

# ANNAI MATHAMMAL SHEELA ENGINEERING COLLEGE

## DEPARTMENT OF MECHANICAL ENGINEERING

Sub Code & Name: ME6501 & COMPUTER AIDED DESIGN

2 MARKS WITH QUESTION AND ANSWER

### UNIT –I FUNDAMENTAL OF COMPUTER GRAPHICS

#### PART-A

1. Define the term Product Cycle.

In the conventional product cycle, after the design of product, the part drawing are released for production. The production department then takes appropriate actions for the manufacture of the product. It is called product cycle.

2. What is design process ?

The design is the act of devising an original solution to a problem by a combination of principles, resources and product in design. The design process is the pattern of activities that is followed by the designer in arriving at the solution of technological problem.

3. What are the types of models of the design process ?

Shigley model  
Paul and Beitz model  
Ohsuga model  
Earle model

4. What are the steps involved in Shigley model ?

Recognition of need  
Definition of problem  
Synthesis  
Analysis and optimization  
Evaluation  
Presentation

5. What are the four main phases of Paul and Beitz model?

Clarification of the task  
Conceptual design  
Embodiment design  
Detail design

6. What are the six steps proposed by Earle for the design process?

- Problem Identification
- Preliminary Ideas
- Problem refinement
- Analysis
- Decision
- Implementation

7. What are the data's needs to get for problem identification?

- Fixed data
- Opinion surveys
- Historical records
- Personal observation
- Experimental data

8. What is Sequential Engineering?

Sequential Engineering is also called as “across the wall” method. Each segment of the product development team complete their tasks in isolation and passes over the documents to the next segment. There is no interaction among the product development groups.

9. What is Concurrent Engineering ?

Concurrent Engineering is also called as parallel engineering . Concurrent Engineering is an approach used in product development in which the function of design engineering, manufacturing engineering and other function are integrated to reduce the time required to bring a new product to the market.

10. Define CAD.

CAD is defined the use of digital computer for creation, modification, analysis and optimization of design.

11. What are the four CAD activities ?

- Geometric modeling
- Engineering analysis
- Design review and evaluation
- Automated drafting

12. Name any two application of CAD.

- Designing machine component
- Finite element analysis

CNC programming

13. What are the various steps or phases involved in product cycle?

Design phase  
Manufacturing phase  
End-of-life phase

14. What are the Benefits of CAD.

Improved design accuracy  
Improved Engineering analysis  
Shorter lead time of design

15. Define Computer Graphics.

It is defined as a pictorial representation or graphical representation of objects in a computer.

16. Name the basic geometric transformations.

Translation  
Rotation  
Scaling

17. Define 2D translation.

2D translation move the object on X,Y plane along straight line by adding increments in X-axis , Y-axis.

18. Define 3D translation.

3D translation move the object on XYZ coordinates along straight line adding increments in X-axis, Y-axis and Z-axis .

19. Define translation .

Translation is the simplest form of transformation. It is rigid body transformation that moves the object without any deformation.

20. Define rotation.

Rotation is the rigid body transformation that move the object along the circular path in xy plane or in xyz coordinates without any deformation .

21. Define scaling.

Scaling transformation is used to enlarge or reduce the size of the object .

22. Define concatenation .

If series of transformation is applied to a geometric model, then they can be compiled as a sequence of transformation. This is called concatenation.

23. What is the need of homogeneous coordinates?

To perform more than one transformation at a time, use homogeneous coordinates or matrixes. They reduce unwanted calculations intermediate steps saves time and memory and produce a sequence of transformations.

24. Define Clipping.

Any procedure that identifies those portions of a picture that are either inside or outside of a specified region of space is referred to as a clipping algorithm or simply clipping. The region against which an object is clipped is called clip window.

25. What are the types of clipping?

- Point clipping
- Line clipping
- Area clipping
- Curve clipping
- Text clipping

26. What is viewing transformation?

The mapping of a part of a world-coordinates scene to device coordinates is referred to as viewing transformation.

27. What is Transformation?

Transformation is the process of introducing changes in the shape size and orientation of the object using scaling rotation, reflection, shearing & translation etc.

