

## COLLEGE OF ENGINEERING HONORS SYLLABUS

**COURSE:** ME 27000, Basic Mechanics I  
**ACADEMIC PERIOD:** Fall 2020

### HONORS CONTRACT OBJECTIVES

The purpose of conducting this project is to give students an intuitive understanding on how different types of mechanisms (e.g., linkages, gears, shafts, etc.) are applied in practical mechanical systems (e.g, cars, cranes, aerospace vehicles, etc.). It also allows students to apply methods learnt in ME 270 to analyze the load transmission in these mechanisms as well as strain and stress for critical parts involved in the mechanisms.

### HONORS CONTRACT DELIVERABLES

#### 1. Model assembly

A Lego model of a real-life mechanical system will be provided to each student participating in the honor project. Examples of possible Lego model choices are shown in figure 1. Each student is asked to assemble one model of his/her choice. During the model assembly process, particular attention should be paid to understand the load transmission when each mechanism is in operation.



(a)



(b)



(c)



(d)

Figure 1. Examples of possible Lego models used in projects.

## 2. Choose mechanisms for analysis

Each student is required to choose at least two mechanisms of different types in the Lego model for later load and strain/stress analysis. For example, the crane arm linkage system, landing foot of Apollo 11, power train of a car, etc. Students need to write a brief description on the function of the chosen mechanisms and how different loads are transmitted through the mechanisms. It is also required for students to search for additional information and estimate the external loads for each chosen mechanism when it is operated in practice for one (or more) typical working condition(s). In addition, the geometric dimensions as well as the materials of different parts in the chosen mechanisms need to be estimated. All this information is required to be included in the written descriptions of the mechanisms.

## 3. Scale-up load and Strain/stress analysis

Based on the estimated external loads of each chosen mechanism under practical operating conditions, the loads at all the joints in the mechanisms need to be calculated. Students can give reasonable assumptions to facilitate their calculations. It is recommended (not required) to code the calculation process into a Matlab program, so that the program can perform load analysis on any given external load and geometric parameters.

After loads at the joints are calculated, students are required to perform strain/stress analysis on a number of parts in the mechanisms. For ME 270 students, it is required to perform strain/stress analysis for at least four parts of at least two different types. Parts with irregular geometries can be replaced by equivalent simple geometries in the strain/stress analysis, so that the analytical methods covered in class can be directly applied. It is also recommended to code the strain/stress analysis into a Matlab program.

## HONORS CONTRACT DEADLINES

A written report containing all of the above information (function of the chosen mechanisms; load transmission description; estimation of loads, geometric dimensions, and materials; results of load calculations and stress/strain analysis) should be submitted to the instructor no later than December 1. All code produced for this project shall be included, along with any libraries necessary to execute the code.

## **HONORS CONTRACT EXPECTATIONS**

A final grade for the honor project will be given to each student based on the following aspects: the written report of the project; the number of mechanisms and parts chosen for analysis; the accuracy, difficulty level, and completeness of analysis; the estimation of loads, geometry and material information; recommended coding work; other related comments made based on the analysis done in the project.

## **HONORS GRADING SCHEME**

In the calculation of the final grade of the course for honor students, the grade of the honor project will have a weighting of 5% (this weighting is still under discussion among the instructors and is subject to change) of the final grade of the course. The weighting of the honor project is taken away from the weighting of homework and quizzes listed in the syllabus of the regular course.