Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2024-2025
Course Handout Part II

Date: 06-01-2025

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.   : **ME F318 (L-T-P-U: 2-1-1-3)**
Course Title   : **Computer Aided Design**
Instructor-in-Charge   : **Prof. Kurra Suresh**
Tutorial/Practical Instructors : Dr. Partha Saradhi G, Alok Kumar, Vicky Lad, Abhinav M,Mrinmoy Saha, Yogesh Ulhe, Sankalp Jain, S Nagarani, Vempada Vasudeva Rao, Mohd Parvez Ahmed,

Scope and Objective of the Course:
Mathematical modeling of parametric curves, surfaces and solids. Geometric transformations, isometric transformations including translation, scaling, reflection, and rotation using specialized solid modeling packages. CAD/CAM data exchange. Introduction to FEM & FEA practice on a specialized CAE package. Modeling and simulation based practical exercises related to geometric modeling, finite element analysis, and machine drawing such as orthographic drawing, sectional view, assembly drawing & exploded view.

Textbooks:
TB1) Zeid , Ibrahim, "Mastering CAD/CAM", Tata McGraw-Hill, 2007.
TB2) Chandrupatla, T. R., Belegundu, A. D., "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice Hall of India, 2005, New Delhi.

Reference books:
RB1) Rogers D. F. and J. A. Adams, "Mathematical Elements of Computer Graphics", Tata McGraw-Hill, New York, 2004.
RB2) Srinivasa Prakash Regalla, "Computer Aided Analysis and Design", IK International Publishers, New Delhi, 2010.
RB3) Mortenson M. E., "Geometric Modeling", McGraw-Hill Education (India) Pvt. Ltd, 2006.
RB4) Anupam Saxena, Birendra Sahay "Computer Aided Engineering Design" Springer, 2005.
RB5) Sham Tickoo "Creo Parametric 6.0"

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
(A) Computer Aided Geometric Modeling (GM) and Design			
L1	Course overview	Course Overview and Introduction to CAD	

L2	Introduction to CAD	Introduction, 3D modeling and viewing, modeling aids and tools, engineering drawings, CAD programming, Computer simulation tools.	TB1: Ch-1 to 4
L3	Parametric Curves: Analytical curves	Parametric representation of Analytical curves	TB1: Ch-6 RB1: Ch-4
L4-5	Parametric Curves: Hermite Cubic Spline (HCS)	Parametric representation: Algebraic form, Geometric form, four-point form. Blending of Hermite curve segments End conditions: Clamped, Relaxed, Cyclic and Anti-Cyclic Properties of Hermite Curves	TB1: Ch-6 RB1: Ch. 5
L6-7	Parametric Curves: Bezier Curve	Parametric representation, Subdivision, Degree elevation, Characteristics of Bezier Curves	TB1: Ch-6 RB1: Ch. 5
L8-9	Parametric Curves: B-Splines	Parametric representation, Open-uniform, Uniform, Non-uniform, Closed B-Splines, Properties.	TB1: Ch-6 RB1: Ch. 5
L10=11	2D, 3D Transformations and Projections	2D Transformations: Translation, Rotation, Reflection and Scaling, Rotation about an arbitrary point, Reflection about an arbitrary line 3D Transformations: Translation, Rotation, Reflection and Scaling, Rotation about an arbitrary line, Reflection about an arbitrary plane Projections: Orthographic, Isometric, Dimetric, Oblique and Perspective	TB1: Ch-12
L12	Surfaces	Parametric representation of Analytical surface segments	TB1: Ch-7 RB1: Ch. 6
L13-14	Surfaces	Parametric representation of Bi-linear, Ruled, Bi-linear Coons, Bi-cubic Coons, Bezier and B-Spline surface patches	TB1: Ch-7 RB1: Ch. 6
L15	Solids	Solid modeling approaches, NURBS	TB1: Ch-9

	(B) Integration of GM with Computer Aided Engineering (CAE) and other Applications		
L16	CAD/CAM/CAE/AM data exchange formats	IGES, STL, STEP, DXF, WRL formats	TB1: Ch-12
L17-26	Computer Aided Engineering (CAE) using Finite Element Analysis (FEA)	Fundamental concepts, matrix algebra and Gaussian elimination, one-dimensional problems, two-dimensional problems, beams.	TB2: Ch-1 to Ch-8
L27-28	Introduction to Rapid Prototyping using Additive Manufacturing (AM)/3D-printing	Virtual prototyping versus physical prototyping, polymer AM technologies for prototyping, CAD neutral formats for AM	RB2: Ch-17

Practicals (Each practical is evaluative): (These are the minimum suggested; actual practical topics to be covered may be more)

Prac No	Learning Objective	Reference	Sections in Reference
1	Sketch Module	RB5	Ch-2,3
2	Part Module -I	RB5	Ch-5,6
3	Part Module -II	RB5	Ch-7,8
4	Part Module -III	RB5	Ch-8,9
5	Part Models – Gears and Bearings	RB5	
6	Assembly Modeling -I	RB5	Ch-10
7	Assembly Modeling -II	RB5	Ch-10
8	FEA of 1-D problems – Bar and Beam elements, Trusses	TB2	Ch-5
9	FEA 2D structural problems	TB2	Ch-6
10	FEA of 2D heat transfer problem	TB2	Ch-10
11	FEA of 3D structural problem	TB2	Ch-9
12	Comprehensive Practical Examination		

Evaluation Scheme:

Component	Duration (min)	Weightage (%)	Date & Time	Nature of Component
Mid-semester Examination	90	25%=50M	03/03 - 11.30 - 1.00PM	Closed Book
Practicals		25%=50M	D208-A & B	Open Book
Tutorials		10%=20M		Open Book
Classroom Interaction Tests (Quizzes)	10 to 15 min	5% =10M		Closed Book
Comprehensive Examination	180	35%=70M	01/05 AN	Closed Book

Chamber Consultation Hour: To be announced in the lecture class.

Notices: All notices on CMS. **Students are required to register in the CMS with their full name and full ID No as per the ID Card.**

Make-up Policy: Only for genuine illness cases.

Academic Honesty and Integrity Policy:

Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Policy to get Valid Grade:

Student should get at least 30% of the lowest mark of the highest grade awarded to obtain a valid grade.

INSTRUCTOR-IN-CHARGE