

UNIT I INTRODUCTION

PART –A

1. Why should we go for CAD? (Nov/Dec2015)

There are four fundamental reasons for implementing CAD system which are as follows

- To increase the Productivity of the designer
- To improve the qualities of the design
- To improve Communications
- To create a database for engineering

2. Mention any four applications of computer aided design in mechanical engineering?(Nov/Dec 2015)

The applications of computer aided design in mechanical engineering cover all types of manufacturing operations such as milling, turning wire cut EDM, punching, etc.

3. List the types of 2D geometric transformation? (Nov/Dec 2015)

- Windowing and viewing transformation, Zooming transformation
- Clipping transformation, Reflection transformation

4. What is the design process? Mention the steps involved in shigley's model for the design process? (May/June 2016)

The engineering design process is a methodical series of steps that engineers use in creating functional products and processes. The process is highly iterative - parts of the process often need to be repeated many times before another can be entered – though the part(s) that get iterated and the number of such cycles in any given project can be highly variable.

5. What is Translation?

Translation is one of the important types of transformer. This is used to move the entity after moving all points of new entity are parallel to all points of old entity.

6. Define Concurrent Engineering?

Concurrent Engineering is also known as Simultaneous Engineering. Here while the product is designed the design and manufacturing process are carried out simultaneously this technique facilitates the design engineer to improve the efficiency of product design and process.

7. List out the factor consider for CAD ?

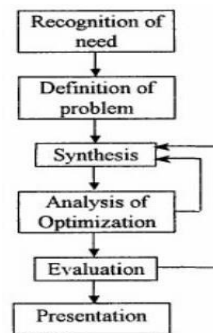
- Reliability, Cost Factor
- Comparability with other system
- Memory Requirements and Storage requirements

8. What is the main drawback of wire frame modeling ?

The main drawback in terms of representation of objects in wireframe model is

- Lack of clarity
- The part geometry model is complex in the case of 3D wireframe system
- Hidden line causes the image to be confused

9. Draw the flow diagram of Sequential Engineering



10. What are the disadvantages of Beizer Curve ?

- The Curve does not pass through the control points which may be inconvenient to the designer
- The Bezier curve lacks control it only has the global control nature
- If one control point is changed the whole curve changes thus the designer cannot selectively change part of the curve

11. What is meant by morphology design?

Morphology design refers the study of the chronological structure of design projects.

12. List the various stages in the life cycle of a product? (May/June 2016)

- Introduction Stage, Maturity Stage
- Growth Stage, Decline Stage

13) Define computer graphics.

Computer graphics may be defined as the process of creation, storage and manipulation of drawings and pictures with the aid of a number.

14) What are the functions of IGC?

- a. Solid modeling
- b. Storage
- c. Manipulation
- d. Viewing

15) What are the various display control facilities in graphics?

- i.VectorGeneration
- ii. Windowing and viewingtransformation.
- iii. Clippingtransformation
- iv. Zooming
- v. Panning
- vi. Transmitting information on a network and
- vii. Graphicslibraries.

16) What is meant by viewpoint?

The viewpoint is the area on the screen in which the contents of the window are to be displayed as an image.

17) What is viewing transformation and windowing transformation?

The processes of mapping from the model co-ordinate system to the screen coordinate system is known as viewing transformation. The viewing transformation in which no rotation is applied is called the windowing transformation.

18) What is meant by Clipping?

Clipping is the process of determining the visible portion of a drawing lying within a window and discarding the rest.

19) State the use of reflection transformation.

It allows a copy of the object to be displayed while the object is reflected about a line or a plane.

20) What is the use shading Technique?

This technique is used to display the images in natural way. It is based on the recognition of distance and shape as a function of illumination.

21) How information is transmitted on a network?

The data must be encoded using a protocol. Protocol is a set of rules that control the exchange of data between the communicating devices.

22) What are the main types of 2D transformations?

- i. Translation
- ii. Scaling
- iii. Reflection
- iv. Rotation
- v. Shearing

23) What is meant by concurrent engineering?

The concept and practice of various functions or departments working together, from the beginning, to engineer a product.

24) What are the advantages of Concurrent engineering?

- The design decisions are taken by a team of multi disciplinary experts.
- Changes and modification on the product design will be faster.
- Higher quality.

25) What are the characteristics of concurrent engineering?

- Product responsibilities lie on team of multi disciplinary group.
- Integration of design, process planning and production will be achieved.
- Frequent review of design and development process.

