

**Department of Mechanical Engineering**  
**ME6501 COMPUTER AIDED DESIGN**

**Two marks Question and Answer**

**Unit – I**

**1. Define Product cycle.**

Product cycle is the process of managing the entire lifecycle of a product from starting, through design and manufacture, to repair and removal of manufactured products.

**2. List out fundamentals of product life cycle management.**

1. Customer Relationship Management (CRM)
2. Supply Chain Management (SCM)
3. Enterprise resource planning (ERP)
4. Product Planning and Development (PPD).

**3. What is conceptualization in design process?**

A Concept Study is the stage of project planning that includes developing ideas and taking into account the all features of executing those ideas. This stage of a project is done to reduce the likelihood of assess risks, error and evaluate the potential success of the planned project.

**4. Differentiate preliminary design and detailed design.**

Preliminary design	Detailed design
The preliminary design fills the gap between the design concept and the detailed design phase. The system configuration is defined, and schematics, diagrams, and layouts of the project will offer early project configuration. In detailed design and optimization, the parameters of the part being produced will change, but the preliminary design focuses on creating the common framework to construct the project.	The next phase of preliminary design is the Detailed Design which may includes of procurement also. This phase builds on the already developed preliminary design, aiming to further develop each phase of the project by total description through drawings, modeling as well as specifications.

## **5. What are the advantages of concurrent engineering?**

1. Both product and process design run in parallel and take place in the same time.
2. Process and Product are coordinated to attain optimal matching of requirements for effective quality and delivery.
3. Decision making involves full team involvement.

## **6. Define concurrent engineering.**

In concurrent engineering, various tasks are handled at the same time, and not essentially in the standard order. This means that info found out later in the course can be added to earlier parts, improving them, and also saving time.

Concurrent engineering is a method by which several groups within an organization work simultaneously to create new products and services.

## **7. Describe Computer Aided Design.**

CAD is the function of computer systems to support in the creation, modification, analysis, or optimization of a design. CAD software is used to raise the productivity of the designer, progress the quality of design, progress communications through documentation, and to generate a database for manufacturing.

## **9. State the importance of Computer Architecture in CAD.**

In CAD, Computer architecture is a set of disciplines that explains the functionality, the organization and the introduction of computer systems; that is, it describes the capabilities of a computer and its programming method in a summary way, and how the internal organization of the system is designed and executed to meet the specified facilities.

## **10. What are the steps involved in architecture implementation?**

Computer architecture engages different aspects, including instruction set architecture design, logic design, and implementation. The implementation includes Integrated Circuit Design, Power, and Cooling. Optimization of the design needs expertise with Compilers, Operating Systems and Packaging.

## **11. What is 'Rendering'?**

Rendering is the making of a two dimensional image from a three dimensional model by means of computer programs. A picture file has objects in a strictly defined data structure; it would have information of geometry, lighting, viewpoint, texture, and shading as a description of the scene.

## **12. Define shading in graphics.**

Shading refers to depicting depth in three dimensional models by changing levels of darkness. It is a method used in drawing for depicting levels of darkness on document by providing media more tightly and less tightly for lighter areas.

**13. What do you understand by the term ‘Texture Mapping’?**

Texture mapping is a system for providing detail, surface texture and color to a computer-generated graphic model. A texture map is used to the surface of a polygon. This process is like to sticking patterned paper to a plain white paper. Multi texturing is the use of more numbers of textures at a time on a polygon.

**14. What in ‘Anti-aliasing’?**

Anti-aliasing is a advanced process for better illustration with multiple color gradations during drawing a line.

**15. Differentiate clockwise and counter clockwise rotation matrix.**

The direction of vector rotation is counterclockwise if  $\theta$  is positive and clockwise if  $\theta$  is negative

$$R(\theta) = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$$
$$R(-\theta) = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$$

## Unit – II

### 1. Write down the eccentricity value for ellipse, parabola and hyperbola.

The value of eccentricity less than one is ellipses, those with eccentricity equal to one are parabolas, and those with eccentricity greater than one is hyperbolas.

