

# GUJARAT TECHNOLOGICAL UNIVERSITY

**SUBJECT NAME: AUTOMATED MANUFACTURING - I**

**SUBJECT CODE: 2172002**

**B.E. 7<sup>th</sup> SEMESTER**

**Type of course: Engineering Science**

**Prerequisite: N.A.**

**Rationale:** This subject is useful to understand the different types of automation and production system used in industries. Understand the different components of Computer Aided Manufacturing (CAM) basic concept of Computer Numerical Control (CNC), Numerical machine (NC) and Direct numerical machine (DNC). Understand the basic concept of the automated material handling system AGV, AS/RS and also learn to fundamental of CAPP, CAQC, CMM and Rapid prototyping.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		C	Theory Marks			Practical Marks		
			ESE		PA (M)		PA (V)		PA	
			(E)		PA	ALA	ESE	OEP		(I)
4	0	2	6	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
1	<b>INTRODUCTION</b> Automation and types, production systems, automation in production system, automation principles and strategies, production facilities, introduction to NC, CNC and DNC machines tools, Explanation of execution system, Basic configuration of machine, Accuracy, Precision, Resolution, CNC MCU, Advantage, Capabilities and Limitations, Intelligent Manufacturing, Recent Trends.	7	15%
2	<b>MOTION CONTROL AND MACHINE ELEMENTS :</b> Recirculating Ball screws, Linear Motion Guide ways, Hardened and ground guide ways, Spindle Bearings, Air Bearings, Hydrostatic and Hydrodynamic Bearings, transmission system, Tool Clamping systems, Servo motors and their applications, Feedback systems, Tachos, Encoders, Linear Glass Scales.	6	13%

3	<b>BASIC PART PROGRAMMING:</b> Axes identification, coordinate system, movements and interpolation with other axis, Application of rotary axis, Manual programming for CNC turning and Milling– offline, Programming formats, Tool offsets, Type of compensations and cutting parameters, Introduction to G codes and M codes for CNC Turning and Milling, single and multipass canned cycle in turning, drilling canned cycles in milling, sub programing.	13	29%
4	<b>ACCESSORIES AND OTHER ESSENTIAL PERIPHERALS:</b> Automatic Tool Changer (ATC), Automatic Pallet Changer (APC), Coolant system, chip conveyor system, Auto part loading devices.	3	6%
5	<b>MATERIAL HANDLING AND STORAGE:</b> Types, characteristics, Automated Guided Vehicle systems (AGVs), guidance, routing and control, Automated Storage and Retrieval systems (AS/RS), Components, Controls and applications, Integration of automated material handling and storage systems to manufacturing environment.	6	13%
6	<b>COMPUTER AIDED PROCESS PLANNING (CAPP):</b> Need, types, benefits, Retrieval and Generative type CAPP, Computerized machinability database systems.	3	6%
7	<b>COMPUTER AIDED QUALITY CONTROL:</b> Basic Concept and Introduction to CMM , CMM Configurations, CMM Controls, CMM Software, Probes, Benefits and Applications Non-Contact Inspection Method , Machine Vision Systems and Laser Scanners Errors, Positional accuracies and repeatability, Static Accuracy tests, Axis calibration by laser.	4	9%
8	<b>RAPID PROTOTYPING:</b> An overview, Applications, Methods and Working of 3D printer Stereolithography (SLA), Selective Laser Sintering (SLS), Fused Deposit Modeling (FDM), Laminated Object Manufacturing (LOM), Limitations	3	6%

**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>				
<b>Remembrance</b>	<b>Understanding</b>	<b>Application</b>	<b>Analyze</b>	<b>Evaluate</b>
<b>R Level</b>	<b>U Level</b>	<b>A Level</b>	<b>N Level</b>	<b>E Level</b>
<b>30</b>	<b>30</b>	<b>15</b>	<b>15</b>	<b>10</b>

**Legends: R : Remembrance ; U = Understanding; A = Application and above Levels (Revised Bloom’s Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

**Text Books:**

1. Automation Production systems and Computer Integrated Manufacturing,  
2nd Edition, Groover M.P.  
Prentice Hall of India
2. CNC Fundamentals and Programming  
P. M. Agrawal &V. J. Patel  
Charotar Publishing House Pvt. Ltd.

**Reference Book:**

1. Numerical Control & Computer Aided Manufacturing  
Kundra T.K. Rao P.N. Tewari N.K.  
Tata McGraw Hill
2. Mechatronics  
HMT  
Tata McGraw Hill
3. CNC Technology and Programming  
Steve Krar and Arthur Gill  
McGraw Hill International
4. Computer Control of Manufacturing systems  
Koren Y.C.  
McGraw Hill

**Course Outcome:**

After learning the course the students should be able to:

1. Understand the different types of automation and production system used in industries.
2. Understand the different components of Computer Aided Manufacturing (CAM) Environments and the relevance of Computer Numerical Control (CNC), Numerical machine (NC) and Direct numerical machine (DNC).
3. Create programmes manually for the CNC Lathe and CNC Mill using G and M codes.
4. Understand the basic concept of the automated material handling and storage system using automated guided vehicles.

**List of Experiments:**

1. Introduction to Computer Aided Manufacturing Systems.
2. Operation with Single Turning Cycle (G90) for simple turning and step turning.
3. Circular interpolation by G02 and G03 on STAR MILL with incremental and absolute programming.
4. Use of single turning cycle (G90) for taper turning on Turning Center.
5. Cutter Radius compensation on STAR MILL.

6. Simple and Taper facing Cycle (G94) on Turning Center.
7. Use of Mirroring command on STAR MILL
8. Drilling, Grooving and Threading cycles on Turning Center.
9. Circular pocketing and rectangular pocketing cycles on STAR MILL.
10. Multiple Turning stock removal, Multiple Facing stock removal and pattern repeating cycles on Turning Centers.
11. Different boring cycles on STAR MILL

**Design based Problems (DP)/Open Ended Problem:**

Student may be given a task to write part program for mechanical part.

**Major Equipments / Softwares:**

1. XL TURN (CNC Lathe Machine)
2. STAR MILL (CNC Milling Machine)
3. Offline software such as Cut viewer turn and cut viewer Mill or any other programming software.

**List of Open Source Software/learning website:**

The website of NPTL may be utilized for additional learning.

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.