COMPUTER NUMERICAL CONTROL MACHINES

Subject Code: 13ME2112

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Prerequisites: Machine Tools

Course Educational Objectives:

To make the student understand

1. computer aided technologies used in manufacturing
2. various programming techniques of CNC machines
3. application of adaptive control in CNC machine

Course Outcomes:

The student will be able to

1. explain NC, CNC and DNC machines
2. write manual part program for various machining operations
3. write computer aided part program for various machining operations
4. apply adaptive control in CNC machine

UNIT-I:

Introduction: NC, DNC, CNC, Programmed Automations, Machine control unit, Part program, NC tooling. NC machine tools: Nomenclature of NC machine axes, Types of NC machine tools, Machining centres, Automatic tool changers (ATC), Turning centres.

UNIT-II:

Machine control unit & tooling: Functions of MCU, NC actuation systems, Part program to command signal, MCU organization, Computerized numerical control, Transducers for NC machine tools, Tooling for NC machining centres and NC turning machines, Tool presetting. Adaptive control of CNC machine tools – SMART manufacturing. Programmable logic controllers (PLC) – Hardware, ladder logic programming of PLCs using basic functions – timers and counters – Advanced programming with control and arithmetic instructions.

UNIT-III:

Manual part programming: Part program instruction formats, Information codes: Preparatory function, Miscellaneous functions, Tool code and tool length offset, Interpolations, Canned cycles. Manual part programming for drilling, milling and turning operations, Parametric subroutines.

UNIT-IV:

APT programming: APT language structure, APT geometry: Definition of point, time, vector, circle, plane, patterns and matrices. APT motion commands: setup commands, point-to-point motion commands, continuous path motion commands. Post processor commands, complication control commands. Macro subroutines. Part programming preparation for typical examples.

UNIT-V:

Computer aided part programming: NC languages: NELAPT, EXAPT, GNC, VNC, Preprocessor, Post processor.

Adaptive control systems: Introduction, adaptive control with optimization for a milling machine, adaptive control with constraints for lathe, adaptive control of grinding

TEXT BOOKS:

1. P.N. Rao, "*CAD/CAM*", 2e,TMH, 2005.

2. Yoram Koren, "*Computer control of Manufacturing Systems*", 6e,TMH, 2009.

REFERENCES:

1. Mikell P.Groover, "*Automation, Production systems and computer Integrated manufacturing*" 8e,PHI, 2008.

2. D S N Murthy," *CNC Applications & Programming Techniques*", 1e, Goutam publications, 2003.