### 2. Define Conic section.

A conic section is a curve created as the intersection of a cone with a plane. In analytic geometry, a conic may be described as a plane algebraic curve of degree two, and as a quadric of dimension two.

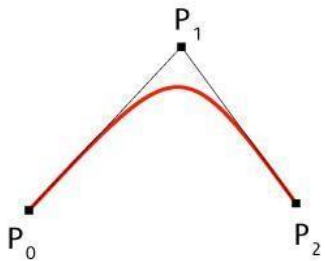
### 3. Define 'focus' of a curve.

In geometry, the focus is pair of special points with reference to which any of a variety of curves is constructed.

### 4. Write a short note 'Hermite curve'.

A Hermite curve is a spline where every piece is a third degree polynomial defined in Hermite form: that is, by its values and initial derivatives at the end points of the equivalent domain interval.

### 5. Define Quadratic Bezier curve.

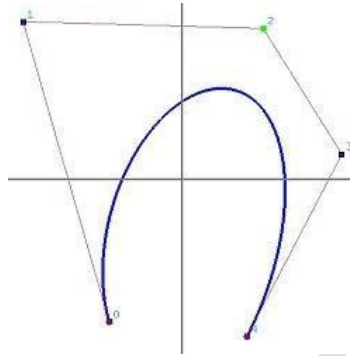


As shown in the figure, a quadratic Bezier curve is the path defined by the function  $B(t)$ , given points  $P_0$ ,  $P_1$ , and  $P_2$ ,  $B(t) = (1-t)[(1-t)P_0 + tP_1] + t[(1-t)P_1 + tP_2]$ ,  $t \in [0, 1]$ .

### 6. List out the various Bezier curves based on control points.

Linear Bezier curve, Cubic Bezier curve and Quadratic Bezier curve

## 7. Describe Rational Bezier curve.



The rational Bezier curve includes variable weights ( $w$ ) to provide closer approximations to arbitrary shapes. For Rational Bezier Curve, the numerator is a weighted Bernstein form Bezier and the denominator is a weighted sum of Bernstein polynomials.

## 8. Define NURBS.

In computer graphics, a powerful extension of B-splines is non-uniform rational B-splines is NURBS. NURBS are basically B-splines in uniform coordinates. Like B-splines, they are described by their order, and a knot vector, and a set of control points, but unlike B-splines, the control points have a weight.

## 9. Write down 'Free form surface'.

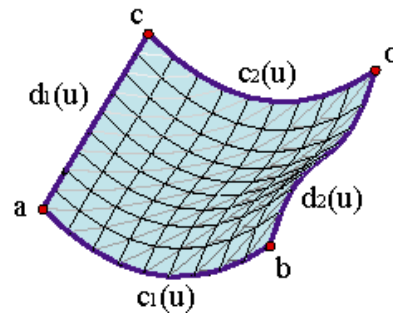
Freeform surface is used in CAD and other computer graphics software to describe the skin of a 3D geometric element. Freeform surfaces do not have rigid radial dimensions, unlike regular surfaces such as planes, cylinders and conic surfaces.

## 10. Write down the advantages and limitations of surface modeling.

Advantages of Surface modeling :

1. Surface modeling can be used to check the real look of the product with coloring and shading.
2. Surface modeling can be used to perform interference checking.
3. As the surface models precisely define the part geometry such as surface and boundaries, they can help to produce machine instructions automatically.
4. Complex surface features can be created very easily.
5. Un ambiguities in the interpretation of object is less than wire frame models by using the provision of hidden line removal.

**11. Describe the 'Surface patch'.**



Surface patch, which is used to create a surface using curves that form closed boundaries.

**12. Write down 'Bernstein' polynomial.**

The Bernstein polynomial can be described by as follows:

$$B_i^n(u) = \binom{n}{i} u^i (1-u)^{n-i}$$

**13. List out properties of B-Spline.**

- i. The maximum order in every parametric direction is limited to the number of describing polygon vertices in that path.
- ii. The surface is changeable to an affine transformation.
- iii. The deviation diminishing property of B-spline surface is not well recognized.
- iv. The control of any polygon net vertex is limited to  $\pm p/2$ ,  $\pm q/2$  spans in the particular parametric direction.
- v. If the number of polygon net vertices is equal to the order of basis in that direction and if there are no interior knot values, then the B-spline surface decreases to a Bezier surface.