- Rapid prototyping.

26) Define CAD. Mention areas of application of CAD.

- The computers help in design and draft is commonly expressed by the term “Computer Aided Design” (CAD). A CAD system helps designer in various ways Invites and promotes interaction through various input/output devices.
- Allows manipulation of image (such as scalling, translation, rotation) in the computer screen.
- Enable the designer to carry out the engineering analyses for stress, vibration, noise thermal distortions and more using FEA.
- Design optimization through simulation and animation.
- Automated drafting.

27) What is mean by Co-Ordinate Systems?

When a design package is initiated, the display will have a set of co-ordinate values. These are called default co-ordinates. A user co-ordinate system is one in which the designer can specify his own co-ordinates for a specific design application.

UNIT II

GEOMETRIC MODELING

PART A

1. What are the limitation of Hermite curves?(May/June 2016)

- It is difficult to select the magnitude as well as angle of the tangent vector at the two end points of the curve segment
- Curves are difficult to control because of global shape control characteristics.
- The cubic curve never reduces exactly to a conical section and poorly approximate asymptotic curve

2. What are the advantage and disadvantage of wire frame model?(May/June 2016) Advantage

- Wire frame models are more clear than 2D representation
- It is widely used method

Disadvantage

- Representation of model in wire frame models is lack in clarity
- During surface definition there might be confusion by eliminating hidden lines
-

3. Difference between analytical curves interpolated curves and approximated curves. (Nov/Dec 2015)

S.NO	ANALYTICAL CURVE	INTERPOLATED CURVE	APPROXIMATED CURVE

1.	These curves are represented by a simple mathematical equation	It is drawn by the interpolating the given data points	It provides the most flexibility in drawing curves for complex shapes.
2.	They have a fixed form cannot be modified to achieve the shapes that violates the mathematical equations	These curves have limited flexibility in shape creation	The model of automobile fender can be easily created with the help of approximated curves

4. What are the types of surfaces that CAD/CAM systems use?

- Open and closed surfaces
- Flattening a surface
- Surface patches
- Faces
- Skins and volumes
- Transition to solids

5. What is meant by Coons surface?

In mathematics, a Coons patch, is a type of manifold parameterization used in computer graphics to smoothly join other surfaces together, and in computational mechanics applications, particularly in finite element method and boundary element method, to mesh problem domains into elements.

6. What do you understand by the form element method of geometric construction?

Geometric constructions of figures and lengths were restricted to the use of only a straightedge and compass (or in Plato's case, a compass only; a technique now called a Mascheroni construction). Although the term "ruler" is sometimes used instead of "straight edge," the Greek prescription prohibited markings that could be used to make measurements. Furthermore, the "compass" could not even be used to mark off distances by setting it and then "walking" it along, so the compass had to be considered to automatically collapse when not in the process of drawing a circle.

7. Specify the applications of this method of modeling in comparison to that of the variant type?

The finite element method is used to describe the detailed properties of the atmospheric boundary layer by use of a high-resolution model and its bulk properties by use of a simple vertically integrated model. Features of the finite element method that can be exploited for applications to the atmospheric boundary layer include the capability to use different basis functions in different parts of the domain, ability to grid over irregular terrain, ease of using time-dependent basis functions and the natural way that surface boundary conditions and vertically integrated properties enter the model.

8. What are the limitations in utilizing the sweep method for geometric?

- In computational geometry, a sweep line algorithm or plane sweep algorithm is a type of algorithm that uses a conceptual sweep line or sweep surface to solve various problems in Euclidean space.

- The idea behind algorithms of this type is to imagine that a line (often a vertical line) is swept or moved across the plane, stopping at some points. Geometric operations are restricted to geometric objects that either intersect or are in the immediate vicinity of the sweep line whenever it stops, and the complete solution is available once the line has passed over all objects.

