

3D Printing & Design

COURSE SYLLABUS

COURSE OBJECTIVES

The student will be able to

- To gain knowledge and skills related to 3D printing technologies.
- To learn the selection of material, equipment and development of a product for Industry 4.0 environment.
- To understand the various software tools, process and techniques for digital manufacturing.
- To apply these techniques into various applications.

COURSE OUTCOMES

After completion of this course, the students will be able to:

- Develop CAD models for 3D printing.
- Import and Export CAD data and generate .stl file.
- Select a specific material for the given application.
- Select a 3D printing process for an application.
- Produce a product using 3D Printing or Additive Manufacturing (AM).

PRE-REQUISITES

Computer Aided Design & Drafting
Engineering Materials

TOTAL: 30 HOURS

DETAIL CONTENTS

•3D Printing (Additive Manufacturing)

(6 Hours)

Introduction, Process, Classifications, Advantages, Additive v/s Conventional Manufacturing processes, Applications.

•CAD for Additive Manufacturing

(4 Hours)

CAD Data formats, Data translation, Data loss, STL format.

•Additive Manufacturing Techniques

(10 Hours)

•Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology.

•Process, Process parameter, Process Selection for various applications.

•Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools

4. Materials

(4 Hours)

•Polymers, Metals, Non-Metals, Ceramics Process, Process parameter, Process Selection for various applications.

• Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties.

4.3 Support Materials

5. Additive Manufacturing Equipment (4 Hours)

- 5.1 Process Equipment- Design and process parameters
- 5.2 Governing Bonding Mechanism
- 5.3 Common faults and troubleshooting
- 5.4 Process Design

6. Post Processing: Requirement and Techniques (1 Hour)

Support Removal, Sanding, Acetone treatment, polishing,

7. Product Quality (1 Hour)

- 7.1 Inspection and testing
- 7.2 Defects and their causes

LIST OF PRACTICALS

- 3D Modelling of a single component.
- Assembly of CAD modelled Components
- Exercise on CAD Data Exchange.
- Generation of .stl files.
- Identification of a product for Additive Manufacturing and its process plan.
- Printing of identified product on an available AM machine.
- Post processing of additively manufactured product.
- Inspection and defect analysis of the additively manufactured product.
- Comparison of Additively manufactured product with conventional manufactured counterpart.

LIST OF SUGGESTED BOOKS

- Lan Gibson, David W. Rosen and Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
- Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing”, Hanser Publisher, 2011.
- Khanna Editorial, “3D Printing and Design”, Khanna Publishing House, Delhi.
- CK Chua, Kah Fai Leong, “3D Printing and Rapid Prototyping- Principles and Applications”, World Scientific, 2017.
- J.D. Majumdar and I. Manna, “Laser-Assisted Fabrication of Materials”, Springer Series in Material Science, 2013.
- L. Lu, J. Fuh and Y.S. Wong, “Laser-Induced Materials and Processes for Rapid Prototyping”, Kulwer Academic Press, 2001.
- Zhiqiang Fan And Frank Liou, “Numerical Modelling of the Additive Manufacturing (AM) Processes of Titanium Alloy”, InTech, 2012