Subject Description Form

Subject Code	ME32002
Subject Title	Engineering Design Fundamentals
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME22003 Visualization and Communication in Design Engineering
Objectives	To provide students with an extensive knowledge in product design and development process, and professional obligations of an engineer with the use of real world open-ended engineering problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify, formulate and solve engineering design problems and search for design related/needed data, information and knowledge for decision-making and design solution generation in product design and development. b. Explore up-to-date information on product design, materials and manufacturing processes. c. Recognize the design for X, human factors/ergonomics, product safety and reliability, and the professional and ethical responsibilities in product design and development. d. Use different modes of communications effectively to present outcomes of design activities.
Subject Synopsis/ Indicative Syllabus	***Overview of Design Process*** - Design problem formulation, identifying product function and establishing engineering specifications, generating and evaluating design alternatives, detail design, product testing and prototyping, communicating the design outcome: virtual/physical prototypes, engineering drawings, oral and written reports ***Types of Design Problems –*** Selection design, configuration design, variant design, adaptive design, original design, redesign ***Design of Common Mechanical Components –*** Load and stress analysis, material selection, strategies for failure prevention, safety factors, overview and design/selection design of common engineering components (gears, bearings, couplings, belt and train drives, shafts, keys, springs, etc.) ***Design for X –*** Design for manufacture, assembly, tolerance, affordability, safety & reliability, quality, environment, human factors / ergonomics ***Cost Estimation in Design Engineering –*** Time value of money, design to cost, cost and price estimation, break-even economics ***Ethics in Design –*** Professional obligations, codes of ethics

Teaching/Learning Methodology

This subject provides students with the opportunity to develop essential skills required for a professional design engineer and understanding of key concepts through activity-, project-, and problem-based (APPB) learning approach. APPB-learning challenges students to continually hone their interpersonal skills, creative abilities and understanding of the design process. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.

Lectures are used to deliver the fundamental knowledge related to product engineering design and development (Outcomes a – c).

Group/individual design activities and case studies are used to illustrate the application of fundamental knowledge to practical situations (Outcomes a – c).

Group project is used to apply concepts learned to develop design solution/s for real-world open-ended engineering problem and enhance team-working skills, communication skills, project management skills, etc. (Outcomes a – d).

Assessment Methods in Alignment with Intended Learning Outcomes

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	
Small group activities	√	√	√	√
Project	√	√	√	√
Homework/assignment	√	√	√	√

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Group Project a. Individual concept solutions b. Final group report c. Group oral presentation d. Peer and facilitator evaluation	60 %	√	√	√	√
2. Homework/Assignments	15 %	√	√	√	√
3. Test	25 %	√	√	√	
Total	100 %				

<table>
<tr><td></td><td colspan="2">Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:
1.0 x Continuous Assessment

The group project is intended to be carried out by student groups of 3-4 members. The outcome of the group design project is presented orally in group oral presentation and in a detailed design project report. Other than the contribution for group activities each student in the group need to develop individual conceptual designs which will be assessed individually. Peer and facilitator assessments will be used to decide the individual contribution by group members for project activities. Individual homework assignments are used to enhance students' comprehension and assimilation of selected design concepts. Test is adopted for assessment of individual student's overall understanding and the ability of applying engineering design concepts.</td></tr>
<tr><td rowspan="8">Student Study Effort Required</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures</td><td>24 Hrs.</td></tr>
<tr><td>▪ Small group activities/ Workshops/ Consultations</td><td>15 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Reading and review</td><td>20 Hrs.</td></tr>
<tr><td>▪ Homework assignment</td><td>20 Hrs.</td></tr>
<tr><td>▪ Project</td><td>40 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>119 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">1. C.L. Dym and P. Little, Engineering Design – A Project-Based Introduction, Jon Wiley & Sons, latest edition
2. D.G. Ullman, The Mechanical Design Process, McGraw Hill Education, latest edition
3. R.J. Eggert, Engineering design, Prentice Hall, latest edition.
4. B. Hyman, Fundamentals of Engineering Design, Prentice Hall, latest edition.
5. George E. Dieter, Engineering Design, McGraw-Hill International Editions, latest edition.
6. G. Pahl and W. Beitz, Engineering Design-A systematic approach, Springer, latest edition.
7. R.C. Juvinall, Fundamentals of machine component design, John Wiley & sons, latest edition
8. J.A. Collins, Mechanical design of machine elements and machines: a failure prevention perspective, John Wiley & sons, latest edition</td></tr>
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