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**IE 527 – Additive Manufacturing**

**Instructor:**

Dr. Sanjay Joshi

303 Leonhard Building

Phone #:865-2108

Email:sjoshi@psu.edu

**Course Description:**

Comprehensive study of fundamentals, process characteristics and practical applications of various Additive Manufacturing processes.

**Learning Objectives:**

* Learn the basic process steps of the Digital Work Flow from Design to Manufactured AM parts
* Understand the various software tools, processes and techniques that enable advanced/additive manufacturing
* Learn the fundamentals of various additive manufacturing (AM) processes using polymers, metals, and other material and understand the operating principles, capabilities, and limitations of AM processes
* Gain hands-on experience with AM machines and understand the complete process steps through design, fabrication, and measurement of example parts.
* Study the range of applications of AM across the spectrum of industries (e.g. aerospace/automotive, medical devices, and consumer products) while developing the understanding of the requirements, constraints, and business case for the applications.
* Be able to evaluate and select appropriate AM technologies for specific applications
* AM role in the future of manufacturing and digital transformation of manufacturing

**Text Book:**

*Additive Manufacturing Technologies-3D Printing, Rapid Prototyping and Direct Digital Manufacturing*

*Authors: Ian Gibson, David W. Rosen, Brent Stucker*

*Springer, 2015*

**Course Outline**

Introduction to Additive Manufacturing Processes

Digital Workflow for Additive Manufacturing

 Common Process Steps

 Role of 3-D CAD

 Other Sources of 3-D data (Point Cloud, CT scan, MRI) and conversion to data for AM

 Data files and Data Standards

 Algorithms for processing CAD Data - Slicing, Orientation, Support Generation

 Process Planning for AM

Implications of Additive Manufacturing on Design

 Shape Optimization

 Design for Additive Manufacturing

Reverse Engineering

 3-D Geometric Data Acquisition

 Technology for 3-D Scanning

 Working with 3-D Point Cloud Data

 Fitting polygons and surfaces

 Reconstruction of Solid and Surface Models

Material for AM and Material Properties

 Polymers and Photopolymers

 Metal Powders

 Material Properties and Impact of AM

Additive Manufacturing Processes, Process Characteristics and Capability, Process Models

 Vat Polymerization

 Material Extrusion

 Material Jetting

 Binder Jetting

 Sheet Lamination

 Powder Bed Fusion

 Directed Energy Deposition

Post Processing of AM Parts

* Processes to improve material characteristics (HIP, Annealing, etc.)
* Improving Surface Finish

Business Case for AM

 Applications and Case Studies of AM in Aerospace, Bio Medical and other domains

 Process Cost Models

 Impact on Supply Chain