9. Generate the conical surface obtained by rotation of the line segment AB around the z-axis with A= (1,0,1) and B= (7,0,7)(Nov/Dec 2015)

Solution

From the given coordinates, the coordinate's matrix can be written by

$$\begin{bmatrix} A \\ B \end{bmatrix} = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 7 & 0 & 7 & 1 \end{bmatrix}$$

$$[R_{xy}] = [R_z] = \begin{bmatrix} \sin\theta & -\cos\theta & 0 & 0 \\ \cos\theta & \sin\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

The resultant matrix after rotation is calculated by

$$\begin{bmatrix} A' \\ B' \end{bmatrix} = \begin{bmatrix} A \\ B \end{bmatrix} [R_x]$$

$$\begin{bmatrix} A' \\ B' \end{bmatrix} = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 7 & 0 & 7 & 1 \end{bmatrix} \begin{bmatrix} \sin\theta & -\cos\theta & 0 & 0 \\ \cos\theta & \sin\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} A' \\ B' \end{bmatrix} = \begin{bmatrix} \sin\theta & -\cos\theta & 1 & 1 \\ 7\sin\theta & -7\cos\theta & 7 & 1 \end{bmatrix}$$

10. For a cubic Bezier curve, carry a similar matrix formulation to a cubic spline?

A Bézier curve is a parametric curve frequently used in computer graphics and related fields. Generalizations of Bézier curves to higher dimensions are called Bézier surfaces, of which the Bézier triangle is a special.

UNIT III CAD STANDARDS

1. Write any three CAD standards for exchange of modeling data. (May/June 2016)

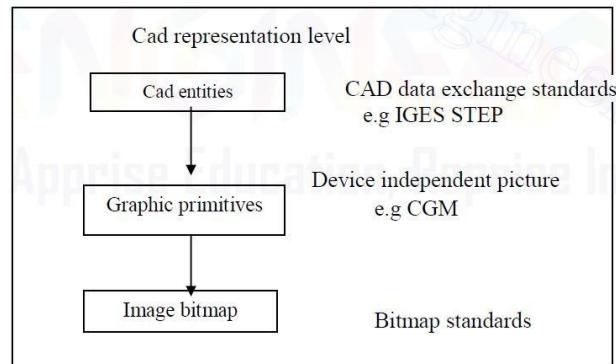
- IGES (Initial Graphics Exchange Specification)
- DXF (Drawing / Data Exchange Format)
- STEP (Standard for the Exchange of Product model data)

2. What is the importance of standards in CAD? (May/June 2016)

- To save the time of drafting.
- To make training easier.
- To make outsourcing more efficient

3. What is meant by CAD data exchange? Mention its importance. (Nov/Dec 2015)

CAD data exchange involves a number of software technologies and methods to translate data from one Computer-aided design system to another CAD file format. This PLM technology is required to facilitate collaborative work (CPD) between OEMs and their suppliers.



4. Compare the shape based and the product data based exchange standards. (Nov/Dec 2015)

S.NO	SHAPE BASED EXCHANGE STANDARDS	PRODUCT DATA BASED EXCHANGE STANDARDS
1	All data exchange data are neutral file	It has a specific file format
2	It has section of header table block entities and ends	It has a three layered architecture such as application logical and physical layer
3	These file do not have any software specific function	The file must have any software specific function
4	EX : DXE & IGES	Example STEP,SDF,EDIF &PDES

Give the requirements of product data exchange between dissimilar CAD/CAM systems?

CAD data exchange involves a number of software technologies and methods to translate data from one Computer-aided design system to another CAD file format. This PLM technology is required to facilitate collaborative work (CPD) between OEMs and their suppliers.

The main topic is with the translation of geometry (wireframe, surface and solid) but also of importance is other data such as attributes; metadata, assembly structure and feature data.

5. Compare IGES, PDES?

The Initial Graphics Exchange Specification (IGES) (pronounced eye-jess) is a vendor neutral file format that allows the digital exchange of information among computer-aided design (CAD) systems. Using IGES, a CAD user can exchange product data models in the form of circuit diagrams, wireframe, free form surface or solid modeling representations. Standards for The Exchange of Product model data (STEP) is also called as Product Design Exchange Specification (PDES). This is the standard data format used to store all the data relevant to the entire life cycle of the product including design, analysis, manufacturing quality assurance, testing and maintenance, in addition to the simple product definition data.

6. Write the scan-conversion process of a straight line in terms of pixel position.

- Digital Differential Analyzer (DDA)
- Floating Point Algorithms

7. Write the mathematical expression to scale a straight line about a fixed point.

I have a log-log graph with a straight line on it, and I want to find the line's equation. The x-axis is scaled as 0.01, 0.1, 1, 10, 100 and the y-axis is 10, 100, 1000, 10000.

8. Write any 2 properties of bezier curves.

Bezier curves exhibit a symmetry property: The same Bezier curve shape is obtained if the control points are specified in the opposite order. The only difference will be the parametric direction of the curve. The direction of increasing parameter reverses when the control points are specified in the reverse order. Bezier curves are invariant under affine transformations, but they are not invariant under projective transformations.