28. What are the three steps involved in 3D transformation?

- Modeling transformation
- Viewing transformation
- Projection transformation
- Workstation transformation

## **PART-B**

1. What is product cycle? And briefly explain about the product cycle.
2. What is design process? Explain briefly the four models for the design process.
3. Explain the various steps for the Shigley design process.
4. Explain the steps of Pahl and Beitz model for the design process.
5. Explain the Ohsuga model of design process.
6. Explain briefly about the various step of Earle model of design process.
7. Explain about the sequential and concurrent engineering in detail.
8. What is CAD? Explain about the CAD system architecture.
9. Explain in detail about the 2D and 3D transformation.
10. Write short notes on i) Line drawing ii) clipping iii) viewing transformation

## **UNIT-II GEOMETRIC MODELING**

### **PART-A**

1. Define B-Spline curve?

A B-Spline curve is a set of piecewise (usually cubic) polynomial segments that pass close to a set of control points. However the curve does not pass through these control points, it only passes close to them.

2. What is a spline?

To produce a smooth curve through a designed set of points, a flexible strip called spline is used.

3. What is Bezier surface?

This is a surface that approximates given input data. It is different in that it is a synthetic surface. Similarly to the Bezier curve it does not pass through all given data points. It is a general surface that permits, twist and kinks. The Bezier surface allows only global control of surface.

4. What is B-spline surface?

This is a surface that approximate a characteristics polygon and passes through the corner points of the polygon, where its edges are tangential to the edges of the polygon.

5. What is surface modeling?

Surface modeling is the extension of wire frame modeling. A surface model is created by defining the points, boundary edges and boundary surfaces/.

6. What are the uses of surface modeling?

- Automobile body design
- Aircraft body design
- Marine vehicle design
- Consumer product design

7. What are the advantages of surface modeling?

- They are less confusing than wire frame models
- Hidden line removal is possible
- Shading algorithms are available
- It is used in finite element modeling

8. What are the disadvantages of surface modeling?

- It requires more time to create
- It requires more memory space to store
- It requires more manipulation time

9. What is solid modeling?

Solid models are the extension of surface models. Solid modeling defines boundary edges, surfaces and interior details of an object.

10. What are the solid modeling creating methods?

- Constructive solid geometry (CSG)
- Boundary representation (B-rep)
- Pure primitive instancing
- Generalized sweep
- Cellular decomposition
- Hybrid scheme

11. What are the most commonly used primitives in CSG?

- Rectangular block
- Cylinder

Cone  
Sphere  
Wedge  
Torous

12. What is the advantages of solid modeling?

It is complete and clear  
It store more information than other models  
Hidden line removal is possible  
It is used for CAPP

13. What is the disadvantages of solid modeling?

It occupies more memory space  
It require more manipulation time

14. Give some software packages available for modeling.

UNI GRAPHICS  
PRO/ENGINEERS  
CATIA

15. What are the geometric modeling techniques?

Wire frame modeling  
Surface modeling  
Solid modeling

16. State the advantage of a surface model over wire frame model.

Since the surface modeling techniques use the basic of surface geometry to build up the shapes. It is more useful in modeling complex surfaces.

17. Write short note about Boundary representation (B-rep).

A B-rep model is based on the topological notion that a physical object is boundary by a set of faces. These faces are regions or subsets of closed and orientable surface is one in which it is possible of the surface normal to point to the inside or outside of the solid model under construction.

18. Write short note about Constructive solid geometry (CSG).

CSG model is based on the topological notion that a physical object can be divided into a set of primitives that can be combined in certain order following a set rules to form the

object. Primitives themselves are considered valid CSG models each primitive is bounded by a set of surfaces usually closed and oriental.

19. What is Bezier curve?

Bezier used a control polygon for curves, in place of points and tangent vector. This polygon is approximated by a polynomial curve whose degree is one less than the number of polygon vectors.

20. What is a Piecewise (Cubic) Hermite Curve?

A piecewise cubic hermite curve is a curve that is represented with four degrees of freedom. Two degrees of freedom are defined as the positions of the two end points of the curve. The other two degrees of freedom are defined as the tangents to the endpoints of the curve.

21. What are the techniques for surface modeling?

- Surface patch
- Coons patch
- Bicubic patch

22. What is surface patch?

The patch is the fundamental building block for surface. The two variable  $u$  and  $v$  vary across the patch-patch may be termed biparametric. The parametric variables often lie in the range 0 to 1.

23. What is Coons patch?

The sculptured surfaces often involve interpolation across an intersecting mesh of curves that in effect comprise a rectangular grid of patches, each bounded by four boundary curves.

