

## Department of Mechanical Engineering

**19MEE307 Additive Manufacturing**

**UNIT I INTRODUCTION**

Standard Terminology for  
Additive Manufacturing Technologies

### Theory:

Overview – Need - Development of Additive Manufacturing Technology -Principle –AM Process Chain- **Classification** –Rapid Prototyping- Rapid Tooling – Rapid Manufacturing – Applications Benefits –Case studies.

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### Practicals :

- 1.Study on various RP machines and its features available in the market
2. Survey on the Materials used in AM process

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### Standard Terminology for Additive Manufacturing Technologies

This terminology includes terms, definitions of terms, descriptions of terms, nomenclature, and acronyms associated with additive-manufacturing (AM) technologies in an effort to standardize terminology used by AM users, producers, researchers, educators, press/media and others

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### Additive Manufacturing Process Categories

**binder jetting**,  $n$ —an additive manufacturing process in which a liquid bonding agent is selectively deposited to join powder materials.

**directed energy deposition**,  $n$ —an additive manufacturing process in which focused thermal energy is used to fuse materials by melting as they are being deposited.

Focused thermal energy means that an energy source (e.g., laser, electron beam, or plasma arc) is focused to melt the materials being deposited.

**material extrusion**,  $n$ —an additive manufacturing process in which material is selectively dispensed through a nozzle or orifice.

**material jetting**,  $n$ —an additive manufacturing process in which droplets of build material are selectively deposited.

Example materials include photopolymer and wax.

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**powder bed fusion,  $n$** —an additive manufacturing process in which thermal energy selectively fuses regions of a powder bed.

**sheet lamination,  $n$** —an additive manufacturing process in which sheets of material are bonded to form an object.

**vat photo polymerization,  $n$** —an additive manufacturing process in which liquid photopolymer in a vat is selectively cured by light-activated polymerization.

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### Terminology *Definitions*

**3D printer**, *n*—a machine used for 3D printing.

**3D printing**, *n*—the fabrication of objects through the deposition of a material using a print head, nozzle, or another printer technology.

**3D scanning**, *n*—a method of acquiring the shape and size of an object as a 3-dimensional representation by recording X,y,Z coordinates on the object's surface and through software the collection of points is converted into digital data.

Typical methods use some amount of automation, coupled with a touch probe, optical sensor, or other device. Synonym: 3D digitizing.

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**additive manufacturing (AM)**, *n*—a process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies. Synonyms: additive fabrication, additive processes, additive techniques, additive layer **manufacturing**, layer manufacturing, and freeform fabrication.

**additive systems**, *n*—machines used for additive manufacturing.

**binder jetting**, *n*—an additive manufacturing process in which a liquid bonding agent is selectively deposited to join powder materials.

**direct metal laser sintering (DMLS)**, *n*—a powder bed fusion process used to make metal parts directly from metal powders without intermediate “green” or “brown” parts; term denotes metal-based laser sintering systems from EOS GmbH - Electro Optical Systems. Synonym: direct metal laser melting.

**fused deposition modeling (FDM®)**, *n*—a material extrusion process used to make thermoplastic parts through heated extrusion and deposition of materials layer by layer; term denotes machines built by Stratasys, Inc.

**laser sintering (LS)**, *n*—a powder bed fusion process used to produce objects from powdered materials using one or more lasers to selectively fuse or melt the particles at the surface, layer by layer, in an enclosed chamber.

Most LS machines partially or fully melt the materials they process. The word “sintering” is a historical term and a misnomer, as the process typically involves full or partial melting, as opposed to traditional powdered metal sintering using a mold and heat and/or pressure.



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**prototype tooling**,  $n$ —molds, dies, and other devices used to produce prototypes; sometimes referred to as bridge tooling or soft tooling.

**rapid prototyping**,  $n$ —additive manufacturing of a design, often iterative, for form, fit, or functional testing, or combination thereof.

**rapid tooling**,  $n$ —the use of additive manufacturing to make tools or tooling quickly, either directly, by making parts that serve as the actual tools or tooling components, such as mold inserts, or indirectly, by producing patterns that are, in turn, used in a secondary process to produce the actual tools.

**rapid tooling**,  $n$ —*in machining processes*, the production of tools or tooling quickly by subtractive manufacturing methods, such as CNC milling, etc.



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**reverse engineering**, *n*—*in additive manufacturing*, method of creating a digital representation from a physical object to define its shape, dimensions, and internal and external features.