**14. Write down two important solid modeling technique.**

The solid modeling techniques permit for the automation of some complicated engineering calculations that are approved as a part of the design progression. Simulation, planning, and confirmation of processes such as machining and assembly were one of the initiations for the development of solid modeling technique.

**15. What is CGS?**

Constructive solid geometry (CSG) is a method used in solid modeling for creating 3D models in CAD. Constructive solid geometry permits a modeler to make a complex surface by applying Boolean operators to join objects. Frequently CSG presents a model/surface that appears visually complex, but is essentially little more than cleverly combined.

## Unit-III

### 1. Classify the Visualization.

Visualization in geometric modeling  
Visualization in scientific computing.

### 2. What is the need of visualization?

Visualization in geometric modeling is helpful in finding connection in the design applications. By shading the parts with various shadows, colors and transparency, the designer can recognize undesired unknown interferences. In the design of complex surfaces shading with different texture characteristics can use to find any undesired quick modifications in surface changes.

### 3. List out the various visualization approaches.

Parallel projections  
Perspective projection.  
Hidden line removal  
Hidden surface removal  
Hidden solid removal  
Shaded models

### 4. What is hidden line removal?

Hidden line removal (HLR) is the method of computing which edges are not hidden by the faces of parts for a specified view and the display of parts in the projection of a model into a 2D plane.

### 5. Mention any two surface removal algorithm.

1. Z - buffer algorithm
2. Painters algorithm

### 6. What are the advantages and limitations of Painter's algorithm?

Advantage of painter's algorithm is the inner loops are quite easy and limitation is sorting operation.

### 7. What is hidden solid removal?

The hidden solid removal problem involves the view of solid models with hidden line or surface eliminated. Available hidden line algorithm and hidden surface algorithms are useable to hidden solid elimination of B-rep models.

## 8. Mention the advantages and limitations of ray tracking algorithm.

Advantages of Ray tracing:

1. A realistic simulation of lighting over other rendering.
2. An effect such as reflections and shadows is easy and effective.
3. Simple to implement yet yielding impressive visual results.

Limitation of ray tracing:

Scan line algorithms use data consistency to divide computations between pixels, while ray tracing normally begins the process anew, treating every eye ray separately.

## 9. What is powder shading?

Powder shading is a sketching shading method. In this style, the stumping powder and paper stumps are used to draw a picture. This can be in color. The stumping powder is smooth and doesn't have any shiny particles. The poster created with powder shading looks more beautiful than the original. The paper to be used should have small grains on it so that the powder remains on the paper.

## 10. Differentiate flat shading and smooth shading.

### Flat Shading

Uses the similar color for each pixel in a face - generally the color of the first vertex.

Edges show extra pronounced than they would on a real object because of a occurrence in the eye known as 'lateral inhibition'.

Similar color for some point of the face.

Selected faces are visualized.

Not suitable for soft objects.

Less computationally costly.

### Smooth Shading

Soft shading utilizes linear interpolation of colors between vertices

The edges vanish with this method.

Every point of the face has its own color.

Visualize fundamental surface.

Apposite for some objects.

More computationally costly.



## Unit-IV

### 1. List out techniques of assembly modeling.

Bottom-up assembly model

Top-down assembly model

### 2. Define Bottom-up assembly design.

In a 'bottom up' assembly design, complex assemblies are divided into minor subassemblies and parts. Every part is considered as individual part by one or more designers. The parts can be archived in a **library** in one or more 3D Files. This is the high effective way to generate and manage complex assemblies.

### 3. Write down Top-down assembly design.

In a 'top down' assembly design all parts are classically designed by the similar person within a single part. 3D assembly handles 'top down' method by allowing to **design and creation of** a component while work in the active part. Hence, the active part will be an assembly part.

### 4. What is mating conditions?

Components can be positioned within the product assembly using absolute coordinate placement methods or by means of mating conditions. Mating conditions are definitions of the relative position of components between each other; for example alignment of axis of two holes or distance of two faces from one another.

