Design and Engineering

BE 102

Course Objectives

1. To excite the student on creative design and its significance;
2. To make the student aware of the processes involved in design;
3. To make the student understand the interesting interaction of various segments of humanities, sciences and engineering in the evolution of a design;
4. To get an exposure as to how to engineer a design.

Expected Outcome

The student will be:-

1. **Able to appreciate the different elements involved in good designs and to apply them in practice when called for.**
2. **Aware of the product oriented and user oriented aspects that make the design a success.**
3. **Will be capable to think of innovative designs incorporating different segments of knowledge gained in the course;**
4. **Students will have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.**

Module 1 - 15 % Marks

2 Hours Lecture

Design and its objectives; Design constraints, Design functions, Design means and Design from;
Role of Science, Engineering and Technology in design;
Engineering as a business proposition;
Functional and Strength Designs. Design form, function and strength;

3 Hours Lecture

How to initiate creative designs? Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey- customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.

4 Hours Project

An Exercise in the process of design initiation. A simple problem is to be taken up to examine different solutions- Ceiling fan? Group Presentation and discussion.

Module 2 - 15 % Marks

2 Hours Lecture

Design process- Different stages in design and their significance; Defining the design space; Analogies and thinking outside of the box"; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design.

3 Hours Lecture

Design Communication; Realization of the concept into a configuration, drawing and model. Concept of "Complex is Simple". Design for function and strength. Design detailing- Material selection, Design visualisation- Solid modelling; Detailed 2D drawings; Tolerancing; Use of standard items in design; Research needs in design; Energy needs of the design, both in its realization and application.

4 Hours Project

An exercise in the detailed design of two products.
(Stapler/ door/clock)

Module 3 - 15 % Marks

2 Hours Lecture

DesignPrototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis

3 Hours Lecture

Engineering the design – From prototype to product. Planning; Scheduling; Supply chains; inventory; handling, manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design.

4 Hours Project

List out the standards organizations. Prepare a list of standard items used in any engineering. Develop any design with over 50% standard items as parts.

Module 4 - 15 % Marks

4 Hours Lecture

Design for “X”; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. List out the design requirements(x) for designing a rocket etc.

4 Hours Project

Design mineral water bottles that could be packed compactly for transportation.

Module 5 - 15 % Marks

2 Hours Lecture

Product centred and user centred design. Product centred. attributes and user centred attributes. Bringing the two closer. Example: Smart phone. Aesthetics and ergonomics.

4 Hours Lecture

Value engineering, Concurrent engineering, Reverse engineering in design; Culture based design; Architectural designs; Motifs and cultural background; Tradition and design; Study the evolution of Wet grinders; Printed motifs; Role of colours in design.

6 Hours Project

Make sharp corners and change them to smooth curves- check the acceptance. Examine the possibility of value addition for an Existing product

Module 6 - 15 % Marks

3 Hours Lecture

Modular design; Design optimization; Intelligent and autonomous products; User interfaces; communication between products; autonomous products; internet of things; human psychology and the advanced products. Design as a marketing tool; Intellectual Property rights – Trade secret; patent; copy-right; trademarks; product liability.

6 Hours Project

Group presentation of any such products covering all aspects that could make or market it.

References Books:

Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN-13: 978-0124158917 ISBN-10: 0124158919

Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction - Wiley, ISBN-978-1-118-32458-5

Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer

Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning, ISBN-13: 978-0-495-66816-9

Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic Approach, 3rd ed. 2007, XXI, 617p., ISBN 978-1-84628-319-2

References Books:

Voland, G., Engineering by Design, ISBN 978-93-325-3505-3, Pearson India

Dieter & Schmidt - Engineering Design 5th Edition, Mcgraw Hill.

E-Book: http://opim.wharton.upenn.edu/~ulrich/designbook.html

Evaluation Scheme:

First Internal Exam (Closed Books)- 25 Marks

Second Internal Exam (open Book) - 25 Marks

Assignment/projects – 50 marks

Assignments: Marks: 20 Two assignments are to be given (10 marks each)

Projects: Marks: 30 Two mini projects are to be assigned. One is to be a group project and the other an individual one

(iv) End semester exam – open book exam – 50 marks
(2 hours duration – conducted by the University)

Question Paper Pattern for End Semester Examination (Open Book)

Part A – Eight questions of each 5 marks, out of which six questions are to be answered.

Part B – Three questions of each 10 marks, out of which two questions are to be answered.