**selective laser sintering (SLS®)**, *n*—denotes the LS process and machines from 3D Systems Corporation.

**sheet lamination**, *n*—an additive manufacturing process in which sheets of material are bonded to form an object.

**stereolithography (SL)**, *n*—a vat photopolymerization process used to produce parts from photopolymer materials in a liquid state using one or more lasers to selectively cure to a predetermined thickness and harden the material into shape layer upon layer.

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**subtractive manufacturing,  $n$** —making objects by removing of material (for example, milling, drilling, grinding, carving, etc.) from a bulk solid to leave a desired shape, as opposed to additive manufacturing.

**surface model,  $n$** —a mathematical or digital representation of an object as a set of planar or curved surfaces, or both, that may or may not represent a closed volume.

**D<sub>ISCUSSION</sub>**—May consist of Bezier B-spline surfaces or NURBS surfaces. A surface model may also consist of a mesh of polygons, such as triangles, although this approach approximates the exact shape of the model.

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**tool, tooling,  $n$** —a mold, die, or other device used in various manufacturing and fabricating processes such as plastic injection molding, thermoforming, blow molding, vacuum casting, die casting, sheet metal stamping, hydroforming, forging, composite lay-up tools, machining and assembly fixtures, etc.

**vat photopolymerization,  $n$** —an additive manufacturing process in which liquid photopolymer in a vat is selectively cured by light-activated polymerization.

### *Acronyms:*

**CAD**, *n*—Computer-Aided Design. The use of computers for the design of real or virtual objects.

**CAM**, *n*—Computer-Aided Manufacturing. Typically refers to systems that use surface data to drive CNC machines, such as digitally-driven mills and lathes, to produce parts, molds, and dies.

**CNC**, *n*—Computer Numerical Control. Computerized control of machines for manufacturing.

**D<sub>ISCUSSION</sub>**—Common CNC machines include mills, lathes, grinders, and flame, laser, and water-jet cutters.

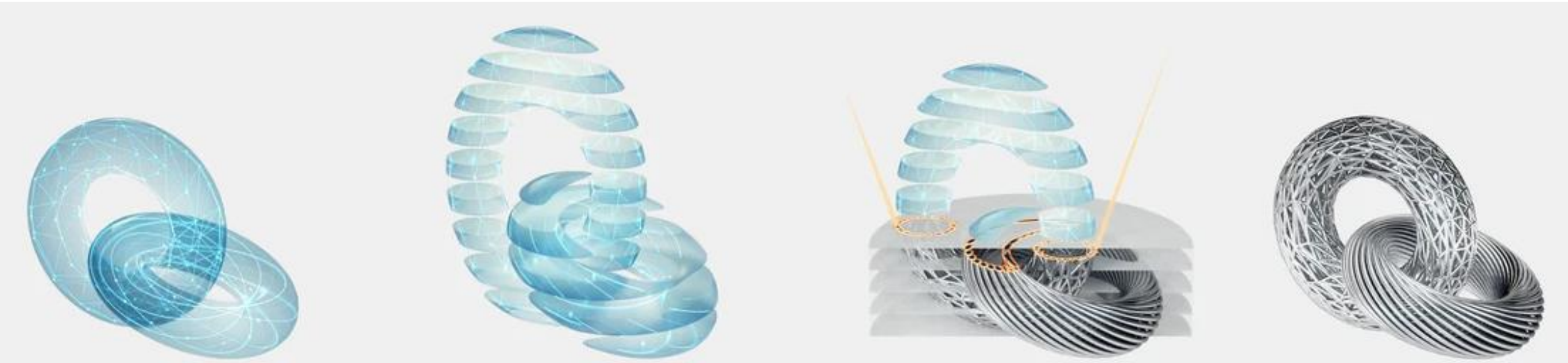
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**IGES**, *n*—Initial Graphics Exchange Specification, a platform neutral CAD data exchange format intended for exchange of product geometry and geometry annotation information;

**STL**, *n*—*in additive manufacturing*, file format for 3D model data used by machines to build physical parts; STL is the de facto standard interface for additive manufacturing systems.

STL originated from the term stereolithography.

**DISCUSSION**—The STL format, in binary and ASCII forms, uses triangular facets to approximate the shape of an object. The format lists the vertices, ordered by the right-hand rule, and unit normals of the triangles, and excludes CAD model attributes.



Ref: <https://www.eos.info/en/industrial-3d-printing/additive-manufacturing-how-it-works>

# Thank you