

# **CNC MACHINES AND AUTOMATION**

## **DETAILED CONTENTS**

### **1. Introduction**

**(06 Periods)**

Introduction to NC, Basic Components of NC, binary coding, MCU, input devices, advantages /disadvantages of NC machines over conventional machines, CNC & DNC, their types, their advantages, disadvantages and applications, selection of parts to be machined on CNC machines, Problems with conventional NC, Rules for Axis identification, New developments in NC, PLC Control and its purpose.

### **2. Construction and Tooling**

**(07 Periods)**

Design features, special mechanical design features, specification Chart of CNC machines, types of slideways, balls, rollers, motor- servo/stepper, axis drive and leadscrew, recirculating ball screw and nut assembly, swarf removal, safety and guarding devices, Various cutting tools for CNC machines, overview of tool holder, different pallet systems and automatic tool changer system, tool change cycle, management of a tool room.

### **3. System Devices**

**(10 Periods)**

Control System, Feedback control classification (open loop, closed loop), Actuators, Transducers and Sensors, characteristics of sensors, Tachometer, LVDT, opto-interrupters, potentiometers for linear and angular position, encoder and decoder, axis drives, other classifications of CNC Machines-Feedback, motion, positioning.

### **4. Part Programming**

**(08 Periods)**

Part programming and basic procedure of part programming, NC words, Blocks, part programming formats, simple programming for rational components (Point to point, Straight line, curved surface), tool off sets, cutter radius compensation and wear compensation. Advanced structures: Advantages of using advanced structures, part programming using canned cycles, subroutines and do loops, mirror image

### **5. Problems in CNC Machines**

**(03 Periods)**

Common problems in mechanical, electrical, pneumatic, electronic and PC components of NC machines, diagnostic study of common problems and remedies, use of on-line fault finding diagnosis tools in CNC machines, methods of using discussion forums, environmental problems.

### **6. Automation and NC system**

**(07 Periods)**

Automation, suitability of production system to automation, types, emerging trends in automation, automatic assembly, manufacture of printed circuit boards, manufacture of integrated Circuits, Overview of FMS, AGV, ASRS, Group technology, CAD/CAM and CIM, Automated Identification system, concept of AI, Robotics, nomenclature of joints, motion.

## **LIST OF PRACTICALS**

- 1 Study the constructional details of CNC lathe.
2. Study the constructional details of CNC milling machine.
3. Study the constructional details and working of:
  - Automatic tool changer and tool setter
  - Multiple pallets
  - Swarf removal
  - Safety devices
4. Develop a part programme for following lathe operations and make the job on CNC lathe and CNC turning center. (for  
finish pass only) – (At least two)  
Calculating coordinate points for a cylindrical job by considering sign convention for lathe
  - Plain turning and facing operations
  - Taper turning operations
  - Operation along contour using circular interpolation.
5. Develop a part programme for the following milling operations and make the job on CNC milling (for finish pass only)- At least two
  - Plain milling
  - Slot milling
  - Contouring
  - Pocket milling  
Calculate coordinate points for a zig zag job by considering sign convention for milling
6. Develop a part program by using canned cycle on CNC lathe for turning, facing
7. Preparation of work instruction for machine operator
8. Preparation of preventive maintenance schedule for CNC machine.
9. Demonstration through industrial visit for awareness of actual working of FMS in production.
10. Use of software for turning operations on CNC turning center.
11. Use of software for milling operations on machine centres.