9. What is composite transformation?

A composite transformation (or composition of transformations) is two or more transformations performed one after the other. Sometimes, a composition of transformations is equivalent to a single transformation.

10. What are the types of parallel projection?

- Isometric projection
- Diametric projection
- Trimetric projection

11. What is color model?

A color model is a system for creating a full range of colors from a small set of primary colors. There are two types of color models: additive and subtractive.

12. What is color gamut?

While pure red can be expressed in the RGB color space, it cannot be expressed in the CMYK color space; pure red is out of gamut in the CMYK color space. A device that is able to reproduce the entire visible color space is an unrealized goal within the engineering of color displays and printing processes.

UNIT IV

FUNDAMENTAL OF CNC AND PART PROGRAMMING

1. What is MCU?
MCU is a hardware system which reads, interprets and translates the program of instructions into mechanical action of machine tool.
2. Define CNC?
CNC is defined as a NC system that utilizes a dedicated, stored computer program to perform some or the entire basic NC functions.
3. Write any four application of NCsystem?
Application are in aero equipment; printed circuit boards; coil winding; automobile parts; and blue print of complex shapes.
4. Define DNC?
Direct numerical control system is defined as a manufacturing system in which a number of machine tools are controlled by a computer through direct connection and in real time.

UNIT-V

CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEMS (FMS)

PART –A

1. What are the activities of CAM?

A CAM activity includes process planning, NC part programming, production scheduling, and computer production monitoring and computer process control.
2. In what way CIM differs from CAD/CAM?

A CIM includes all of the engineering function of CAD/CAM, but it also includes the firm's business functions that are related to manufacturing.
3. What is group technology?

Group technology is a manufacturing philosophy in which similar parts are identified and grouped together to get the advantages of similarities in both design and manufacturing attributes.
4. What is meant by part family?

Part family is a collection of parts which are similar either because of geometric shape or because of similar steps that are required in their manufacture.
5. What is meant by PFA method?
Production flow analysis is a method for identifying part families and associated machine groupings

that uses the information contained on production route sheets rather than on part drawings.

6. What is FMS?

FMS is a manufacturing system based on multi-operation machine tools, incorporating (automatic part handling and storage).

7. What is Process planning?

Process planning consists of preparing a set of instructions that describe how to fabricate a part or build an assembly which will satisfy engineering design specifications. Process planning is the systematic determination of the methods by which product is to be manufactured, economically and competitively.

8. Which is ideal state in computer based manufacturing applications?

Computer Integrated Manufacturing (CIM) is an ideal state in which computer based manufacturing applications communicate information to coordinate design, planning and manufacturing processes.

9. What is the role of process planning in CIM architecture?

The process planning function can ensure the profitability or non profitability of a part being manufactured because of the myriad ways in which a part can be produced.

10. List the applications of FMSs.

Applications of FMS installations are in the following areas. Machining Assembly

Sheet-metal press-working Forging

Plastic injection molding.

Part-B & C

Unit I

1. Elaborate on the basic requirements that CAD software has to satisfy.

2. Distinguish between modes of the design process and models of designs.

3. Describe the various database models which are generally used.

4. What are the differences between the sequential approach to the product development process and the concurrent engineering approach? Why should the latter be adopted?

5. A scaling factor of 2 is applied in the Y direction while no scaling is applied in the X direction to the line whose two end points are at coordinates (1, 3) and (3, 6). The line is to be rotated subsequently through 300, in the counter clockwise direction. Determine the necessary transformation matrix for the operation and the new coordinates of the end points. 6. What are the reasons for implementing a computer aided design system.

7. The vertices of a triangle are situated at points (15, 30), (25, 35) and (5, 45). Find the coordinates of the vertices if the triangle is first rotated 100° counter clockwise direction about the origin and then scaled to twice its size. 8.. Describe the basic types of coordinate transformation in CAD, and then show how these may all be calculated using matrix operations through the homogeneous coordinate with an example of matrix .How

the general rotation transformation be expressed in terms of a combination of other transformation.

9. What is meant by Interactive Computer Graphics? Explain its various elements.

10. Briefly explain the Clipping and Line drawing with an example.

11. Compare and Contrast Sequential and Concurrent Engineering with suitable examples.

12. Explain with block diagram, the CAD process with suitable examples..

13. A rectangle with co-ordinate A(2,3), B(2, 5), C(6, 5) and D(6, 3) is reflected along line whose equation is $y = 2x + 4$, and sheared by 2 units in x direction and 2 units in y direction. Find the new co-ordinates of the object.

