Assignment Manual

CPE 322: Engineering Design VI for Electrical and Computer Engineers

Assignment 0 — GitHub Repository

- Sign in (or sign up) a GitHub account
- Click "Edit profile" to add information and click "Save"
- Click "New" at GitHub Repositories to create a repository (repo) for this course
- Click "Create new file" and name it README.md
- Use Markdown to style headings, text, lists, images, quotes, code, and extras
- Click "Commit new file"
- Submit the clickable link to the GitHub repo via Canvas

Program Outcome 7: (Ability to Learn)
Course Learning Outcomes (CLOs)
1.2 (Tools) Students will be able to efficiently locate information describing and assessing software tools for exploring the mathematical algorithms and techniques that are embedded in a student project.

Assignment 1 — Project Site

Group Assignment

- Open Chrome browser and go to the course site
- Click "i" at the bottom left to select "Google Sites"
- Click "+" at the bottom right to create a new site
- Enter site name and page title, and click "Publish" at top right
  - Enter Web address with only lowercase letters, numbers, and dashes
  - Under "Who can view my site," click MANAGE
    - Draft — Specific people can edit
    - Published — Anyone can find and view
    - Click "Done"
  - Click "Publish"
- Submit the published Google site link via Canvas

Program Outcome 3: (Communications)
3.1 (Communication) Students will be able to write technical reports with sufficient clarity and accuracy.

Assignment 2 — Needs Assessment

Group Assignment

- Identify needs that justify an electrical and computer engineering problem-solving effort
- Start preparing a design proposal that justifies the need to develop a technical solution to a problem

Program Outcome 5: (Teaming and Leadership)
5.2 (Teamwork) Students will participate in a modest-sized team to develop initial ideas into a full project, with the final objectives of the team evolving from the collaboration rather than being defined a-priori.

Assignment 3 — Problem Formulation

- Generate problem statements that focus on the function to be achieved by any viable design solution
- Apply a number of techniques and strategies such as the statement-restatement technique, the source/cause approach, the revision method, present state-desired state (PS-DS) strategy, and Duncker diagrams
- Perform Kepner-Tregoe (KT) situation analysis to evaluate various aspects of a situation in terms of three criteria (timing, trend, and impact), thereby determining what is known, which tasks should be performed, and in what order these tasks should be completed
- Perform KT problem analysis to determine possible causes of a problem

Program Outcome 2: Design

2.4 (Design assessment) Students will be able to critically evaluate the impact of cost, features, and performance on the useful functionality of a project "product" from the perspective of a non-technical customer and will understand the importance of critically challenging his/her design and use assumptions to ensure exploration of alternative designs & features from the perspective of a final customer product.

Assignment 4 — Solution Development

- Design each task in a problem-solving effort so that it is most fruitful and provides the most information or guidance
- Use various attributes of the final solution state to guide earlier decisions made along the solution path
- Define design goals and design specifications
- Eliminate paths that do not satisfy the desired design goals and/or specifications

Program Outcome 2: (Design)
2.3 (Technical design) Students will be able to adjust the overall design of a project by changing or adding a component, developing a representation of the initial understanding of the project design and evolving it to a detailed representation that establishes a "design, test, and build" process based on inputs, outputs, and variables defined by successive levels (hierarchical) of components and subsystems.

Assignment 5 — Intellectual Properties

Search and include relevant results of the proposed design for any of the following:

- Trademarks (or service marks)
- Copyrights (or licenses)
- Patents (or standards)

Program Outcome 7: (Ability to Learn)
1.1 (Tools) Students will be familiar with the use of standard search engines and keywords for an undirected search for information relevant to a specific project, familiar with the use of directed searches, starting from a known-good site and searching for information at that site relevant to a specific project and familiar with resources for compression/decompression of information.

Assignment 6 — Abstraction & Modeling

- Provide applicable models for the proposed design
  - A system model
  - A process model

Program Outcome 2: (Design)
2.1 (Design assessment) Students will be able to design a system or process with considerations of economic, environmental, health and safety, manufacturability and sustainability constraints.

Assignment 7 — Synthesis

Revisit the design goals in Assignment 4 (Solution Development) and develop a morphological chart to combine ideas for achieving desired goals or functions of the proposed design

Program Outcome 2: (Design)
2.5 (Technical design) Students will be able to develop the design for a project using a hierarchical approach (top-down) and to apply successive refinement to their design, incorporating new information and insights into your design while adjusting the overall design for necessary changes.

Assignment 8 — Ethics and Liability

Identify any potential hazards in the proposed design
8.1. Ethical issues, e.g., foreseeable misuses
8.2. Product liability, e.g., changes that may occur during the useful lifetime
8.3. Social impact, e.g., disposal after the useful life has ended

Program Outcome 4: (Ethical and Professional Conduct)
4.2 (Ethics and morals) Students will be able to understand the associated ethical issues.
4.3 (Professionalism) Students will be able to understand the associated professional responsibilities.
Program Outcome 2: (Design)
4.1 (Social issues) Students will be able to explore the non-technical space of social requirements, with a particular concern for the social impacts (both favorable and unfavorable) of their project "product."

Assignment 9 — Failure and Hazard Analysis

Provide solutions to eliminate hazards identified in Assignment 8
9.1. Ethical issues, e.g., foreseeable misuses
9.2. Product liability, e.g., changes that may occur during the useful lifetime
9.3. Social impact, e.g., disposal after the useful life has ended

Program Outcome 4: (Ethical and Professional Conduct)
4.2 (Ethics and morals) Students will be able to understand the associated ethical issues.
4.3 (Professionalism) Students will be able to understand the associated professional responsibilities.
Program Outcome 2: (Design)
4.1 (Social issues) Students will be able to explore the non-technical space of social requirements, with a particular concern for the social impacts (both favorable and unfavorable) of their project "product."

Assignment 10 — Design Analysis

Revisit the morphological chart in Assignment 7 (Synthesis) and

- Develop a KT decision matrix for design alternatives and goals with weighting, rating, and decision factors
- Develop a KT evaluation matrix for design alternatives and adverse consequences with probability, severity, and threat

Program Outcome 2: (Design)
2.2 (Technical design) Students will be able to explore the design space of performance, features, and cost to determine the cost (fixed and operating) of a given project "product."

Assignment 11 — Implementation

Refine the system and process diagrams in Assignment 6 based on Assignments 7-10 and provide
11.1 Design diagrams
11.2 Gantt chart
11.3 Senior design plan

Program Outcome 1: (Complex Problem Solving)
1.3 (Engineering foundations) Students will be able to use block diagrams and a hierarchical representation of the project and use detailed circuit diagrams and interconnected component diagrams with technical specifications on inputs, outputs, and control to describe the detailed operation of components in the project.
Program Outcome 2: (Design)
2.6 (Design assessment) Students will be able to understand and apply the principles of concurrent design in the breakdown of tasks and project plans and will understand and apply Gantt chart and PERT/CPM (either or both) in the creation of a breakdown of tasks and planning the activities to complete the project.
Program Outcome 5: (Teaming and Leadership)
5.1 (Teamwork) Students will be prepared to effectively participate in and manage a multidisciplinary design team.