25UMET413	COMPUTER AIDED DESIGN AND MANUFACTURING	Category	L	T	P	R	Credit	Year of Introduction
		PEC	3	0	0	0	3	2025

Preamble: This course introduces the fundamental concepts of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) used in modern engineering practice. It covers geometric, surface and solid modelling techniques, numerical control systems, and computer-aided process planning. The course also focuses on advanced manufacturing systems such as FMS, MRP, ERP and CIM, along with computer-aided quality control methods. It enables students to understand and apply digital tools for efficient design, manufacturing and production management.

Prerequisite: EGS103 Engineering Graphics and Computer Aided Drawing

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Explain the fundamentals of CAD/CAM and geometric modelling techniques.	K2 Understand
CO2	Explain surface and solid modelling methods used in CAD systems.	K2 Understand
CO3	Apply NC/CNC programming and computer-aided process planning techniques.	K3 Apply
CO4	Apply concepts of modern manufacturing systems such as FMS, MRP, ERP and CIM.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	-	2	-
CO2	3	2	1	-	1	-	-	-	-	-	-	2	-
CO3	2	2	2	1	2	-	-	-	-	-	-	3	2
CO4	2	2	2	1	2	-	-	-	-	-	-	2	2
Avg	2.5	2	1.75	1	1.5	-	-	-	-	-	-	2.25	2.5

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance : 5 marks
Continuous Assessment Test : 20 marks
Continuous Assessment Assignment : 15 marks

SYLLABUS

Module 1 (10 hrs)

Fundamentals of CAD/CAM – Applications of computers in design and manufacturing – Benefits of CAD/CAM – Computer peripherals for CAD/CAM – Design workstation – Graphic terminals – CAD/CAM software: system software and application software – CAD/CAM database and structure.

Geometric Modelling: Wireframe modelling – Wireframe entities – Interpolation and approximation of curves – Parametric and non-parametric representation of curves – Curve fitting techniques – Cubic spline, Bezier and B-spline curves.

Module 2 (10 hrs)

Surface modelling: Algebraic and geometric forms – Parametric space of surfaces – Blending functions – Parametrization of surface patches – Subdivision – Cylindrical, ruled, surface of revolution, spherical and composite surfaces – Bezier and B-spline surfaces – Regenerative surfaces and pathological conditions.

Solid modelling: Cell composition and spatial occupancy enumeration – Sweep representation – Constructive Solid Geometry (CSG) – Boundary representation (B-rep).

Module 3 (10 hrs)

NC control production systems: Numerical control – Elements of NC system – NC part programming – Manual and computer-assisted part programming – Post processor – Computerized part program – APT/SPPL (Simple Programming Language) – CNC, DNC and adaptive control systems.

Group Technology: Part families – Parts classification and coding – Production flow analysis – Machine cell design.

Computer Aided Process Planning (CAPP): Limitations of traditional process planning – Retrieval and generative types – Machinability data systems.

Module 4 (12 hrs)

Computer aided manufacturing resource planning: Material Requirements Planning (MRP) – Inputs and outputs of MRP – Benefits of MRP – Enterprise Resource Planning (ERP) – Capacity Requirements Planning (CRP).

Flexible Manufacturing Systems (FMS): FMS equipment – Layouts – Analysis methods – Benefits of FMS.

Computer aided quality control: Automated inspection – Off-line and on-line inspection – Contact and non-contact methods – Coordinate Measuring Machines (CMM) – Machine vision. Computer Integrated Manufacturing (CIM): CIM system – Components – Benefits and applications.

Text Books:

1. Groover, M.P., *Automation, Production Systems and Computer Integrated Manufacturing,* 4th Edition, Pearson, 2019.
2. Zeid, I., *CAD/CAM: Theory and Practice,* 2nd Edition, McGraw Hill, 2018.
3. Rao, P.N., *CAD/CAM: Principles and Applications*, 4th Edition, Tata McGraw Hill, 2017.

Reference Books:

1. Ibrahim Zeid, *Mastering CAD/CAM*, McGraw Hill, 2020.
2. Kundra, T.K., Rao, P.N., & Tiwari, N.K., *Numerical Control and Computer Aided Manufacturing,* McGraw Hill, 2018.
3. Chang, T.C., Wysk, R.A., & Wang, H.P., *Computer-Aided Manufacturing,* 3rd Edition, Pearson, 2017.
4. Ranky, P.G., *Computer Integrated Manufacturing,* Prentice Hall, 2016.
5. Chitale, A.K. & Gupta, R.C., *Product Design and Manufacturing,* PHI Learning, 2019.

END SEMESTER EXAMINATION - MODEL QUESTION PAPER

Course Code	**25UMET413**
Course Name	**COMPUTER AIDED DESIGN AND MANUFACTURING**
Max. Marks: 60	**Duration: 2.5 Hours**

Part A **(Answer all questions. Each question carries 3 marks)**				
Qn No.	**Question**	**Marks**	**CO**	**BL**
1	Explain the applications of computers in design and manufacturing.	3	1	L2
2	Describe wireframe modelling and its basic entities in CAD systems.	3	1	L2
3	Explain Bezier and B-spline surfaces used in surface modelling.	3	2	L2
4	Describe Constructive Solid Geometry (CSG) and Boundary Representation (B-rep) used in solid modelling.	3	2	L2

5	Use basic NC part programming concepts to identify the functions of preparatory and miscellaneous codes.	3	3	L3
6	Demonstrate the role of Computer-Aided Process Planning (CAPP) in preparing manufacturing process plans.	3	3	L3
7	Apply MRP concepts to identify the main inputs and outputs required for production planning.	3	4	L3
8	Demonstrate the use of Coordinate Measuring Machines (CMM) and machine vision in computer-aided quality control.	3	4	L3

Part B **(Answer any one full question from each Module. Each carries 9 marks)**				
Module I				
Qn No.	**Question**	**Marks**	**CO**	**BL**
9	Explain the fundamentals of CAD/CAM, computer peripherals, design workstations, CAD/CAM software, and database structure.	9	1	L2
OR				
10	Describe wireframe modelling, curve representation, curve fitting techniques, cubic spline, Bezier, and B-spline curves.	9	1	L2
Module II				
Qn No.	**Question**	**Marks**	**CO**	**BL**
11	Explain surface modelling methods including algebraic and geometric forms, parametric space, blending functions, and common surface types used in CAD.	9	2	L2
OR				
12	Describe solid modelling methods including cell composition, spatial occupancy enumeration, sweep representation, Constructive Solid Geometry (CSG), and Boundary Representation (B-rep).	9	2	L2
Module III				
Qn No.	**Question**	**Marks**	**CO**	**BL**
13.a	Use NC part programming concepts to prepare a basic machining sequence for a simple component.	5	3	L3

13.b	Demonstrate the role of post processor and APT/SPPL in computer-assisted part programming.	4	3	L3
OR				
14.a	Use Group Technology concepts to form part families and machine cells for production planning.	5	3	L3
14.b	Demonstrate retrieval and generative CAPP methods for a given manufacturing requirement.	4	3	L3
Module IV				
Qn No.	**Question**	**Marks**	**CO**	**BL**
15.a	Apply MRP concepts to identify inputs, outputs, and benefits for manufacturing resource planning.	5	4	L3
15.b	Demonstrate the use of Flexible Manufacturing System (FMS) equipment and layouts for flexible production.	4	4	L3
OR				
16.a	Apply computer-aided quality control techniques to select contact and non-contact inspection methods for manufactured components.	5	4	L3
16.b	Demonstrate CIM integration among CAD, CAM, MRP/ERP, inspection, and production management systems.	4	4	L3