14. A triangle has coordinates with A(5, 2), B(3, 5), and C(7, 5). First rotate the triangles by about the origin and then translate the triangle 2 units in x direction and 2 units in y direction. • Then translate the triangle 2 units in x direction and 2 units in y direction and then rotate by about the origin. Obtain the resultant for both cases and write your inferences.

UNIT II

1. Write a note on:

- 1.NURBS
- 2. B-splines.

2. Discuss the modelling guidelines to be followed by the user while constructing a surface model as a CAD/CAM system.

3. Differentiate between Bezier and B- spline surface with reference to number of control points, order of continuity and surface normal.

4. Explain how a Bezier curve is defined.

5. What are the advantages of Bezier curves over cubic spline?

6. Explain how the curves are represented in Generic form

7. Explain how the curves are represented in parametric form.

8. Describe the effect of characteristic polyhedron over the resulting Bezier surface.

9. What do you mean by blending function? Explain rep of a surface.

10. Briefly explain CSG and B–Rep of solid modelling techniques.

11. Explain the different schemes used to generate a solid model

12. Write short notes on approximated synthetic curves.

13. Derive the equation for Bezier Curve. Find the equation of a Bezier curve which is defined by the four points as P0 (2, 2, 0), P1(2, 3, 0), P2(3, 3, 0) and also find the points on the curve for $u = 0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1$.

14. Derive the equation for Hermite Cubic spline curve.

15. Draw a Bezier spline for the following control points: (0, 0), (4, 3), (8, 4) & (12, 0)

UNIT III

1. Explain the following polyhedral object using b-rep elements and verify the Euler equation for the same
 - 1 Simple polyhedral.
 - 2 Polyhedral object a face may have loops.
 - 3 Objects with holes that do not go through the entire object.
 - 4 Objects have holes that go through entire objects.
2. Sketch the following feature operations using CSG.
 1. Extruded 2. revolved feature
 3. Chamber 4. loft feature
 5. Pocket 6. shell
 7. Fillet 8. draft
 9. Rib 10. Dimpe.
3. Explain briefly with sketches any six tests used for hidden line identification.
4. Describe the IGES methodology.
5. Describe the PDES methodology.
6. Compare various testing methods of IGES processors.
7. Explain about Graphics Kernel System (GKS).
8. Write short notes on drawing exchange format (DXF) standard.
9. Briefly explain any one of the known graphic standards.
10. Discuss the functions of Software Graphic package.
11. Create a CAD model and obtain the export files in different formats and make a comparative study.

UNIT IV

1. Describe the different data input devices of NC machine tool.
2. Explain the working of NC machine tool with the help of the diagram.
3. Describe the constructional details of CNC machine tools.
4. Describe the classifications of CNC based on feedback control system.
5. Describe the various type of CNC machine based on tool motion.
6. Explain the classification of interpolation.
7. Briefly explain the different types of control systems in NC.

8. Describe the features of a machining centre. Why machining centers are particularly advantage for the use of NC.
9. Briefly explain the Canned cycle in manual part programming.
10. With the aid of block diagram explain the steps involved in computer assisted part programming.
11. Briefly explain the process of CALS System.
12. Write a short note on communication standards.
13. Discuss about software used for mechanism simulations.
14. Explain CAD interference checking capabilities.
15. What are the roles of a PLC in a CNC machine?

UNIT 5

1. Enumerate the role of GT in CAD/CAM integration.
2. Briefly discuss the various benefits of implementing a GT in a firm; also bring out the advantages and limitations of using GT.
3. Define part classification and coding. How is it useful in forming group technology layout?
4. Discuss with examples the following:
(a) Monocode (b) Polycode (c) Mixed code.
5. List the factors to be considered in selecting a suitable classification and coding system.
6. Discuss DC CLASS and MI CLASS coding systems.
7. Discuss DC CLASS and OPITZ coding system with suitable examples.
8. Explain OPITZ parts classification and coding system with examples.
9. Briefly explain the techniques used in Automatic Identification systems for computer process monitoring.
10. Explain the different flexibilities in FMS.
11. Discuss tool management in relation to the operation of a FMS.
12. What is a FMC? How does FMC ensure flexibility in manufacturing?
13. Describe the additional subsystems that make a machining centre a flexible machining system.
14. Compare FMS with transfer lines and CNC on the basis of volume and variety of parts produced..