

2023-24

# MECHANICAL ENGINEERING

CIMS



PREPARED BY  
Mr.Naresh K.

# **Techno India NJR Institute of Technology**



## **Course File**

### **6ME4-02: COMPUTER INTEGRATED MANUFACTURING SYSTEMS (CIMS)**

Naresh Kumar  
(Assistant Professor)

**Department of Mechanical Engineering**



# RAJASTHAN TECHNICAL UNIVERSITY, KOTA

## Syllabus

3<sup>rd</sup> Year - VI Semester: B.Tech. : Mechanical Engineering

### 6ME4-02: COMPUTER INTEGRATED MANUFACTURING SYSTEMS (CIMS)

Credit: 3  
3L+0T+0P

Max. Marks: 150(IA:30, ETE:120)  
End Term Exam: 3 Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction to CIM: Overview of Production Systems, the product cycle, Automation in Production Systems, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning of CAM: Historical Background,	2
	Numerical Control (NC): Basic components of an NC system, coordinate system and motions control systems. Computer Numerical Control (CNC): features of CNC, machine control unit, CNC software. Direct Numerical Control and Distributed Numerical Control. Applications, advantages and disadvantages of NC. Adaptive control of machining system.	3
3	NC Part programming: Manual and computer assisted part programming, Part programming with APT. NC part programming using CAD/CAM software. NC cutter path verification.	8
4	Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data systems, computer generated time standards.	4
	Group Technology: Introduction, part families, part classification and coding, coding system and machining cells.	4
5	Computer Aided Production Management Systems: Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control.	6
	Computer Aided Quality Control; Computer in quality control, contact inspection methods, Non contact inspection methods, optical and non optical computer aided testing.	3
6	Computer Aided Material Handling; Computer control on material handling, conveying, picking. Ware house control, computerized material handling for automated inspection and assembly.	3
	Computer Integrated Manufacturing Systems: Introduction, types special manufacturing systems, flexible manufacturing systems (FMS).	5
	Collaborative Engineering; Introduction, Faster Design throughput, Web based design, Changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing.	3
	<b>TOTAL</b>	<b>41</b>

### **Course Overview:**

Student will learn applications of CAD/CAM from these 41 hours course. In this course, Computer Integrated Manufacturing (CIM) approaches are discussed. CAD/CAM tools and their within and between the production systems are presented along with appropriate case studies. Data storage and handling is also the need of contemporary manufacturing systems. This is also catered using software tools. The course is reinforced with the laboratory demonstrations to add a practitioners' touch.

### **Course Outcomes:**

<b>CO. NO.</b>	<b>Cognitive Level</b>	<b>Course Outcome</b>
1	Synthesis	The students will able to use computers in manufacturing and to combine the advanced knowledge in manufacturing tools, solutions to industrial applications.
2	Synthesis	Students will be able to apply knowledge about Computer Aided Quality control and Process Planning Control.
3	Synthesis	Students will be able to apply knowledge about various methods of communication in CIMS.
4	Design	Generate habit of individual critical thinking in analysing a complex problem in the computer aided designing, manufacturing and optimization.
5	Design	Formulate CNC part programs using CADEM simulation package for simulation of machining operations such as Turning, Drilling & Milling.

### **Prerequisites:**

1. Completed first year of BE/BTech.
2. Students should be aware of Machining and Machine Tools Technology.

### Course Outcome Mapping with Program Outcome:

Course Outcome	Program Outcomes (PO's)												
	CO. NO.	Domain Specific (PSO)					Domain Independent (PO)						
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	-	-	-	1	-	1	
CO2	2	3	3	2	2	1	-	-	-	1	1	1	
CO3	3	3	3	3	3	1	-	-	-	1	1	1	
CO4	3	3	3	3	3	1	-	-	-	1	1	1	
CO5	3	3	3	3	3	1	-	-	-	1	1	1	

1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)

### Course Coverage Module Wise:

Lecture No.	Unit	Topic
1	1	<b>INTRODUCTION:</b> Students will able to understand the objective, scope and outcome of the course.
2	2	<b>INTRODUCTION TO CIM:</b> Students will able to know the overview of Production Systems, the product cycle
3	2	Students will able to know the automation in Production Systems, computer's role in manufacturing
4	2	Students will able to know the sources and types of data used in manufacturing. The Beginning of CAM: Historical Background
5	2	<b>NUMERICAL CONTROL (NC):</b> Students will able to know the basic components of an NC system, coordinate system and motions control systems.
6	2	Students will able to know the features of CNC, machine control unit, CNC software.
7	2	Students will able to differentiate between the Direct Numerical Control and Distributed Numerical Control.
8	2	Students will able to know the applications, advantages and disadvantages of NC. Adaptive control of machining system.
9	3	<b>NC PART PROGRAMMING:</b> Students will able to know the manual and computer assisted part programming,
10	3	Students will able to know the manual and computer assisted part programming,
11	3	Students will able to know the Part programming with APT.
12	3	Students will able to know the NC part programming using CAD/CAM software.

13	3	Students will able to know the NC part programming using CAD/CAM software.
14	3	Students will able to know the NC cutter path verification.
15	4	<b>COMPUTER AIDED PROCESS PLANNING:</b> Students will able to know the traditional Process Planning, Retrieval process planning system
16	4	Students will able to know the Generative Process Planning
17	4	Students will able to know the Machinability data systems
18	4	Students will able to know the computer-generated time standards
19	4	<b>GROUP TECHNOLOGY:</b> Students will able to know the concept of part families
20	4	Students will able to know the part classification and coding, Coding system and machining cells
21	5	<b>COMPUTER AIDED PRODUCTION MANAGEMENT SYSTEMS</b>
22	5	Students will able to know the various computer aided inventory management systems
23	5	Students will able to know the Manufacturing resource planning (MRPII)
24	5	Students will able to know the computer process monitoring
25	5	Students will able to know the shop floor control processes
26	5	Students will able to know the computer process control.
27	5	<b>COMPUTER AIDED QUALITY CONTROL</b>
28	5	Students will able to know the contact inspection methods
29	5	Students will able to know the non-contact inspection methods
30	5	Students will able to know the Optical and non-optical computer aided testing.
31	6	<b>COMPUTER AIDED MATERIAL HANDLING</b>
32	6	Students will able to know the computer aided conveying, picking process and equipment
33	6	Students will able to know the ware house control
34	6	Students will able to know the computerized material handling for automated inspection and assembly.
35	6	<b>COMPUTER INTEGRATED MANUFACTURING SYSTEMS</b>
36	6	Students will able to know the types of special manufacturing systems
37	6	Students will able to know the flexible manufacturing systems (FMS).
38	6	<b>COLLABORATIVE ENGINEERING</b>
39	6	Students will able to know the web-based design, Changing design approaches
40	6	Students will able to know the extended enterprises, concurrent engineering,
41	6	Students will able to know the agile and lean manufacturing.

### **Text Books**

1. Mikell. P. Groover “Automation, Production Systems and Computer Integrated Manufacturing”, 3 rd edition, Pearson Education 2008.
2. CAD/CAM/CIM by P. Radhakrishnan, S. Subramanyan, V. Raju, New age publication, 2nd edn, 2004.

### **References**

1. Mikell. P. Groover and Emory Zimmers Jr., “CAD/CAM”, Prentice hall of India Pvt.Ltd., 1998.
2. James A. Regh and Henry W. Kreabber, “Computer Integrated Manufacturing”, Pearson Edu 2nd edn, 2005.
3. Chris McMahan and Jimmie Browne, “CAD CAM Principles, Practice and Manufacturing Management”, Pearson Education 2nd edition, 2005.
4. Ranky, Paul G., “Computer Integrated Manufacturing”, Prentice Hall of India Pvt. Ltd., 2005.
5. Yorem Koren, “Computer Integrated Manufacturing”, McGraw Hill, 2005.

### **Assessment Methodology:**

1. Online quiz on googles form after every module completion.
2. Practical exam in lab where they have to write G & M code on Cut Viewer Turn software for the given problem statement. (Once in a week)
3. Assignments one from each unit.
4. Midterm subjective paper where they have to write APT programs to perform different operations on different codes in the modules. (Twice during the semester)
5. Final paper at the end of the semester subjective.

## Teaching and Learning resources unit-wise:

### Unit-1

Introduction to CIM

**Video Tutorials:** [https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808\\_CfYhZKdv2eXplAQiAwS](https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808_CfYhZKdv2eXplAQiAwS)

Theory concepts: [https://onlinecourses.nptel.ac.in/noc20\\_me44/preview](https://onlinecourses.nptel.ac.in/noc20_me44/preview)

Quiz: <https://www.sanfoundry.com/mechatronics-questions-answers-computer-integrated-manufacturing/>

### Unit-2

Numerical Control (NC)

**Video Tutorials:** [https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808\\_CfYhZKdv2eXplAQiAwS](https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808_CfYhZKdv2eXplAQiAwS)

Theory concepts: [https://onlinecourses.nptel.ac.in/noc20\\_me44/preview](https://onlinecourses.nptel.ac.in/noc20_me44/preview)

Quiz: <https://www.sanfoundry.com/mechatronics-questions-answers-computer-integrated-manufacturing/>



## Unit-3

### A. NC Part Programming

**Video Tutorials:** [https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808\\_CfYhZKdv2eXplAQiAwS](https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808_CfYhZKdv2eXplAQiAwS)

Theory concepts: [https://onlinecourses.nptel.ac.in/noc20\\_me44/preview](https://onlinecourses.nptel.ac.in/noc20_me44/preview)

Quiz: <https://www.sanfoundry.com/mechatronics-questions-answers-computer-integrated-manufacturing/>

### B. APT Programming

**Video Tutorials:** [https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808\\_CfYhZKdv2eXplAQiAwS](https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808_CfYhZKdv2eXplAQiAwS)

Theory concepts: [https://onlinecourses.nptel.ac.in/noc20\\_me44/preview](https://onlinecourses.nptel.ac.in/noc20_me44/preview)

Quiz: <https://www.sanfoundry.com/mechatronics-questions-answers-computer-integrated-manufacturing/>

## Unit-4

### A. Computer Aided Process Planning

**Video Tutorials:** [https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808\\_CfYhZKdv2eXplAQiAwS](https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808_CfYhZKdv2eXplAQiAwS)

Theory concepts: [https://onlinecourses.nptel.ac.in/noc20\\_me44/preview](https://onlinecourses.nptel.ac.in/noc20_me44/preview)

### B. Group Technology

**Video Tutorials:** [https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808\\_CfYhZKdv2eXplAQiAwS](https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808_CfYhZKdv2eXplAQiAwS)

Theory concepts: [https://onlinecourses.nptel.ac.in/noc20\\_me44/preview](https://onlinecourses.nptel.ac.in/noc20_me44/preview)

Quiz: <https://www.sanfoundry.com/mechatronics-questions-answers-computer-integrated-manufacturing/>

## Unit-5

### A. Computer Aided Production Management System

**Video Tutorials:** [https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808\\_CfYhZKdv2eXplAQiAwS](https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808_CfYhZKdv2eXplAQiAwS)

Theory concepts: [https://onlinecourses.nptel.ac.in/noc20\\_me44/preview](https://onlinecourses.nptel.ac.in/noc20_me44/preview)

Quiz: <https://www.sanfoundry.com/mechatronics-questions-answers-computer-integrated-manufacturing/>

### B. Computer Aided Quality Control

**Video Tutorials:** [https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808\\_CfYhZKdv2eXplAQiAwS](https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808_CfYhZKdv2eXplAQiAwS)

Theory concepts: [https://onlinecourses.nptel.ac.in/noc20\\_me44/preview](https://onlinecourses.nptel.ac.in/noc20_me44/preview)

Quiz: <https://www.sanfoundry.com/mechatronics-questions-answers-computer-integrated-manufacturing/>

## Unit-6

Computer Aided Material Handling System

**Video Tutorials:** [https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808\\_CfYhZKdv2eXpIAQiAwS](https://youtu.be/49RET0N-ITY?list=PLFW6lRTa1g808_CfYhZKdv2eXpIAQiAwS)

Theory concepts: [https://onlinecourses.nptel.ac.in/noc20\\_me44/preview](https://onlinecourses.nptel.ac.in/noc20_me44/preview)

Quiz: <https://www.sanfoundry.com/mechatronics-questions-answers-computer-integrated-manufacturing/>

Previous Year Question Papers:

**8E8071**

Roll No. \_\_\_\_\_

Total No of Pages: **3****8E8071**

**B. Tech. VIII Sem. (Main / Back) Exam., April – May 2018**  
**Mechanical Engineering**  
**8ME1A Computer Integrated Manufacturing System**

**Time: 3 Hours****Maximum Marks: 80**  
**Min. Passing Marks: 26***Instructions to Candidates:*

*Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

*Units of quantities used/calculated must be stated clearly.*

1. NIL2. NIL**UNIT-I**

- Q.1 (a) What do you understand about CIM and what are Benefits of CIM. [8]  
(b) Explain the product cycle and its various production processes. [8]

**OR**

- Q.1 (a) Explain the following: - [4×2=8]  
(i) NC coordinate system.  
(ii) Motion Control system.  
(b) Explain the NC procedure. [8]

## UNIT-II

- Q.2 Write the complete APT program for the part shown in fig - 1. The postprocessor command statement is MACHIN/MILL. The inside and outside tolerances on the circular approx. should be 0.001 inches. The end mill is 1 inch in diameter. Speed and feed should be 400 rpm and 3.0 in./min respectively. [10]

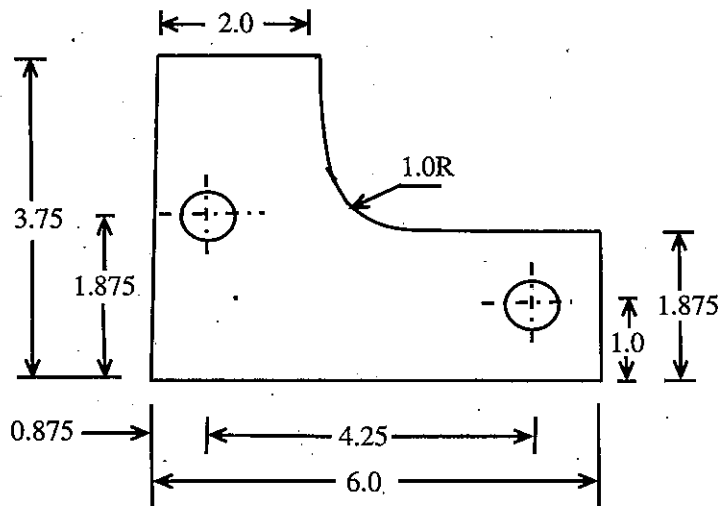


Fig. - 1

## OR

- Q.2 (a) Explain the various types of NC part programming languages. [10]  
(b) Explain Adaptive control system. What are the benefits of adaptive control systems? [10]

## UNIT-III

- Q.3 (a) Explain the automated process planning and its various process planning. [10]  
(b) Explain briefly the computer generated time standards. [10]

**OR**

- Q.3 (a) Explain Group Technology machine cells. What are the types of Group technology machine cells? [8]
- (b) Briefly explain the part families in Group Technology. [8]

**UNIT-IV**

- Q.4 (a) Explain the MRP II and its various steps. [8]
- (b) Explain the shop floor control system and what are its functions. [8]

**OR**

- Q.4 (a) Explain computer process monitoring. [8]
- (b) Explain various process control strategies. [8]

**UNIT-V**

- Q.5 (a) Discuss Automated Guided vehicles (AGV) and its types. [8]
- (b) Discuss Robot application in CIM. [8]

**OR**

- Q.5 (a) Discuss Automated storage and Retrieval system. [8]
- (b) Explain coordinate measuring machine and its types. [8]

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**8E8071****8E8071**

**B.Tech. VIII Semester (Main/Back) Examination, April/May - 2017**  
**Mechanical Engg.**  
**8ME1A Computer Integrated Manufacturing Systems**

**Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 26****Instructions to Candidates:**

*Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

**Unit-I**

1. a) Explain various types of manufacturing systems. (6)
- b) Explain Product cycle. Briefly outline various achievements in CAD/CAM. (4+6)

**OR**

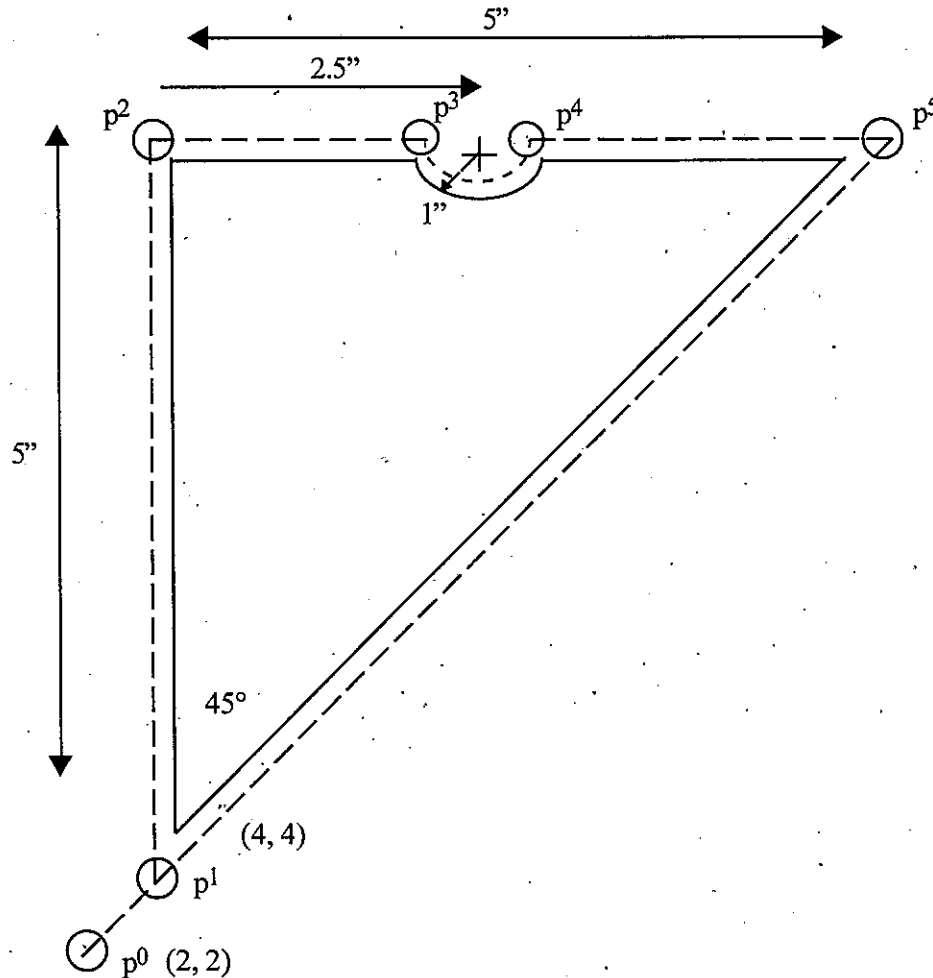
1. a) Briefly explain various basic components of NC system. Explain the NC procedure for milling a part. (5+5)
- b) Briefly explain economics of NC manufacturing over conventional manufacturing. (6)

**Unit-II**

2. a) Differentiate CNC, direct NC and combined CNC/DNC system. (5)
- b) Explain the various functions of CNC. (6)
- c) Write various R&D opportunities in the conventional NC system for developing the advance NC system. (5)

OR

2. a) Write the part programme for milling the side surfaces of the part given below. Given data : Tool size = 0.25 inch, Feed rate = 6 inch per minute, Cutting speed = 300 rpm, Tool start position : 2.0, 2.0, Programming in inches. Motion of tool is along the path  $p_0 \rightarrow p_1 \rightarrow p_2 \rightarrow p_3 \rightarrow p_4 \rightarrow p_5 \rightarrow p_1 \rightarrow p_0$ . (8)



- b) Explain various types of adaptive control systems. What are the various benefits of adaptive control systems? (4+4)

### Unit-III

3. a) Explain information flow system in retrieval type CAPP system. Enumerate various benefits of CAPP. (4+4)
- b) Write short note on computerized machinability data system and time standards. (8)

OR

3. a) Explain various parts classification systems. Explain various parts coding structures. (4+4)

- b) Explain OPITZ parts classification and coding system. (8)

**Unit-IV**

4. a) Explain the various functions of inventory management module of computer integrated production management system. Explain various configurations for process computer monitoring. (4+6)
- b) Differentiate between Direct Digital and Supervisory computer process control system. (6)

**OR**

4. a) Explain photogrammetry and machine vision inspection methods. (8)
- b) Explain various automated parts identification and data collection technologies. (8)

**Unit-V**

5. a) Explain various tests of flexibility in FMS. Also explain various types of flexibility in manufacturing. (4+4)
- b) Explain various functions of computer control system in FMS. (8)

**OR**

5. a) Explain extended enterprise and concurrent engineering concepts. Explain the three aspects of automation in brief. (2+2+4)
- b) Explain the various building blocks of lean manufacturing system. (8)





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[Total No. of Pages : 2]

8E8071

8E8071

B.Tech. VIII Semester (Main) Examination, April/May 2016

Mechanical Engg.

SME1A Computer Integrated Manufacturing Systems

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

**Instructions to Candidates:**

Attempt any **five** questions, selecting one question from **each unit**. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.)

Units of quantities used/calculated must be stated clearly.

**Unit - I**

1. a) Explain various components of CIM (6)
- b) What is NC system? Also discuss the different methods of listing the coordinates of points in NC system (10)

**OR**

1. a) Discuss the role of CIM in manufacturing, manufacturing planning and manufacturing control (8)
- b) Discuss various controls used in CNC machines. Explain the principle of operation of closed loop CNC machine (8)

**Unit - II**

2. a) Explain manual part programming with suitable example (8)
- b) Explain NC application characteristics & NC part programming in detail (8)

**OR**

2. a) Explain NC Cutter path verification (8)
- b) Discuss in brief on interfacing NC with CIM (8)

**Unit - III**

3. a) Define group technology. List out various stages in GT and the methods available for solving problems in GT (8)
- b) Define part families. Explain the two categories of attributes of parts (8)

**OR**

3. Define the term process planning. Discuss various steps involved in process planning and its prerequisites (16)

**Unit - IV**

4. a) Discuss optical and non optical computer aided testing method. Discuss how computer is used in quality control (8)
- b) Discuss non contact inspection methods and different activities in a PPC system (8)

**OR**

4. Write short notes on
- a) MRP II
- b) Computer process control
- c) Contact inspection method (16)

**Unit - V**

5. a) What difficulties do companies interested in implementing CIM face (8)
- b) Compare agile and lean manufacturing (8)

**OR**

5. What is FMS? Describe the principle of FMS. Discuss the importance of material handling system in FMS (16)