B.Tech IV Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME72 – INTRODUCTION TO CAD/CAM

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Course Objectives: The objectives of the course are to make the students learn about

- Understand the basics of CAD/CAM, geometric representation, transformations.
- Explain geometric modeling methods in CAD.
- Familiarize numerical control (NC), computer numerical control (CNC) and direct numerical control (DNC) machines.
- Impart knowledge on manual part programming and computer aided part programming.
- Explain the principles robotics, CIM, AR,VR and AI in CIM

UNIT – 1: CAD/CAM, 2D and 3D geometric transformations **12 Hrs**

CAD/CAM: Introduction, hardware and software, I/O devices, benefits. Graphics standards-Neutral file formats – IGES, STEP.

2D and 3D geometric transformations: Translation, scaling, rotation, mirroring, homogenous transformations, concatenation of transformations, viewing transformations.

Learning Outcomes:

At the end of this unit, the student will be able to

- List various input and output devices **L1**
- Apply geometric transformations in 2D and 3D **L3**
- Apply window to viewport transformation. **L3**

UNIT – II: Parametric representation & Geometric Modelling of Solids **10Hrs**

Parametric representation: Representation of curves, Hermite curves, Spline, Bezier and B-spline curves in two dimensions; Geometric modelling of surfaces: Surface patch, Coons and bicubic patches, Bezier and B-spline surfaces, sweep surfaces, surface of revolution, blending of surfaces;

Geometric Modelling of Solids: Wireframe, surface modelling, solid entities, boolean operations, CSG approach and B-rep of solid modelling, geometric modelling of surfaces.

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the concepts of parametric representation to curves and surfaces. **L3**
- Create surfaces such as Coons, Bezier and B-spline **L6**
- Differentiate wireframe, surface and solid modeling. **L4**
- Apply the solid modeling concepts. **L3**

UNIT – III: Computer Aided Manufacturing (CAM) **8Hrs**

Structure of numerical control (NC) machine tools, designation of axes, drives and actuation systems, feedback devices, computer numerical control (CNC) and direct numerical control (DNC), adaptive control system, CNC tooling, automatic tool changers and work holding devices, functions of CNC and DNC systems.

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify the differences between NC, CNC and DNC **L3**
- Use devices and activation systems. **L3**
- Apply adaptive control system **L3**
- Apply different tooling and tool chargers, working holding devices. **L3**

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UNIT – IV: Part programming and APT Programming **10 Hrs**

Part Programming: Part programming instruction formats, information codes, preparatory functions, miscellaneous functions (G-codes, M-codes). Tool codes and tool length offset, interpolations canned cycles.

APT Programming: APT language structure, APT geometry, Definition of point, line, circle, plane.

APT Motion Commands: set-up commands, pint to point motion commands; continuous path motion commands part programming preparation for typical examples (milling and turning operation)

Learning Outcomes:

At the end of this unit, the student will be able to

- Apply the fundamentals of part programming in CNC. **L3**
- Use G codes, M codes in CNC part programs. **L3**
- Apply the concept of canned or fixed cycles for the hole making operations. **L3**
- Identify geometric features in APT language. **L3**

UNIT – V: Automation **8Hrs**

Automation: Anatomy and configuration of robot, characteristics of robots, grippers, application of robots in manufacturing, robot programming languages. Computer integrated manufacturing (CIM): Elements of CIM, Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI) and expert systems in CIM.

Learning Outcomes:

At the end of this unit, the student will be able to

- Summarize the fundamentals of robotics. **L2**
- Categorize the CIM environment and its elements. **L4**
- Explain the role VR, AR and AI in manufacturing engineering. **L3**

Text Books:

1. P.N. Rao, CAD/CAM: Principles and applications, 3/e, Tata McGraw-Hill, Delhi, 2017.
2. Ibrahim Zeid, R.Siva Subramanian, CAD/CAM: Theory and Practice, 2/e, Tata McGraw-Hill, Delhi, 2009.

Reference Books:

1. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008.
2. P. Radhakrishnan, S. Subramanyan & V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008.
3. Computer Aided Manufacturing, 3/e, Tien Chien Chang, Pearson, 2008.

Course Outcomes:

At the end of this Course the student will be able to

- Apply the basics of geometric representation and transformations in CAD/CAM **L3**
- Choose geometric modeling methods for building CAD models. **L1**
- Compare NC, CNC and DNC **L2**
- Develop manual and computer aided part programming for turning and milling operations. **L3**
- Summarize the principles of robotics AR, VR and AI in CIM **L2**