

# *CAD/CAM (21-342)*

*Advanced Manufacturing Laboratory  
Department of Industrial Engineering  
Sharif University of Technology*

*Session # 11*



## *Course Description*

### ▪ *Instructor*

- *Omid Fatahi Valilai, Ph.D. Industrial Engineering Department, Sharif University of Technology*
- *Email: [FValilai@sharif.edu](mailto:FValilai@sharif.edu), Tel: 6616-5706*
- *Website: [Sharif.edu/~fvalilai](http://Sharif.edu/~fvalilai)*

### ▪ *Class time*

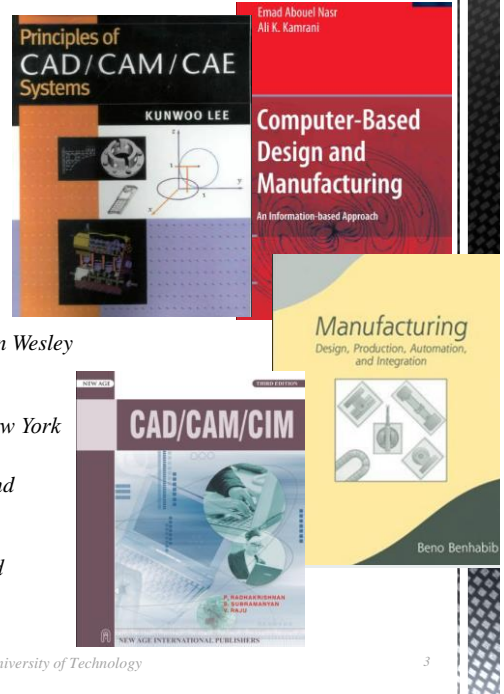
- *Saturday- Monday 10:30-12:00*

### ▪ *Course evaluation*

- *Mid-term (25%)*
- *Final exam (40%)*
- *Quiz (5%)*
- *Exercise (30%)*

## Course Description (Continued ...)

- **Mid-term session:**
  - Monday: 8<sup>th</sup> Ordibehesht 1393, 10:30 ~ 12:30
- **Final Exam:**
  - Saturday: 24<sup>th</sup> Khordad 1393, 15:00 ~ 17:30
- **Reference:**
  - Lee, Kunwoo; "Principles of CAD/CAM/CAE systems", 1999, Addison Wesley
  - Abouel Nasr, Emad; Kamrani, Ali K.; "Computer-Based Design and Manufacturing: An Information-Based Approach", 2007, Springer, New York
  - Benhabib, Beno; "Manufacturing: Design, Production, CAD/CAM, and Integration", 2003, Marcel Dekker Inc, New York
  - Radhakrishnan, P.; Subramanian, S.; Raju, V.; "CAD/CAM/CIM", 3rd edition, 2005, New age international (P) limited publishers, New York



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## Course Description (Continued..)

- **Contents:**
  - Introduction to CAD/CAM/CAE systems (5 sessions)
  - Components of CAD/CAM/CAE systems (2 sessions)
  - Geometric modeling systems (3 sessions)
  - Optimization in CAD (5 sessions)
  - Rapid prototyping and manufacturing (3 sessions)
  - Virtual engineering (2 sessions)
  - Product Life Cycle Cost Model (2 sessions)
  - Computer-Based Design and Features/Methodologies of Feature Representations (5 sessions)
  - Feature-Based Process Planning and Techniques (3 sessions)
  - Collaborative Engineering (2 sessions)

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## Course Description (Continued..)

