

B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME55b – RAPID PROTOTYPING

(Open Elective-I)

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

- Familiarize techniques for processing of CAD models for rapid prototyping.
- Explain fundamentals of rapid prototyping techniques.
- Demonstrate appropriate tooling for rapid prototyping process.
- Focus Rapid prototyping techniques for reverse engineering.
- Train Various Pre – Processing, Processing and Post Processing errors in RP Processes

UNIT I

12 Hours

Introduction: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

RP Software: Need for RP software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, SolidView, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

Learning Outcomes:

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

- Explain prototyping process. L2
- Classify different Rapid Prototyping Processes. L2
- Summarize RP software’s and Represent a 3D model in STL format, other RP data formats. L2

UNIT II

10 Hours

Solid and Liquid Based RP Systems: Stereolithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications. Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications. Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications. Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

Learning Outcomes:

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

- Explain the principles, advantages, limitations and applications of Solid and Liquid based AM systems. L2
- Identify the materials for Solid and Liquid based AM systems. L2

UNIT III

8 Hours

Powder Based RP Systems: Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.

Other RP Systems: Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballistic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

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Learning Outcomes:

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

- Explain the principles, advantages, limitations and applications of powder based AM systems. L2
- Understand the principles, advantages, limitations and applications of other Additive Manufacturing Systems such as 3D Printing, Ballistic Particle Manufacturing and Shape Deposition Modeling. L2

UNIT IV**8 hours**

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

Learning Outcomes:

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

- Classify Rapid Tooling methods. L2
- Explain the concepts of reverse engineering and scanning tools. L2

UNIT V**8 Hours**

Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc.

RP Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Learning Outcomes:

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

- Identify various Pre – Processing, Processing and Post – Processing errors in RP processes. L2
- Apply of RP in engineering design analysis and medical applications. L3

Text Books:

1. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e Edition, World Scientific Publishers, 2003.
2. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1st Edition, Springer, 2010.
3. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

Reference Books:

1. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007.
2. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid tooling, Springer, London 2001.
3. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003.
4. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005.

Course Outcomes:

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

- Use techniques for processing of CAD models for rapid prototyping. L3
- Understand and apply fundamentals of rapid prototyping techniques. L3
- Use appropriate tooling for rapid prototyping process. L3
- Use rapid prototyping techniques for reverse engineering. L3
- Identify Various Pre – Processing, Processing and Post Processing errors in RP processes. L3