3D PRINTING

Course Code: MEOE01 **Course Credits: 3:0:0**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Dr JAYA CHRISTIYAN K G

Preamble

This course addresses additive manufacturing principles, variety and its concept, scope of additive manufacturing and areas of application.The current marketplace is undergoing an accelerated pace of change that challenges companies to innovate new techniques to rapidly respond to the ever changing global environment. A country's economy is highly dependent on the development of new products that are innovative with shorter development time. Organizations now fail or succeed based upon their ability to respond quickly to changing customer demands and to utilize new innovative technologies. In this environment, the advantage goes to the firm that can offer greater varieties of new products with higher performance and greater overall appeal.
At the center of this environment is a new generation of customers. These customers have forced organizations to look for new methods and techniques to improve their business processes and speed up the product development cycle. As the direct result of this, the industry is required to apply new engineering philosophy such as Rapid Response to Manufacturing (RRM). RRM concept uses the knowledge of previously designed products in support of developing new products.

Course Learning Objectives

1. The aim of the course is to provide the students, with an opportunity to conceive, design, and implement products quickly and effectively, using the latest Additive Manufacturing Techniques.
2. Technologies associated with material addition process are identified and its advantages are evaluated.
3. Students learn to differentiate various process parameters associated with Additive Manufacturing Technique & choose tooling techniques for a specific application.
4. Learn how relative improvements can be established by using computers and optimization techniques as compared to initial, manual solutions.

5. Students learn the Software associated with rapid prototyping techniques is explored.

UNIT I

Additive Manufacturing, The Generic AM Process, AM Information work flow, AM – An Integral part of Time compression Engineering, The Benefits of AM, Distinction Between AM and CNC Machining.
Reverse Engineering Technology: Introduction to reverse Engineering, Computer aided forward/Reverse Engineering, Reverse Engineering Hardware, Contact methods, Non contact Methods, Reverse Engineering Software.

UNIT II

Classification of AM Processes: Liquid Polymer Systems, Discrete Particle Systems, Molten Material Systems, Solid Sheet Systems, New AM Classification Schemes, Metal Systems, Hybrid Systems,
Design for AM: Part Orientation, Removal of Supports, Hollowing Out Parts, Reduction of Part Count in an Assembly.

UNIT III

Vat Photo polymerization Processes: Introduction, Vat Photo polymerization Materials, Photo polymerization Process,
Powder Bed Fusion Processes: Introduction, Materials, Powder Fusion Mechanisms, Process Parameters and Modeling, Polymer Laser Sintering

UNIT IV

Extrusion-Based Systems: Introduction, Basic Principles, Fused Deposition Modeling from Stratasys, Materials, Limitations of FDM, Bio extrusion,

Directed Energy Deposition Processes: Introduction, Material Delivery, Powder Feeding, Wire Feeding, Laser Based Metal Deposition Processes; Electron Beam Based Metal Deposition Processes

UNIT V

Direct Methods for Rapid Tool: RTV Tools, Paper Pulp Molding Tools
Indirect Methods for Rapid Tool Rapid Tooling: Silicone rubber tooling, Aluminum filled epoxy tooling, and Spray metal tooling.
Applications for Additive Manufacture: Medical, art models, Engineering analysis models, Functional models

TEXT BOOKS:

1. Additive Manufacturing Technologies, I. Gibson l D. W. Rosen l B. Stucker, Springer New York Heidelberg Dordrecht London, 2010.
2. Stereo lithography and other RP & M Technologies, Paul F.Jacobs: "SME, NY 1996.
3. Rapid manufacturing, FIham D.T &Dinjoy S.S verlog London 2001.

REFERENCE BOOKS:

1. Rapid prototyping, Terry Wohler's Report 2000" association 2000.

2. Rapid prototyping materials by Gurumurthi. IISc Bangalore.

3. Rapid automated by lament wood. Indus press New York.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Describe the differences and of the application of a range of additive manufacturing processes[PO1,PO2,PO4,PO12,PSO1,PSO2]
2. Select and use correct CAD formats in the manufacture of a 3D printed part. [PO1,PO2,PO4,PO12,PSO1,PSO2]
3. Understand the operating principles, capabilities, and limitations of liquid and solid based additive manufacturing system, including fused deposition modeling and stereolithography. [PO1,PO2,PO3,PO4,PO5,PO12,PSO1,PSO2]
4. Appreciate the operating principles, capabilities and limitations of powder based additive manufacturing system, including 3D printing and laser sintering[PO1,PO2,PO3,PO4,PO5,PO12,PSO1,PSO2]
5. Describe the important process parameters of AM techniques[PO1,PO2,PO3,PO4,PO5,PO12,PSO1,PSO2]