### ▪ Contents:

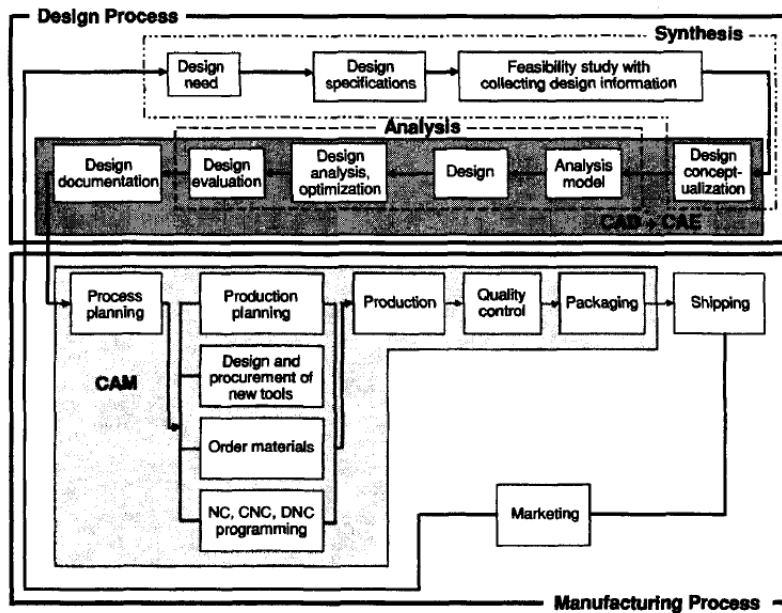
- Rapid prototyping and manufacturing
- RP primitives
- Application of RP

(3 sessions)

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## Introduction to CAD/CAM/CAE systems



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## Rapid prototyping and manufacturing

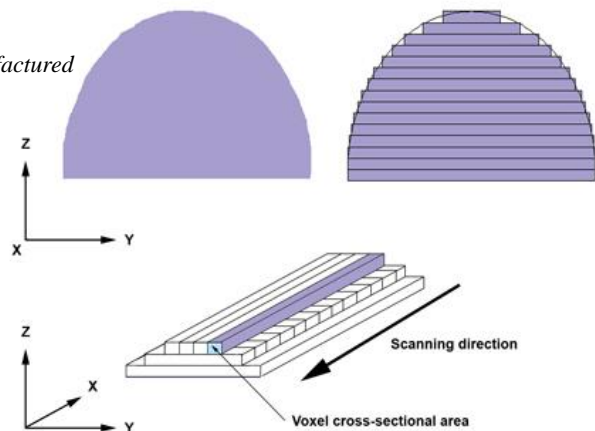
- **RP primitives**
  - *Rapid prototyping' is a group of techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer aided design (CAD) data.*
  - *Construction of the part or assembly is usually done using 3D printing or "additive layer manufacturing" technology.*
    - *Alternatively, it is also called:*
      - *Layered manufacturing*
      - *3D printing*
      - *Desktop manufacturing*
      - *Solid free form manufacturing*

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## Rapid prototyping and manufacturing

- **RP primitives**
  - *The process of RP is consists of three steps:*
    - *Form the cross sections of the part to be manufactured*
    - *Lay the cross section layer by layer*
    - *Combine the layers*



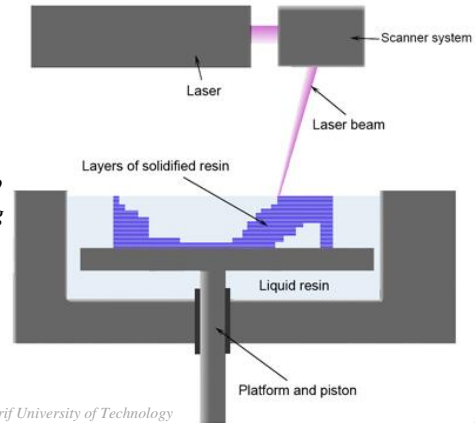
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## Rapid prototyping and manufacturing

### RP

- Stereo Lithography:
  - In late 1970s and 1980s:
    - A photosensitive polymer that solidifies when exposed to a lightening source is maintained in liquid state
  - A platform as an elevator
  - The UV laser scans the polymer layer above the platform to solidify the polymer and give it the shape of the corresponding cross section
  - The platform is lowered in the polymer bath based on the layer thickness



