



# SAMSKRUTI COLLEGE OF ENGINEERING & TECHNOLOG

(Approved by AICTE, New Delhi & Affiliated to JNTUH.)

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**Subject Name:CAD/CAM**

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**Year and Sem, Department:IV-I,MECHANICAL**

## **Unit-I: FUNDAMENTALS OF CAD AND GEOMETRICAL MODELING**

### **Important points / Definitions**

1. Computer-aided design/computer-aided manufacturing (CAD/CAM) refers to hardware and software systems that can be used in manufacturing or design processes.
2. Professionals use CAD/CAM tools in multiple stages of product development
3. first in building designs in blueprints, and then in actually creating or assembling physical products and parts using computer-controlled equipment
4. CAD can be thought of as a system consisting of input devices, processors and output devices.
5. For example Input devices include keyboard, mouse, scanner, digital camera and drawing tablet.
6. Processors include CPU (Central Processing Unit the brains of the computer), operating system, and memory and CAD software.
7. Output devices include monitor, printer, plotter, cutter and CNC machines.
8. Various applications of CAD software like geometric modeling, engineering analysis, FEA, design review and evaluation, drafting.
9. Five major advantages of CAD drafting
  - i. Better Quality Designs
  - ii. Easy Saving and Sharing
  - iii. Modify and Reproduce Faster
  - iv. Ability to Create 3D CAD Model
  - v. Template and Database Creation
10. Geometric modeling is a branch of [applied mathematics](#) and [computational geometry](#) that studies methods and [algorithms](#) for the mathematical description of shapes.
11. The shapes studied in geometric modeling are mostly two- or three-[dimensional](#), although many of its tools and principles can be applied to sets of any finite dimension.
12. Wireframe modeling is the process of visual presentation of a three-dimensional or physical object used in 3-D computer graphics. It is an abstract edge or skeletal representation of a real-world 3-D object using lines and curves.
13. Basic wire-frame entities can be divided into analytic and synthetic entities.
14. analytic entities
  - Lines, Circles, Ellipses, Parabolas, Hyperbolas, Conic Curves
15. and synthetic entities



16. Hermite Cubic Splines, Bezier Curves: cubic curve with four control points, B-Splines: general case of Bezier's curve (non-uniform)

### Short Questions

1. . What is parametric CAD system? (Dec-2018)
2. Differentiate between implicit and explicit functions? (Dec-2018)
3. List out input and output devices of CAD? (April-2018)
4. What is the importance of continuity curves? (April-2018)
5. What are the computer peripherals of CAD? (Dec-2017)
6. Distinguish between algebraic and geometric form of curve? (Dec-2017)
7. What is the function s of geometric modeling in design? (Dec-2017)
8. Write 10 advantages and disadvantages by the adaption of CAD? (Dec-2016)
9. Write any 10 auto CAD commands with small description? (Dec-2016)
10. What are the CAD benefits? (Dec-2016)

### Long Questions

1. Briefly describe the types of storage devices used in computers? (Dec-2018)
2. Explain the concepts of parametric and non-parametric curves with examples? (Dec-2018)
3. Differentiate the terms wire frame, surface and solid models along with their benefits? (Dec-2018)
4. Write the properties of Bezier and B-spline curves? (Dec-2018)
5. Differentiate between the interpolation and approximation of curves? (April-2018)
6. What are the applications of computer in design? (April-2018)
7. Derive the parametric equation of Hermite cubic spline and list out its characteristics? (April-2018)
8. What is the most commonly used graphic terminal? Explain its working? (Dec-2017)
9. What are the input and output devices, explain in briefly? (Dec-2016)
10. How do you distinguish between a CPU and a microprocessor? (Dec-2016)

### Fill in the Blanks / Choose the Best

1. CAD/CAM is the relationship between
  - a) science and engineering
  - b) manufacturing and marketing
  - c) design and manufacturing
  - d) design and marketing

**Ans:c**

2. The term that is used for geometric modeling like solid modeling, wire frame modeling and drafting is known as
  - a) software package
  - b) operating system



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- c) application software
- d) none of the mentioned

**Ans:c**

3. The system environment in a mainframe computer consists of
- a) central processing
  - b) storage devices
  - c) printers and plotters
  - d) both central processing and storage devices

**Ans:d**

4. The nerve center or brain of any computer system is known as
- a) CPU
  - b) Storage device
  - c) ALU
  - d) Monitor

**Ans:c**

5. The basic geometric building blocks provided in a CAD/CAM package are
- a) points
  - b) lines
  - c) circles
  - d) all of the mentioned

