COURSE OUTLINE : ENGR 133
D Credit – Degree Applicable
COURSE ID 010498
Cyclical Review: November 2019

COURSE DISCIPLINE : ENGR

COURSE NUMBER : 133

COURSE TITLE (FULL) : Introduction to Engineering Design

COURSE TITLE (SHORT) : Intro Engr Design

CATALOG DESCRIPTION

ENGR 133 introduces students to the engineering design process through engineering design projects. A multidisciplinary approach uses computer-aided design and modeling as well as hand and machine tools and testing instruments. Students work in teams on relevant projects that are modeled on professional engineering design practices and offer a practical experience of hands-on engineering work.

Total Lecture Units: 2.00

Total Laboratory Units: 1.00

Total Course Units: 3.00

Total Lecture Hours: 36.00

Total Laboratory Hours: 54.00

Total Laboratory Hours To Be Arranged: 0.00

Total Contact Hours: 90.00

Total Out-of-Class Hours: 72.00

Prerequisite: PHY 101 and ENGR 100.

ENTRY STANDARDS

	Subject	Number	Title	Description	Include
1	PHY	101	Physics for Scientists and Engineers: A	analyze the motion of objects with constant acceleration;	Yes
2	PHY	101	Physics for Scientists and Engineers: A	calculate the work performed by forces;	Yes
3	PHY	101	Physics for Scientists and Engineers: A	explain conservation of energy, momentum, and angular momentum;	Yes
4	PHY	101	Physics for Scientists and Engineers: A	calculate forces necessary for the static equilibrium of physical objects;	Yes
5	PHY	101	Physics for Scientists and Engineers: A	collect quantitative data from observations of physical phenomena;	Yes
6	PHY	101	Physics for Scientists and Engineers: A	organize data in tables, and present data using graphs;	Yes
7	PHY	101	Physics for Scientists and Engineers: A	use computers to perform calculations and to make graphs.	Yes
8	ENGR	100	Introduction To Engineering	identify the various engineering disciplines and the industries in which engineers work;	Yes
9	ENGR	100	Introduction To Engineering	discuss the job functions of an engineer;	Yes
10	ENGR	100	Introduction To Engineering	explain academic ethical principles and its connection to professional engineering ethical practices and standards	Yes
11	ENGR	100	Introduction To Engineering	demonstrate knowledge of effective technical writing and oral presentations;	Yes
12	ENGR	100	Introduction To Engineering	analyze and explain an engineering problem using the engineering design process;	Yes
13	ENGR	100	Introduction To Engineering	demonstrate teamwork skills in working on an engineering design team.	Yes

EXIT STANDARDS

1 Explain the steps of the engineering design process;
2 define engineering design and explain the differences between design and engineering design;
3 interpret customer requirements, design need, purpose or mission of an engineering design problem;
4 demonstrate one of three manufacturing processes such as machining, 3D printing, or welding;
5 demonstrate use of hand tools and explain their proper uses;
6 evaluate design iterations needed to meet stakeholder and life cycle requirements;

7 evaluate design to judge parts of design that should be tested and analyzed;
8 evaluate joints to decide fastener parameters;
9 explain ethics commitments with respect to engineering design;
10 explain analysis methods for evaluating design success;
11 explain importance of measurements and tolerancing to account for fitting;
12 demonstrate basic principles of engineering graphics and computer aided design tools;
13 demonstrate ability to function in a team.

STUDENT LEARNING OUTCOMES

1 employ the engineering design procedure to design a product and assess its performance;
2 demonstrate effective use of hand and machine tools for efficient and sustainable prototyping;
3 communicate product designs or procedures to both technical and non-technical audiences.

COURSE CONTENT WITH INSTRUCTIONAL HOURS

	Description	Lecture	Lab	Total Hours
1	Introduction of Engineering Design • Definition of engineering design • Steps in the engineering design process • Vocabulary • Communication (graphical and written) • Teamwork • Environmental sustainability	3	1	4
2	Case Studies in Engineering Design • Product Development Company example • Case study of student's choice	3	5	8
3	Engineering Design Process • Definition and History of • Reason and application of • Ethics • Design Judgement and Criteria; manufacturing, assembly materials, cost, reliability. • Stakeholders	3	5	8
4	Problem Definition • Defining/identifying the goal or outcome of the design project	3	5	8

5	Research and Brainstorming • Defining scope and parameters of the design. Resources available: time, capital, materials, tools, people hours etc • Techniques and methods of investing time to think of solutions and analyzing those solutions to choose best concept. • Reviewing physics concepts such as free body diagram, energy, degrees of freedom/rotation, and velocity to plan for solutions. • Creativity	3	5	8
6	Conceptual Design • Hand sketching • Hand drafting • Computer aided design 2-dimensional, • Drawing projections and isometrics • Computer aided design 3-dimensional • Geometric dimensioning and tolerancing • Detail design • Assembly design	3	5	8
7	Analysis • Energy analysis • Troubleshooting; risk reduction • Power analysis • Structural analysis • Dynamic analysis • Aesthetic and any other stakeholder defined parameter	3	5	8
8	Prototype • Hand-made models • 3D printed prototypes • Understanding concept of what should be prototyped (piece parts, assemblies, joints)	3	5	8
9	Testing • Fit • Form • Function, effectiveness; performance • Weight • Human factors • Strength	3	5	8

10	Iteration • Cycling through analysis, prototype and testing until design is mature for market entry/stakeholder goal completion. • Problem Solving • Understanding innovation management and optimization • Communication of design	3	5	8
11	Manufacturing • Introduction to subtractive, additive and joining manufacturing processes • Practical in one of the following: Machining, 3D Printing, Welding • Creating and assembling piece parts • Fastener choices	3	4	7
12	Product Lifestyle and Sustainability • Cost vs. durability • Aftermarket support • Retrofitting and service • Waste management	3	4	7
				90

OUT OF CLASS ASSIGNMENTS

1 homework (e.g. summarize an engineering design project failure);
2 design report (e.g. significant group paper or poster of a robotic conceptual design).

METHODS OF EVALUATION

1 quizzes
2 presentations (e.g. preliminary design review of a design project);
3 final design project (e.g. physical working product such as a robot).

METHODS OF INSTRUCTION

- [x] Lecture
- [x] Laboratory
- [ ] Studio
- [x] Discussion
- [x] Multimedia
- [ ] Tutorial

- [ ] Independent Study
- [x] Collaboratory Learning
- [x] Demonstration
- [ ] Field Activities (Trips)
- [ ] Guest Speakers
- [x] Presentations

TEXTBOOKS

Title	Type	Publisher	Edition	Medium	Author	IBSN	Date
Engineering Design: A Project-Based Introduction	Required	Wiley	4	Print	Clive L. Dym	9781118324585	2014