ISE 316
Manufacturing Engineering I: Processes
FALL 2019

COURSE PROJECT
(100 pts.)

Introduction:

ISEs are frequently involved in new product development. In this project, each team is tasked with the development of a new NC State themed *coaster set*. The goal is to design an aesthetic and functional product, engineer the necessary manufacturing processes, and develop relevant product engineering documentation to mass produce (qty. 100,000) the product while minimizing the total production time and cost. The project allows teams to display creativity and demonstrate an understanding of concepts illustrated in the course and the ability to synthesize design, manufacturing and economic analyses.

All team members are responsible for the final content (product and report), and the work load should be equitably shared. *A confidential peer evaluation will be conducted at the end of the project, and its outcomes will be taken into consideration during grading.* Each team will provide updates during the 3 review meetings in the semester. Teams are strongly encouraged to start early and work closely with the instructor, TA and lab manager to accomplish this project.

Product Requirements:

Each team will produce a set consisting of one aluminum coaster and a polymer holder/stand assembly. The teams have creative freedom provided the design and fabrication methods satisfy the following requirements and are approved by the instructor and TA:
1) The maximum size of each coaster should be 3.75" x 3.75" x 0.5"
2) Each coaster should include:
    a. at least one instance of a curved surface, fillets or chamfers
    b. at least one pocket feature
    c. at least one instance of NSCU/ISE themed artwork
3) The holder/stand should consist of two or more individual components (e.g., combination of blocks and/or shafts/pins) assembled together (e.g., press/snap fit, screw assembly).
4) CNC machining (based on Fusion360 programs) should be the primary manufacturing process. Additionally, at least one component (e.g., NCSU themed insert) must be laser beam machined.
5) The final set including the assembled holder/stand and the coaster should fit within an envelope of 5" x 5"x 5".

Report Requirements:

The report should focus on the following four primary aspects:
1) Product design and specifications
    a. CAD drawings (with complete engineering specifications) of individual components and assembly
    b. Section(s) to explain the actual product design/assembly and functionality
    c. Section(s) to explain your dimension/tolerance assignments

2) Manufacturing process plans
   a. Process plans describing all manufacturing steps, conditions, tooling, etc.
   b. Section(s) to describe the processes used and justify their selection
   c. Section(s) to describe and justify work-holding & fixturing for all value-added operations
   d. Determination of production time (by operation, and total)
3) Inspection plan
   a. Plan for production inspection
   b. Data from actual inspection of the product you manufactured in the lab
4) Economics of manufacturing
   Estimate the total manufacturing cost if the product were made in:
   a. USA
   b. Mexico

The following guidelines should help in organizing the report to convey the required information. *A report template will be provided in Moodle.*

General Organization: The report should have a cover page with project title, team member names, and submission date. It should also include a table of contents listing all sections/sub-sections and appendices. Use appendices to document details, including calculation steps and detailed engineering drawings, which are not appropriate in the main body. Appendices should be titled and lettered.

Writing: The report should not be a series of disparate sections compiled together on the day of submission. Instead, think of it as a cohesive report submitted to the VP of Product Engineering, providing them the necessary information about the design, manufacturing, and economics of the product to help them make a decision about how and where the product should be manufactured. Each section should contain concise prose explaining the aspect under consideration. A section on design (*requirement 1 above*) should describe the product design, its impact on processing and the rationale behind the selection of tolerances. It should not simply contain the CAD drawings. Similarly, process plans (*requirement 2 above*) should be explained and the rationale given (e.g., why produce one set of features in a particular way and then refixture for others). They should include all manufacturing operations, not just CNC machining. This might include loading/unloading, fixturing/refixturing, in-process inspection, assembly, laser cutting, etc. All relevant calculations should be explicitly presented in the appendices. All figures and tables should be numbered and cited in the text.

Assumptions: All assumptions should be explicitly stated and justified. If any external data (e.g., wage rates) or other sources of information (books, conference/journal papers, websites etc.) were used, these should be cited in the text and included in a Bibliography section at the end of the report.

Grading:

The project accounts for 25% of the course grade. Of this, 10% is assigned to the 3 review meetings which will entail the team giving 15-20 min presentation about the project status to the instructor and TA during the lab (see schedule). Missing a review meeting or being ill-prepared will affect this grade. Rest of the project grade (90%) will be based on:
1) Realization of the complete final product meeting the requirements described above
2) Meeting the report requirements described above
3) Peer evaluations

Merit will be given to the effort as well as the final execution.

Schedule:

Week	Date	Details
6	9/24,26,27	Review Meeting#1: Product conceptual designs
9	10/15,17,18	Review Meeting#2: Complete CAD drawings
12	11/5,7,8	Review Meeting#3: Process plans and CAM codes
Finals	**12/9**	**Completed physical product + report**