**Ans:d**

6. Modern CAD systems are based on:
- a) ICG
  - b) GCI
  - c) GIF
  - d) IFG

**Ans:a**

7. Wire frame model sometimes referred to as a-----
8. A-----curve is the minimum acceptable curve for engineering design.
9. Parametric equation for a line -----
10. Keyboard is a-----device

**Answers:**

- 7. Stick figure or edge representation of the object
- 8. C1
- 9.  $P=p1+u (p2-p1)$
- 10. Input



## **Unit-II: SURFACE MODELING AND SOLID MODELLING**

### **Important points / Definitions**

1. **Surface modeling** is a mathematical method usually provided in computer-aided design applications for displaying solid-appearing objects.
2. Surface modeling this process is used to create surfaces of desired shape by trimming, stitching and joining different surfaces to create a final shape model.
3. Surface modeling is a popular technique for architectural designs and renderings. Surface modeling has wide range of applications such as in consumer products, marine vehicles, body panels of automobiles and aircraft structures
4. Surface modeling is widely used in CAD (computer-aided design) for illustrations and architectural renderings. It is also used in 3D animation for games and other presentations.
5. Surface Modeling Analytical Surface Free-form, Curved, & Sculptured Surface
6. A surface model A surface model is a set of faces a set of faces. A surface model consists of wireframe entities that form the basis to create surface entities the basis to create surface entities.
7. In general, a wireframe model can be extracted from a surface model surface model by deleting or blanking all surface entities deleting or blanking all surface entities
8. **Solid modeling** (or modeling) is a consistent set of principles for mathematical and computer modeling of three-dimensional solids.
9. Solid modeling this process is used to create solid components of desired shape by joining and cutting different solid volumes. The final solid model is a virtual replica of an actual product but it can be seen and rotated like a real product.
10. There are two main types: · direct where the model can be edited by undoing or modifying the model directly on the 3D parametric where the model is constructed using parameters (variable quantities such as measurements) and the model can be edited at any point in its history.
11. Together, the principles of geometric and solid modeling form the foundation of 3D-computer-aided design and in general support the creation, exchange, visualization, animation, interrogation, and annotation of digital models of physical objects.
12. Different Solid Modeling Techniques Different Solid Modeling Techniques
  - i. Constructive Solid Geometry (CSG)
  - ii. Sweeping
  - iii. Boundary Representation (B-Rep)
  - iv. Feature-Based Modeling - uses feature-based primitives to conduct a design
  - v. Primitive Instancing - uses large numbers (200 - 300) of "primitives" to build object - used for programming NC machine tools (past) machine tools (past)
  - vi. object - used for programming NC machine tools (past) machine tools (past)
  - vii. Cell Decomposition, Spatial Enumeration.



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## Short Questions

1. What is meant by surface patch? (Dec-2018)
2. What is subdividing? (April-2018)
3. Write the parametric equation of ruled surface? (April-2018)
4. Write Bezier and B-spline surface mathematical relation? (Dec-2016)
5. What is blending function? (Mar-2017)
6. Write the parametric equation of surface of revolution? (Mar-2017)
7. What is automation? (Mar-2017)

## Long Questions

1. Define Bezier surface? Explain various characteristics of this surface? (April-2018)
2. Enlist and Explain with different Boolean operations in solid modeling? (April-2018)
3. Explain the cell decomposition and special occupancy enumeration? (April-2018)
4. Sketch the geometric parameters required to create these surface operations? (Dec-2018)
  - a) Tabulated cylinder
  - b) Revolve
  - c) Sweep
  - d) Loft
5. Find the equation Bezier curve which is defined by 4 points as  $(80,30,0), (100,100,0), (200,100,0), (250,30,0)$  ? (Dec-2018)
6. Explain the following terms in detail with respect to surface modeling? (Dec-2017)
  - a) Cylinder surface
  - b) Ruled surface
  - c) Composite surface
7. Distinguish between surface modeling and wire frame modeling in detail? (Dec-2017)
8. What is meant by sweep? Discuss in detail the various types sweep techniques available for 3D geometric construction (Dec-2017)
9. Give a classification of the different surfaces that can use in geometric modeling applications? (Dec-2016)
10. What is meant by continuity of curves? What are the types of continuity curves? (Dec-2016)

## Fill in the Blanks / Choose the Best

1. Boolean operations containing.

- a) Union
- b) subtract
- c) Intersect
- d) All above mentioned

**ans:d**

2. Plane surface created with \_\_\_ points

- a) 3 non coincidental
- b) 2 non coincidental
- c) 1 non coincidental
- d) none

**ans:a**



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3. Solid modeling belongs to

- a) 3-D
- b) 2-D
- c) 1-D
- d) None

**ans:a**

4. Surface modeling can create --- objects

- a. Non Sense objects
- b. 2D
- c. Solid appearing objects
- d. All above mentioned

**ans:c**

5. Application of surface modeling

- a) Aero space blades
- b) Ship panels
- c) both
- d) none

**ans:c**

### **Fill in the Blanks**

- 1. Surface of revolution can model -----objects.
- 2. Solid modeling called as-----
- 3. Surface modeling application-----,
- 4. Plane surface used for ----- view of the objects.
- 5. Blending function used for -----.

