Indian Institute of Technology, Kanpur
Proposal for a New Course

Course Number: DESxxxx

Course Title: Computer-Aided Design and Prototyping

Credit system: 3-0-0 Total Credits: 9

Duration of Course: Full Semester

Proposing Department/IDP: DES

Other Departments/IDPs which may be interested in the proposed course: ME, CE, AE

Proposing Instructor(s): Amar Kumar Behera

Other faculty members interested in teaching the proposed course: None

Course Description:
This course introduces students to the principles and practice of computer-aided design (CAD) and digital prototyping as core components of the modern design process. It aims to develop the ability to translate creative ideas into precise digital representations and tangible prototypes using contemporary CAD software and digital fabrication tools. Students will gain practical experience in 3D modeling, design communication, and iterative prototyping, emphasizing design intent, manufacturability, and integration with smart systems.

Objectives:
- To understand the fundamentals and role of computer-aided design in the design process.
- To develop proficiency in 2D drafting and 3D modeling for visualization and manufacturing.
- To explore digital prototyping techniques such as 3D printing, laser cutting, and CNC machining.
- To enable rapid iteration through digital-to-physical workflows.
- To cultivate design thinking integrated with computational and fabrication technologies.

(B) Pre-requisites:

At least 1 course on engineering drawing

(C) Contents:

S. No.	Topic	Details	Lectures
1	Introduction to Computer-Aided Design	Evolution of CAD; overview of CAD tools (AutoCAD, SolidWorks, Fusion 360, Rhino); role in design communication; standards and file formats	4
2	2D Drafting and Parametric Sketching	Geometric constraints, dimensioning, layers, annotations; drawing standards and documentation	6
3	3D Modeling and Assembly Design	Solid and surface modeling; parametric and freeform design; parts, assemblies, and kinematic relationships	8
4	Rendering and Visualization	Creating realistic visualizations; materials, lighting, rendering engines; communicating design intent	4
5	Prototyping and Digital Fabrication	From CAD to physical prototypes; rapid prototyping, 3D printing, laser cutting, CNC milling; tolerances, material selection, post-processing	8

6	Integrating CAD with Simulation and Analysis	Stress analysis, motion study, and generative design; design optimization for performance and manufacturability	4
7	Design Project: CAD to Prototype	Individual or group projects integrating design, modeling, and prototyping; documentation and presentation	4

Total contact hours: 38

Recommended books:

- David F. Rogers, James Alan Adams, Mathematical Elements for Computer Graphics, McGraw-Hill
- William Vaughan. Digital Modeling. United Kingdom, Pearson Education, 2011.
- David A. Madsen, David P. Madsen, Engineering Drawing and Design, Cengage Learning.
- James D. Bethune, Engineering Design and Graphics with SolidWorks.
- Kalpakjian & Schmid, Manufacturing Processes for Engineering Materials.
- Caneparo, Luca. Digital Fabrication in Architecture, Engineering and Construction. Netherlands, Springer Netherlands, 2013.

Any other remarks: The course will include hands-on lab sessions and demonstrations of digital fabrication tools. Students are expected to complete a mini-project culminating in a functional   prototype.

Proposer: A. K. Behera   DPGC Convener

Dated: 02-11-2025   Date:

The course is approved / not approved

Chairperson, SPGC

Dated: