

**Government of Karnataka**  
**Department of Technical Education**  
**Board of Technical Examinations, Bengaluru**

<b>Course Title: Computer Integrated Manufacturing System</b>		<b>Course Code:15MC61T</b>
<b>Mode (L:T:P) : 4:0:0</b>	<b>Credits:4</b>	<b>Core/ Elective: Core</b>
<b>Type of Course: Lectures &amp; Student Activities</b>		<b>Total Contact Hours: 52</b>
<b>CIE= 25 Marks</b>		<b>SEE= 100 Marks</b>

**Pre-requisites:** Knowledge of Manufacturing Science, Engineering Graphics,

**Course Objectives:** Understand the various components of Computer Integrated Manufacturing,

**Course Outcome:** At the end of the course, the student should be able to

1. Explain concept of CIM and Automation
2. Develop CNC programs for a given component
3. Explain the concept and application of group technology
4. Explain various automated shop floor control activities
5. Explain different automated material handling systems
6. Explain the components of FMS

Course Outcome		Cognitive Level	Linked with PO	Teaching Hours
CO1	Explain concept of CIM and Automation	U	2	5
CO2	Develop CNC programs for a given engineering drawing	A	2	15
CO3	Explain the concept and application of group technology	U	2	8
CO4	Explain various automated shop floor control activities	U	2	8
CO5	Explain different automated material handling systems	U	2	8
CO6	Explain the components of FMS	U	2	8
		<b>Total sessions</b>		<b>52</b>

**Legend: R; Remember, U: Understand A: Application**

### Mapping of Course Outcomes with Program Outcomes

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
<b>Computer Integrated Manufacturing</b>	-	3	-	-	-	-	-	-	-	-

### Course Content and Weightage For SEE

Unit No	Unit Name	CO	Hour	Marks allocated for different Cognitive level Questions			Marks weightage (%)
				R	U	A	
<b>1</b>	CIM and Automation	<b>1</b>	5	-	<b>10</b>	-	<b>6.89</b>
<b>2</b>	CNC Machines	<b>2</b>	15	-	-	<b>35</b>	<b>24.15</b>
<b>3</b>	Group Technology	<b>3</b>	8	-	<b>25</b>	-	<b>17.24</b>
<b>4</b>	Automated Shop Floor Control	<b>4</b>	8	-	<b>25</b>	-	<b>17.24</b>
<b>5</b>	Automated Material Handling	<b>5</b>	8	-	<b>25</b>	-	<b>17.24</b>
<b>6</b>	Flexible Manufacturing System	<b>6</b>	8	-	<b>25</b>	-	<b>17.24</b>
	<b>Total</b>		<b>52</b>	<b>145 Marks</b>			<b>100</b>

### Contents

#### Unit-I

##### CIM and Automation

Production systems,(facilities, manufacturing support system), automation In production system (automated manufacturing system, computerized manufacturing support systems,)automation and principles and stagiest(USA principle, ten strategies for automation and process strategies)Basic elements of an automated system, levels of automation.

**5 Hours**

#### Unit-II

##### CNC Machines

Emergence of CNC Machines, Basic Configuration of CNC system, Machining Centre, Applications, Advantages and Disadvantages of CNC Machines, Introduction to Part

Programming-Coordinate system-Dimensioning-Axes & motion nomenclature, Definition and importance of various positions like machine zero, home position, and work piece zero, CNC part programming- Structure of part programme -Word addressed format-Preparatory function(G)-Miscellaneous function(M)- Tool compensation-Subroutines (Macros)(L)-Canned cycles-Mirror image, Simple programme on Milling and Turning operations

**15 Hours**

### **Unit-III**

#### **Group Technology**

Group technology-Definition-Advantages and limitations of GT-Part family formation-Classification and coding-Opitz coding system, Applications & benefits of GT, Cellular manufacturing, Computer aided process planning-Approaches to CAPP- retrieval type CAPP system and generative CAPP system, benefits of CAPP system

**8 Hours**

### **Unit-IV**

#### **Automated Shop Floor Control**

Introduction to shop floor control, relationship between shop floor control and factory information control system, phases of shop floor control system-order release, order scheduling, order progress, factory data collection system,-online versus batch system, data input techniques, automated identification methods-barcodes, radio frequency system, magnetic strip, optical character recognition system

**8 Hours**

### **Unit-V**

#### **Automated Material Handling**

Introduction to Automatic Guided Vehicles-driverless trains, AGV pallet trucks, AGV guidance and routing (frequency select method, path switch select method), traffic control and safety (on-board vehicle sensing, zone blocking), system management (on-board control panel, remote cell station, central computer control), Applications of AGV, Automated storage/retrieval system –Basic components of AS/RS.



## Unit-VI

## Flexible Manufacturing System

Introduction to FMS-Definition, Components of FMS, types of FMS-single machine cell, flexible manufacturing cell, flexible manufacturing systems, applications, advantages and disadvantages of FMS, types of machines used in FMS-machining centers, head changers, head indexers, milling modules, turning modules, assembly workstations, inspection stations, sheet metal processing machines, forging stations, FMS layout configurations-inline, loop, ladder, open-field, robot centered cell, FMS computer control system

8 Hour

**Reference**

1. Automation, Production Systems, and Computer-Aided Manufacturing- Mikell P Grover, Prentice-Hall International publication
2. Mechatronics –HMT Limited, McGraw Hill Education
3. CAD/CAM Principles and Applications-P N Rao, McGraw Hill Education
4. CAD/CAM/CIM- P. Radhakrishnan, S. Subramanyan, V. Raju, New Age International Publishers
5. CNC Machines- Pabla B.S., Adithan M., New Age International, New Delhi, 2014(reprint)
6. Computer Numerical Control-Turning and Machining centers- Quesada Robert, Prentice Hall 2014
7. CAD/CAM- Sareen Kuldeep, S Chand 2012

**e-Reference**

1. <https://www.britannica.com/technology/automation/Computer-integrated-manufacturing>
2. [http://www.slideshare.net/suraj\\_21/computer-integrated-manufacturing](http://www.slideshare.net/suraj_21/computer-integrated-manufacturing)
3. <http://www.slideshare.net/100675720/automation-7437801>
4. [http://mosafavi.iut.ac.ir/sites/mosafavi.iut.ac.ir/files/files\\_course/cnc\\_1\\_0.pdf](http://mosafavi.iut.ac.ir/sites/mosafavi.iut.ac.ir/files/files_course/cnc_1_0.pdf)
5. <http://wings.buffalo.edu/academic/departments/eng/mae/courses/460-564/Course-Notes/CNC%20notes.pdf>
6. [http://www.engr.uvic.ca/~mech410/CAM\\_references/CNC\\_Computer\\_Numerical\\_Control\\_Programming\\_Basics.pdf](http://www.engr.uvic.ca/~mech410/CAM_references/CNC_Computer_Numerical_Control_Programming_Basics.pdf)
7. <http://www.meliksah.edu.tr/esefkatlioglu/wp-content/uploads/2014/06/01-Introduction-to-CNC-Technology.pdf>
8. <http://www.slideshare.net/NoumanKhan2/9-oct-2013-lec-13-1415161718>
9. <http://www.slideshare.net/PratikGandhi4/computer-aided-process-planning-capp-57682060>
10. [http://www.slideshare.net/SyedAjeesh/computer-integrated-manufacturing-42768294?qid=f7c2ba99-d26c-445f-81d5-355774a78c00&v=&b=&from\\_search=1](http://www.slideshare.net/SyedAjeesh/computer-integrated-manufacturing-42768294?qid=f7c2ba99-d26c-445f-81d5-355774a78c00&v=&b=&from_search=1)

11. [http://www.wintriss.com/wcg/shopfloorconnect/docs/SFC\\_White\\_Paper.pdf](http://www.wintriss.com/wcg/shopfloorconnect/docs/SFC_White_Paper.pdf)
12. <http://www.slideshare.net/subhashsv/barcode-technology>
13. [http://www.slideshare.net/IAMINURHEARTS1/ocr-ppt-35272335?qid=16588669-68fe-4a3b-ad29-2c69ba58f65f&v=&b=&from\\_search=1](http://www.slideshare.net/IAMINURHEARTS1/ocr-ppt-35272335?qid=16588669-68fe-4a3b-ad29-2c69ba58f65f&v=&b=&from_search=1)
14. <http://tamcam.tamu.edu/courses/inen416/Handouts/AGV%20Presentation.pdf>
15. <http://wings.buffalo.edu/eng/mae/courses/460-564/AGV.pdf>
16. <http://www.invata.com/warehouse-automation/automated-storage-and-retrieval-systems-asrs/>
17. <http://www.slideshare.net/RanjeetKumar41/flexible-manufacturing-system>

### Student Activity

Activity No.	Description of the Student Activity
1	Develop CNC part programming for a turning component having step turning, taper turning, thread cutting, Knurling operations
2	Develop CNC part programming for a milling component having mirroring, pocketing, contour milling operations etc.
3	Present a report on materials used for CNC tooling's( Hand written 2 Or 3 pages)
4	Present a report on inserts used in CNC cutting tools
5	Develop a CNC program for a simple component by using APT language.
6	Prepare a report on various CAM software

### Note:

1. Group of max four students should above activity or any other similar activity related to the course COs and get it approved from concerned Teacher and HOD.
2. No group should have activity repeated or similar
3. Teacher should asses every student by using suitable **Rubrics** approved by HOD

## Sample Rubrics

Dimension	Exemplary	Accomplished	Developing	Beginning	Roll No. of the Student				
	5/4	3	2	1	1	2	3	4	5
<b>Organization</b>	Information presented in logical, interesting sequence	Information in logical sequence	Difficult to follow presentation-- student jumps around	Cannot understand presentation-- no sequence of information	Ex: 2				
<b>Subject Knowledge</b>	Demonstrates full knowledge by answering all class questions with explanations and elaborations	At ease with expected answers to questions but does not elaborate	Uncomfortable with information and is able to answer only rudimentary questions	Does not have a grasp of the information. Cannot answer questions about subject	4				
<b>Graphics</b>	Explain and reinforce screen text and presentation	Relate to text and presentation	Occasionally uses graphics that rarely support text and presentation	Uses superfluous graphics or no graphics	5				
<b>Oral Presentation</b>	Maintains eye contact and pronounces all terms precisely. All audience members can hear	Maintains eye contact most of the time and pronounces most words correctly. Most audience members can hear presentation	Occasionally uses eye contact, mostly reading presentation, and incorrectly pronounces terms. Audience members have difficulty hearing	Reads with no eye contact and incorrectly pronounces terms. Speaks too quietly	3				
<b>Total Score=2+3+4+5=14/4=3.5=4</b>									



### Institutional Activity

Activity No	Description of the Institutional Activity
1	Organize seminar, workshop, lecture from eminent person in the following domain: a) CNC safety b) CIM and its impact on environment c) materials for CNC Tooling d) Modern trends in advanced manufacturing e) Role of professional bodies in manufacturing such as institute of Engineers.
2	Organize industrial visit
3	Motivate student to take case study on particular manufacturing activity to inculcate self and continues learning

### Course Assessment Pattern

Particulars			Max Marks	Evidence	Course outcomes
Direct Assessment	CIE	Three tests (Average of three tests)	20	Blue books	1,2,3,4,5,6
		Student Activity	05	Student Activity Sheets	1,2,3,4,5,6
	SEE	End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course	Middle of the course		Feedback forms	1, 2&3
		End of the course		Feedback forms	1,2,3, 4, 5&6

**Note:** I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

**Note to IA verifier:** The following documents to be verified by CIE verifier at the end of semester

1. Blue books ( 20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

### Model Question Paper (CIE)

Date and Time	Semester	Course	Max Marks		
1Test(6 <sup>th</sup> week of sem) 10-11 Am	VI SEM	<b>Computer Integrated Manufacturing System</b>	20		
	Year: 2017-18	Course code:15MC61T			
Name of Course coordinator :			Units:1,2 Co: 1,2		
All questions carries equal marks					
Question No	Question		CL	CO	PO
1	With a block diagram explain the components of production system  OR Explain the information process cycle in a manufacturing organization		U	1	2
2	Explain the USA automation principle OR Explain ten strategies of automation and process improvement		U	1	2
3	Develop a CNC program for a given component involving turning operations		A	2	2
4	Develop a CNC program for a given component involving milling operations		A	2	2



**Model Question Paper**  
**VI Semester Diploma in Mechatronics Engineering**  
**Computer Integrated Manufacturing System**

**Instructions: Answer any six questions from part A and Seven full questions from part B**

**PART-A**

**Answer any six questions.**

**5X6=30 marks**

1. Explain briefly the reasons for automation
2. Compare preparatory codes G02 with G03
3. Compare subroutine with canned cycle
4. Explain group technology
5. Explain the types of coding systems
6. Explain contact bar code readers
7. Explain Non contact bar code readers
8. Explain the importance of AGV system
9. Explain dedicated FMS

**PART- B**

**Answer any seven full questions.**

**10X7=70M**

1. a) Explain with block diagram , the components of production system  
b) Explain canned cycle with examples
2. Develop CNC turning program for the given component sketch
3. Develop CNC Milling program for the given component sketch
4. a) Explain the different methods available for forming groups in group technology  
b) Explain the methodology to be followed for developing a retrieval type of computer aided process planning system
5. a) Explain about the Opitz coding system generally used in group technology  
b) Explain three phases in shop floor control system with block diagram
6. a) Explain conversion of bar code in to pulse train of electrical signals  
b) Explain automatic identification methods
7. a) Explain AGVS pallet trucks  
b) Explain on board vehicle sensing traffic control system in AGV
8. a) Explain Basic components of AS/RS  
b) Explain central computer control in managing in operations of in AGV
9. a) explain factors to be considered to be considered while planning and implementing FMS  
b) Explain DEFUN commands in LISP programming
10. a) Explain Loop FMS layout configuration  
b) Explain the machining cell

**Model Question Bank**  
**VI Semester Diploma in Mechatronics Engineering**  
**Computer Integrated Manufacturing**

**Unit -1**

**CIM and Automation**

**Cognitive level- Understanding**

1. With a block diagram explain the components of production system
2. Explain the information process cycle in a manufacturing organization
3. Write the reasons for automation
4. Explain the USA automation principle
5. Explain ten strategies of automation and process improvement
6. Explain the automation migration strategies

**Unit –II**

**CNC Machines**

**Cognitive level- Application**

1. Compare preparatory and miscellaneous codes
2. Compare preparatory codes G02 with G03
3. compare use of subroutines (macros) with canned cycles
4. Develop CNC turning program for a given machine component
5. Develop CNC milling program for a given machine component

**Unit –III**

**Group Technology**

**Cognitive level- Understanding**

1. Explain the advantages and limitations of group technology
2. Explain the different methods available for forming groups in group technology
3. Explain the functions of classification and coding system
4. Explain the types of coding systems
5. Explain the applications of group technology
6. Explain the importance of group technology in present manufacturing scenario
7. Explain group technology
8. Explain about the Opitz coding system generally used in group technology
9. Explain the needs for computer aided process planning
10. Explain the retrieval type of computer aided process planning method
11. Explain the generative type of computer aided process planning method
12. Explain the methodology to be followed for developing a retrieval type of computer aided process planning system
13. Explain the methodology to be followed for developing a generative type of computer aided process planning system

**Unit-IV**

**Automated Shop Floor Control**

**Cognitive level- Understanding**

1. Explain factory information control system indicating the relationship of shop floor control in the system

2. Explain three phases in shop floor control system with block diagram
3. Explain various data input techniques
4. Explain automatic identification methods
5. Explain conversion of bar code into pulse train of electrical signals
6. Explain contact bar code readers
7. Explain Non contact bar code readers
8. Explain bar code printers
9. Explain multi level scanning in computer process monitoring

**Unit-V**  
**Automated Material Handling**  
**Cognitive level- Understanding**

1. Explain the importance of AGV system
2. Explain the drive less train of AGVS
3. Explain AGVS pallet trucks
4. Explain AGVS unit load carrier
5. Explain the applications of the AGV
6. Explain AGV guidance system
7. Explain the frequency select method in AGV routing
8. Explain path switch select method in AGV routing
9. Explain on board vehicle sensing traffic control system in AGV
10. Explain zone blocking system in AGV
11. Explain on board control panel in managing the operations of in AGV
12. Explain remote call stations in managing the operations of in AGV
13. Explain central computer control in managing in operations of in AGV
14. Explain Basic components of AS/RS

**Unit-VI**  
**Flexible Manufacturing System**  
**Cognitive level- Understanding**

1. Explain the components of FMS
2. Explain the machining cell
3. Explain dedicated FMS
4. Explain random order FMS
5. Explain in line FMS layout configuration
6. Explain Loop FMS layout configuration
7. Explain Ladder FMS layout configuration
8. Explain Open field FMS layout configuration
9. Explain Robot centered cell FMS layout configuration
10. Explain layout of FMS incorporating AS/RS for material handling
11. Explain the functions performed by FMS computer control system
12. Explain FMS data files
13. Explain the performance data collected during monitoring of FMS
14. Explain factors to be considered to be considered while planning and implementing FMS.