### **Answers:**

- 1. Axi symmetric
- 2. Volumetric modeling
- 3. Car, ship panels design
- 4. Cross sectional view
- 5. Joining of two surfaces



### **Unit-III: NC CONTROL PRODUCTION SYSTEMS**

#### **Important points / Definitions**

1. Numerical control is defined as the form of programmable automation, in which the process is controlled by the number, letters, and symbols.
2. Advantages of Numerical control, Greater operator safety, Greater operator efficiency, Reduction of scrap, Reduced lead time for production, Maximal accuracy and interchangeability of parts
3. Three important components of the numerical control or NC system. These are Program of instructions, Controller unit, also called as the machine control unit (MCU) and Machine tool.
4. CNC stands for Computer Numerical Control.
5. It is defined as the machine which is used to control the motions of the workpiece and tool with the help of prepared program in computer. The program is written in alphanumeric data.
6. In CNC machines, the programs can be stored in the computer and can be used again and again.
7. It can be run continuously for 24 hours of a day.
8. Direct numerical control (DNC), also known as distributed numerical control (also DNC), is a common manufacturing term for networking CNC machine tools. On some CNC machine controllers, the available memory is too small to contain the machining program
9. There are various advantages provided by DNC system. These are as follows  
Easy and Effective programming using DNC Software.  
Higher level of decision making  
Real time control of various machine tools.  
First step which gives hands on experience for future expansion.  
Elimination of Punched Tape and Tape Reader.
10. Elimination of hardwired controller unit on some system.  
Greater Productivity.  
Convenient Storage of NC Part Program.  
Greater Computational ability.  
Location of central compute

#### **Short Questions**

1. Define APT? (Dec-2018)
2. What are the different elements of NC system? (Dec-2018)
3. What do you understand the M and G functions? (April-2018)
4. Compare NC, CNC and DNC? (April-2018)
5. What are the M03 and M30 codes stands for in NC programming? (Dec-2017)
6. Explain the use of the MACROS in part programming? (April-2018)
7. Define the MCU, DPU, and CLU in NC system? (Mar-2017)
8. Differentiate the ACO and ACC type adaptive? (Mar-2017)



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## Long Questions

1. What are the features of CNC Machine tool? Write any 10 G-codes and 10 M-codes with a short description? (Dec-2018)
2. Discuss the advantages of computer assisted part programming over manual part programming? (Dec-2018)
3. Explain the difference between CNC and DNC along with neat sketches? (Dec-2018)
4. Write NC part program for the part shown in the below figure. All the dimensions are in mm only? (Dec-2018)
5. How the NC machines are classified? Explain them with neat sketches? (April-2018)
6. With neat sketches write down the neat procedure for manual part programming? (April-2018)
7. Explain the concept of adaptive control of NC machines? (April-2018)
8. List out the various types G code and M code functions? (April-2018)
9. Discuss the basic feedback control system used in CNC Machine tools? (Dec-2017)
10. With the neat sketch, explain the functioning of a NC machine. State two important differences between NC and CNC? (Dec-2017)
11. What are the four types of statements in APT Language? (Mar-2017)

## Fill in the Blanks / Choose the Best

1. For CNC machining skilled part programmers are needed.

- a) True
- b) False

**ans:a**

2. CNC machining centres do not include operations like \_\_\_\_\_

- a) milling
- b) boring
- c) welding
- d) tapping

**ans:c**

3. In NC (Numerical Control) machine tool, the position feedback package is connected between

- a. control unit and programmer
- b. programmer and machine tool
- c. control unit and machine tool
- d. programmer and process planning

**ans:c**

4. In CNC machine tool, the part program entered into the computer memory

- a. can be used only once
- b. can be used again and again
- c. can be used again but it has to be modified every time
- d. cannot say

**ans:b**

## Fill in the Blanks

1. APT stands for -----
2. DNC Stands for -----





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3. MCU stands for -----
4. M05 for-----
5. G00 for-----
6. N code for -----

**Answers:**

1. Automated programmed tool.
2. Direct numerical control
3. Machine control unit
4. Spindle stop
5. Rapid traverse
6. Sequence number identification