Kerala Technological university KTU First year B.tech Syllabus for **BE102Design And Engineering**

Course No. : BE102

Course Name: Design And Engineering
L-T-P-Credits: 2-0-2-3

Year of Introduction: 2015

Course Objectives:

The purpose of this course is:-
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.

Syllabus:

Design and its objectives; Role of Science, Engineering and Technology in design; Engineering as a business proposition; How to initiate creative designs? Understanding the process of design, with examples; design process, including defining design problems, generating ideas, and building solutions. Design evaluation, and communication of designs; Design for function and strength with examples; Role of standards in design; Material selection in design; Design for quality; Role of value engineering in design; Design for "X"; Product oriented and user oriented designs; Culture based design; Aesthetics and Ergonomics; Concepts of concurrent engineering; Role of reverse engineering in design; Modular design; Design optimization; Design of intelligent products; Human reaction to intelligent products; Communication between products; Internet of things; Autonomous products; Product life cycle; Products and the environment; Product recycling; Re-engineering; Design as a marketing tool; IPR and design; Product liability.

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.

References:

1. Engineering Design-A project based introduction- Clive L.Dym, Patrick Little, Elizabeth J.Orwin, Wiley , ISBN-978-1-118-32458-5
2. Engineering by Design, Gerald Voland, Pearson India, ISBN 978-93-325-3505-3
3. Exploring Engineering, Third Edition: An Introduction to Engineering and Design – [Part 3- Chapters 17 to 27], Robert T. Balmer , William D. Keat, George Wise, Philip Kosky, ISBN- 13: 978-0124158917 ISBN-10: 0124158919
4. Design for X Concurrent engineering imperativesEastman, Charles M. (Ed.), 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer
5. Engineering Design: A Systematic Approach, Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H.3rd ed. 2007, XXI, 617 p., ISBN 978-1-84628-319-2

Web page: 1. E-Book (Free download)

Module 1 Contents

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; 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. 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 Contents

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

Module 3 Contents

Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis. Engineering the design – From prototype to product. Planning; Scheduling; Supply chains; inventory; handling;

manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design. List out the standards organizations. Prepare a list of standard items used in any engineering specialization. Develop any design with over 50% standard items as parts.

Module 4 Contents

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 shell of 3 meter diameter and 8 meter length. Design mineral water bottles that could be packed compactly for transportation.

Module 5 Contents

Product centred and user centred design. Product centred attributes and user centred attributes. Bringing the two closer. Example: Smart phone. Aesthetics and ergonomics. 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. Make sharp corners and change them to smooth curves- check the acceptance. Examine the possibility of value addition for an existing product.

Module 6 Contents

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