### 5. Describe parent – child relationship in assembly design.

When components are additional to an assembly, parent and child relationships are created. These relationships are displayed by graphically as an assembly tree. Parts are parametrically connected by position constraints. These constraints have data about how a part should be placed within the assembly hierarchy and how it should respond if other components are edited.

### 6. Define Interference free matrix.

An interference-free matrix shows interference between two components, when one component is moved, in a given assembly direction, into an assembled location, with another

component already in an assembled location. Assembly actions that result in interferences are denoted as '0' in the matrix, and assembly actions that do not result in interferences are denoted as '1' in the matrix.

#### **7. list out the advantages of Tolerance Analysis**

1. Accurate part assembly.
2. Elimination of assembly rework
3. Improvement in assembly quality.
4. Reduction of assembly cost.
5. High customer satisfaction.
6. Effectiveness of out-sourcing.

#### **8. what is the necessary of locating Center of gravity**

##### **The necessary of center of gravity to**

described the 'center of mass' of the object.

the location where the object would balance.

the single point where the static balance moments are all zero about three mutually perpendicular axis.

the centroid of object the volume when the object is homogeneous.

the point where the total mass of the component could be measured to be concentrated while static calculations.

the point about where the component rotates in free space

the point via the gravity force can be considered to perform

the point at which an exterior force must be used to create translation of an object in space

#### **9. Define tolerance stack-up**

Tolerance stack-up computations show the collective effect of part tolerance with respect to an assembly need. The tolerances 'stacking up' would describe to adding tolerances to obtain total part tolerance, then evaluating that to the existing gap in order to see if the design will work suitably.

#### **10. Tolerance Analysis**

Tolerance analysis is a title to a different approaches applied in product design to know how deficiencies in parts as they are manufactured, and in assemblies, influence the ability of a product to meet customer needs.

## UNIT-5

1. List out the international organizations involved to develop the graphics standards:

ACM ( Association for Computer Machinery )

ANSI ( American National Standards Institute )

ISO ( International Standards Organization )

GIN ( German Standards Institute )

CALS, GKS , PHIGS , VDI , VDM , NAPLPS

2. List out the various standards in graphics programming

IGES (Initial Graphics Exchange Specification)

DXF (Drawing / Data Exchange Format)

STEP (Standard for the Exchange of Product model data)

3. Define Graphics Kernel System (GKS)

The Graphical Kernel System (GKS) was the first ISO standard for computer graphics in low-level, established in 1977. GKS offers a group of drawing aspects for 2D vector graphics appropriate for mapping and related duties.

4. Enumerate Open Graphics Library.

OpenGL draws primitives into a structured buffer focus to a various selectable modes. Every Point, line, polygon, or bitmap are called as a primitive. Each mode can be modified separately; the parameters of one do not affect the parameters of others.

5. Narrate IRIS GL.

OpenGL is supported on Silicon Graphics' Integrated Rater Imaging System Graphics Library (IRIS GL). Though it would have been potential to have designed a totally new Application Programmer's Interface (API), practice with IRIS GL offered insight into what programmers need and don't need in a Three Dimensional graphics API

6. Define NAPLPS

NAPLPS (North American Presentation- Level Protocol Syntax) describes text and graphics in the form of sequences of bytes in ASCII code.

7. Define IGES

IGES (Initial Graphics Exchange Specification) enables an exchange of model data basis among CAD system

8. Define DXF

DXF (Drawing / Data Exchange Format) file format was meant to provide an exact representation of the data in the standard CAD file format.

**9. Define STEP**

STEP (Standard for the Exchange of Product model data) can be used to exchange data between CAD, Computer Aided Manufacturing (CAM) , Computer Aided Engineering (CAE) , product data management/enterprise data modeling (PDES) and other CAX systems.

**10. Define GKS**

GKS (Graphics Kernel System) provides a set of drawing features for two-dimensional vector graphics suitable for charting and similar duties.

**11. Define , PHIGS**

PHIGS ( Programmer's Hierarchical Interactive Graphic System) The PHIGS standard defines a set of functions and data structures to be used by a programmer to manipulate and display 3-D graphical objects.