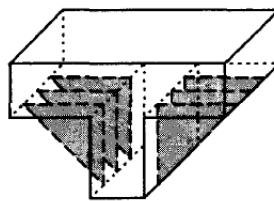
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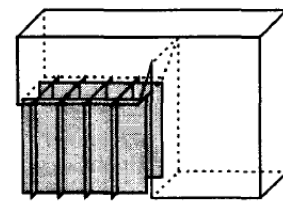
## Rapid prototyping and manufacturing

### RP

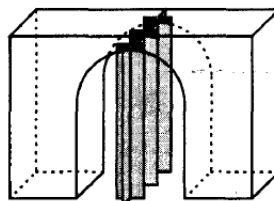
- Stereo Lithography:



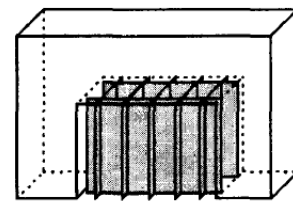
(a) Gusset



(b) Island



(c) Ceiling within an arch



(d) Ceiling

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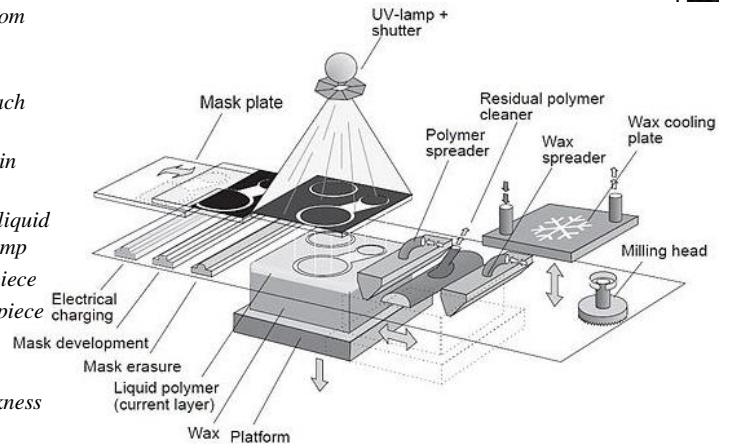
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## Rapid prototyping and manufacturing

### RP

#### Solid Ground Curing (SGC):

- The cross section of each layer is calculated from the geometric model of the part and the desired thickness
- The optical mask is generated conforming to each section
- After leveling the platform is covered with a thin layer of the liquid photopolymer
- The mask is positioned over the surface of the liquid resin, the resin is exposed to high power UV lamp
- The residual liquid is removed from the work piece
- A layer of melted wax is spread over the work piece to fill the voids
- The wax is solidified
- The layer surface is trimmed to the desired thickness
- At the end the wax is melted



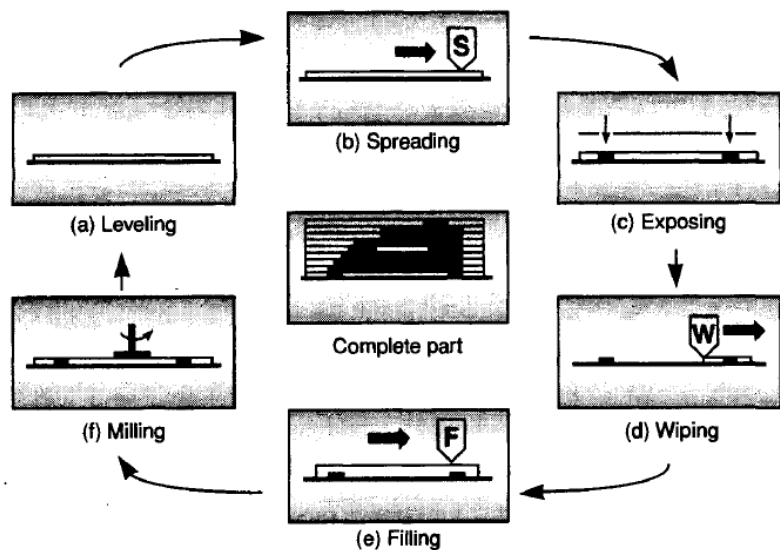
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## Rapid prototyping and manufacturing

### RP

#### Solid Ground Curing (SGC):



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