SECOND SEMESTER 2021-22
COURSE HANDOUT

Date: 09.01.2021

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 G539**
Course Title : **Computer Integrated Manufacturing**
Instructor-in-Charge : **Kurra Suresh**
Practical Instructor : **Pankaj**

1. Course Description:

Computer modeling for mass property analysis, Computer numerical control, Computer-aided manufacturing, operation of CNC machine tools, Design of manufacturing work cells, Automated manufacturing and programmable Controller.

2. Scope and Objective of the Course:

Computer Integrated Manufacturing (CIM) includes the entire range of product development and manufacturing activities with all the functions being carried out with the help of dedicated software packages. CIM uses a common database wherever feasible and communication technologies to integrate design, manufacturing and associated business functions that combine the automated segments of a factory or a manufacturing facility. The course aims at nurturing the knowledge of design and manufacturing and application of computations in various stages in manufacturing system. The course will be helpful to implement computational knowledge in the various stages of design, manufacturing and integration of the different stages of manufacturing system. The data base of CIM will reduce the human component of manufacturing by relieving process slowness, expensive and error prone components in the system. Finally, the knowledge base of CIM improve the productivity and flexibility of the system and achieve near-net-shape product along with customer satisfaction.

3. Text Books:

T1. James A. Rehg, Henry W. Kraebber, “Computer Integrated Manufacturing”, Pearson Education Publication, III Edition, 2004.

4. Reference Books:

R1. Mikell P. Groover, “Automation, Production Systems and Computer Integrated Manufacturing” PHI Publication, Fourth Edition, 2016, New Delhi.

R2. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill International Edition, 1985.

R3. A. Alavudeen, N. Venkateshwaran, “Computer Integrated Manufacturing”, PHI Publication, First Edition, 2011, New Delhi.

R4. Paul G. Ranky, “Computer Integrated Manufacturing”, Prentice Hall International Publication, 1986.

R5. P.N. Rao, CAD/CAM Principles and Applications, McGraw-Hill, III Edition, New Delhi, 2010.

5. Course Plan:

Module No.	Lecture No	Lecture Session	Learning outcomes
1. Introduction to CIM and manufacturing system	1-3	L1.1 Introduction to CIM	Familiarization of CIM in the recent context of modern manufacturing.
		L1.2. Manufacturing enterprise and manufacturing systems	Understanding of manufacturing systems and its relationship with CIM.
		L1.3 Product design and development through CIM	Comprehension about design process and various steps of product design.
2. CAD and Geometric modeling techniques	4-6	L2.1 Design automation and CAD	Understanding of CAD in CIM environment by studying curves, surfaces and solid modeling.
		L2.2 Curves	
		L2.3 Surfaces	
		L2.4 Solids	
3. CAE and Computer modeling for mass property analysis	7-9	L3.1 Computer Aided Engineering and mass property analysis	Realization about analysis and evaluation of engineering design using computer based techniques to calculate product functionality.
		L3.2. CAE and Finite Element Modelling	
		L3.3. Finite element analysis in CIM	
		L3.4. CIM data base and data base management.	
4. Computer numerical control (CNC)	10-12	L4.1 Fundamentals of NC & CNC	To be familiar with features of NC machine tools and various CNC tooling and work holding devices.
		L4.2 Classifications of NC systems and CNC aspects in manufacturing	
		L4.3 CNC hardware	
		L4.4 CNC tooling	
		L4.5 CNC work holding devices	
5. CAM and CNC part programming	13-23	L5.1 Study of coordinate system	Comprehension about CNC part programming and par manufacturing.
		L5.2 Study of manual programming	
		L5.3 Introduction to various codes for manual programming	
		L5.4 Study of manual programming for linear interpolation	

		L5.5 Study of manual programming for circular interpolation	
		L5.6 Study of manual programming for radius & length compensation	
		L5.7 Study of manual programming for canned cycle in milling	
		L5.8 Study of manual programming for turning	
		L5.9 Study of cut planning for turning	
		L5.10 Study of advanced programming	
		L5.11 Part manufacturing in CNC milling and CNC turning	
6. CAD to CAM and operation of CNC machine tools	24-26	L6.1 Introduction to CAM environment in standard software.	Understanding about Automated tool path generation from CAD model.
		L6.2 Automated tool path generation from CAD model.	
7. DNC and CAPP	27-28	L7.1 Introduction of DNC, CNC vs. DNC	Get to about DNC, CAPP and CAI in modern manufacturing.
		L7.2 Group technology and coding system	
		L7.3 Process planning, Computer Aided Process Planning (CAPP)	
8. Design of manufacturing work cells	29-31	L.8.1 Cellular Manufacturing	Understanding about machine cell design and flexible manufacturing systems.
		L.8.2 FMS components, applications and benefits	
		L.8.3 Quantitative analysis of FMS	
9. Automated manufacturing	32-34	L.9.1 Automated production lines	Comprehension about automated production lines and assembly systems.
		L.9.2 Automated assembly systems	
10. Programmable Logic Controller	35-38	L10.1 Discrete process control and ladder logic diagram	To be familiar with various components of discrete process control and programming of PLC.
		L10.2 PLC components, operating cycle and programming of PLC	

11. Additive Manufacturing	39-42	Different 3D printing technologies	

Lab experiments and part manufacturing:

i) CNC programming and part manufacturing.
ii) CNC Milling and Turning
iii) Inspection with video profile projectors
iv) 3D scanning
v) 3D printing
vi) Projects using CAD/CAM softwares (CreO Elements), programming and machining on Industrial Vertical Machining Center, Turning Center are also included in the course.

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of component (Closed Book/ Open Book)
Mid-Semester Test	90 Min.	25	As per Timetable	Closed Book
Comprehensive Examination	120 Min.	35	As per Timetable	Closed Book
Project, Seminars / Assignments /Case Studies/ Lab	Semester long	40	To be announced later	Open Book

After completing this course the students will be able to

i) Comprehend importance of CAD in product design and development in CIM environment.
ii) Understand the role of CAE in evaluating product functionality in CIM environment.
iii) Comprehend CNC technology and role of CAM in modern manufacturing industries.
iv) Generate CNC part programming for any kind of part manufacturing.
v) Gain hands-on experience on CNC machining and turning centers.
vi) Be acquainted with the role CAPP, role of PLC and design of work cell and in CIM.

Closed Book Test: No reference material of any kind will be permitted inside the exam hall.

Open Book Exam: Use of any printed / written reference material (books and notebooks) will be permitted inside the exam hall. Loose sheets of paper will not be permitted. Computers of any kind will not be allowed inside the exam hall. Use of calculators will be allowed in all exams. No exchange of any material will be allowed.

7. Chamber Consultation Hour:

To be announced in the class.

8. Notices:

All notices related to the course will be displayed on CMS only.

9. Make-up Policy:

Make-up will be granted **ONLY** in genuine cases with prior permission. The request application for make-up test **MUST** be reached to the Instructor-in-Charge before commencement of the scheduled test along with **DOCUMENTARY PROOF**. No make-up will be allowed for the Surprise Quiz Tests.

10. Note (if any):

It will be the responsibility of the individual student to be regular in maintaining the self study schedule as given in the course handout, attend lectures and the lab demonstration as per the schedule. Mid Semester Test and Comprehensive Examination are according to the Evaluation Scheme given in the respective Course Handout. If the student is unable to appear for the Regular Test/Examination due to genuine exigencies, the student must refer to the procedure for applying for Make-up Test/Examination.

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.

Instructor-in-Charge
ME G539