KU2DSCCSE103 ENGINEERING DESIGN AND PROTOTYPING

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
2	DSC	100	KU2DSCWST103	4	90

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
2	4	1	50	50	100	2(T)+3(P)*

*** ESE Duration: 2 hours for theory and 3 hours for Lab**

Course Description

This course provides an in-depth exploration of prototyping techniques and materials used for prototyping and will help to effectively communicate the ideas through engineering drawings. The course will also investigate sustainable prototyping practices with a particular emphasis on wood and bamboo. This is a joint inter-disciplinary course offered by Department of wood science and Technology and Department of Information Technology.

Course Objectives

- To understand the characteristics of different materials used in prototyping.
- To clearly communicate concepts using engineering drawings.
- To understand how to use CAD tools to create cost-effective and efficient prototypes.
- To explore the possibilities of sustainable prototyping with wood and bamboo

- To become familiar with the contemporary technology utilised in prototypes

Course outcome

On completion of this course the student will be able to:

C01	Communicate design concepts using engineering drawings and visualization techniques
C02	Develop an understanding of different materials and manufacturing processes used in prototyping
C03	Choose the appropriate prototyping material and process for their product development.
C04	Acquire proficiency in variety of woodworking hand tools and power tools for developing prototypes
C05	Develop a strong emphasis on safety practices in prototyping with different materials

Mapping of COs to PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓

COURSE CONTENTS

Module 1 Engineering drawing for prototyping

Engineering drawing, importance of Engineering drawing in prototyping and product development, relationships of Engineering drawing with artistic

drawing and other types of drawing, viewing an engineering drawing sheet, methods of sheet folding, drawing instruments, and drawing standards.

Module 2 prototyping materials

Material selection in prototyping. Properties of common materials used in prototyping. Wood and Metal prototyping; Resins and plastic prototyping: Introduction to basic metal working techniques including cutting, drilling machining and welding. Sheet metal fabrication, Polymers commonly used in prototyping. Introduction to Fused deposition modelling, Steriolithography methods for polymer prototyping. Health and safety in an engineering workshop.

Module 3 Wood and Bamboo as a sustainable prototyping material

Introduction to Wood and Bamboo as a sustainable prototyping material. Engineered wood products-plywood, MDF, particle boards and their applications. Familiarization with carpentry tools and woodworking machines, Practicing the basic woodworking tools and power tools used for marking, sawing, planning, and boring, Constructing important joints for lengthening, widening, and framing joints.

Module 4 Digital Technologies in product design and prototyping

Familiarizing the use of CAD in product design, Applications of Internet of things (IoT) systems in prototyping. Application of CNC machining and 3D Printing technologies in prototyping using different materials. Laser cutting and engraving

Module X

Introduction to design thinking; Methods of Empathy building; Problem framing and ideation; Testing and iteration; Benefits of prototyping in design thinking; Application of design thinking and prototyping in various disciplines; Case studies highlighting ethical problems in prototyping processes.

Core Compulsory Readings

1. Bjarki Hallgrimsson (2023) Prototyping and model making for product design: Second edition; Hachette UK
2. Kollmann,(1968): Principles of Wood Science & Technology- Volume I - Solid Wood, Springer-Verlage publications, New York
3. Gebhardt, Andreas & Hötter, Jan-Steffen. (2016). Additive Manufacturing 3D Printing for Prototyping and Manufacturing. 10.1007/978-1-56990-583-8.
4. Yang, Li & Hsu, Keng & Baughman, Brian & Godfrey, Donald & Medina, Francisco & Menon, Mamballykalathil & Wiener, Soeren. (2017). Additive Manufacturing of Metals: The Technology, Materials, Design and Production. 10.1007/978-3-319-55128-9.
5. Miller,M.R. *et.al.,*(2004): Carpentary and Constructions(4th Edition) ,The Mc Graw-Hill Companies,United State of America.
6. Khurmi R.S. & Gupta, J.K. (1981), A Text Book of Workshop Technology (Manufacturing Processes), S.Chand & Company Ltd, New Delhi, India
7. Um, Dugan. (2018). Solid Modeling and Applications. 10.1007/978-3-319-74594-7.

Core Suggested Readings

1. Chua, Chee & Leong, Kah Fai & Lim, Chu. (2010). Rapid prototyping: Principles and applications, third edition. 10.1142/6665.
2. Liou, Frank. (2007). Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development. 10.1201/9780429029721.

3. Bordegoni, Monica & Rizzi, Caterina. (2011). Innovation in Product Design: From CAD to Virtual Prototyping.

4. Hoadley, R.B. (2000). Understanding Wood: A Craftsman's Guide to Wood Technology. The Taunton Press

TEACHING LEARNING STRATEGIES

- Lecturing, Demonstration, Digital Learning, Team Work

MODE OF TRANSACTION

- Lecture, Seminar, Discussion, workshop and lab sessions

ASSESSMENT RUBRICS

Refer to section 7 of FYIMP- Computational Science - Scheme and Syllabus for the 4 credit courses with 2 Credit Theory + 2 Credit Practical.

Sample Questions to Test Outcomes

1. How does the application of computer-aided design (CAD) software assist prototype processes in product development?
2. Discuss the importance of standardisation and conventions in engineering drawing and drafting practices.
3. Conduct drilling operation on wood using the given power tool
4. How does the choice of wood and bamboo as a prototyping material correspond with the sustainability aims in product development?
5. Discuss the diverse range of materials used in prototyping, ranging from traditional options like plastics and metals to innovative choices