analysis
4. Physical properties and material
5. Characteristics of Internal combustion engine
6. Various types of power transmission systems
7. Vehicle performance prediction.
8. Chassis and suspension Design
9. Structure Design
10. Brakes and steering systems
11. Familiarity with the function of components and subsystems of a conventional automobile
12. CAD modeling using I-Deas , Finite Element Analysis , Math-Cad , Matlab working model , MCS-word and spread sheet

Week	Topic
1	Team Formation
2	Submitting plan of attack (For two semesters)
3	Concept generation and selection
4	Concept selection

- 5 Vehicle arrangement sketches
- 6 Vehicle design calculation and configuration
- 7 Vehicle ride, handling, and performance prediction
- 8 Working drawings
- 9 Working and assembly Drawings
- 10 Contacting vendors ordering parts and building a scale model
- 11 Final Design Report

Schedule: Two 120 minutes sessions per week.

Computer Usage: CAD (e.g. Ideas ,UG, ProE),Static and Dynamic Simulation tools(e.g.Matlab, Mathcad 8, Working Model ,SSnap) ,Finite Element Analysis, ADAMS.

Laboratory Project: The entire course consists of an open-ended design project.

Relationship to professional component: Four Credits Engineering Design.

Prepared by: Pinhas Barak

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