24. What is Bicubic patch?

The Bicubic patch is used for surface descriptions defined in terms of point and tangent vector information. There is a vector equation with 16 unknown parameter  $k_{ij}$ , which can be found by Lagrange interpolation through  $4 \times 4$  grid.

## **PART-B**

- 1.Explain briefly about the Hermite curve and Bezier curve.
2. Explain briefly about the B-spline curve and rational curve.
3. What are the techniques of surface modeling? And explain about Surface patch, Coons patch and Bicubic patches.
- 4.Explain briefly about the Bezier surface and B-spline surface.
- 5.What are the solid modeling techniques? And explain about CSG and B-rep.

## **UNIT-III VISUAL REALISM**

### **PART-A**

- 1.Explain about Hidden-line removal.

When a complex 3D drawing is fully displayed then the large number of lines usually render the picture impossible to perceive, because the hidden lines are also displayed. The hidden lines can be removed by the computer at the cost of large amount of computing time.

- 2.Explain about Hidden-surface removal.

Hidden-surface removal is generally an image-space process in which an image of an object is generated at a particular resolution of manipulating pixels or a raster display. There is little or no image information at model level. Hidden surface removal also relies heavily on coherence which means that image change slowly with time.

- 3.Explain about Shading.

The shading techniques is based on the recognition of distance and shape as a function of illumination. The surface of the solid is divided into patches and in regions of large curvature, the patches are described in size. The hidden line must be removed before shading.

- 4.What are the types of shading according to CAD system?

Gouraud shading  
Phong shading

5. what is Gouraud shading?

It computes the average of the surface normal at polygon vector points and uses these to determine vertex intensities which are the linearly interpreted across the polygon.

6. What is Phong shading?

It interpolates surface normal vectors across polygons and uses these interpolated vectors in shading models at each pixel in the image.

## **PART-B**

1. Explain in detail about the Hidden line removal.
2. Explain in detail about the Hidden surface removal algorithms.
3. Explain about the shading and colouring in detail.
4. Explain in detail about the computer animation.

## **UNIT-IV ASSEMBLY OF PARTS**

### **PART-A**

1. What is Assembly modeling?

Assembly modeling is a technology and method used by computer-aided design and product visualization computer software systems to handle multiple files that represent components within a product. The components within an assembly are represented as solid or surface models.

2. What are the assembly modeling approaches?

Bottom-up approach  
Top-down approach  
Combination

3. What is bottom-up approach?

This is a logical, traditional, and most common approach. The individual parts are created independently, inserted into the assembly, and located and oriented (using the mating conditions) as required by the design. The first part inserted is known as the base and is fixed.

#### 4. What is top-down approach?

In this approach, the assembly file is created first with an assembly layout sketch. The parts are made in the assembly file or the concept drawing of the parts are inserted and finalized in the assembly file. In other words, the final geometry of the parts have not been defined before bringing them into the assembly file

#### 5. What is interference checking?

Interference checks are important when part motion is involved, such as motion of an automotive suspension or an aircraft landing gear mechanism. It is crucial to understand the potential for interference over the entire range of motion involved, and to account for flexible components that add compliance to the system.

#### 6. What is tolerance analysis?

Tolerance analysis involves the determination of the variation associated with the critical dimension given statistical distributions of the variations in individual component tolerances. Tolerance allocation involves the determination of individual component tolerances given an acceptable variation on the critical tolerance.

#### 7. What is mass property calculation?

Mass properties can be calculated using system parameters within a relation. However, mass properties are not automatically updated when the model changes. You must recalculate the mass properties to see the effect of model changes.

#### 8. What are the mass property calculation included for part or assembly?

- Volume
- Surface area
- Density
- Mass
- Centre of gravity

### **PART-B**

1. Explain in detail about the tolerance analysis.

2. What is mass property calculation? And explain in detail.

3. What is assembly modeling? And briefly explain the approaches in assembly modeling.

## UNIT-V CAD STANDARDS

### PART-A

#### 1. What is Graphic Standard ?

The heart of any CAD model is the component data base. The component database should be standardized, so that they can be easily transferred from one CAD system to another CAD system. Graphic standard are the standardized platform for exchanging component data base between different computer system.

#### 2. What are the need or benefits of Graphics Standard.

- Application program portability
- Picture data portability
- Text portability
- Object database portability

#### 3. What is Graphical Kernel System(GKS)?

GKS is an ANSI and ISO standard. It is device independent, host system-independent and application independent. It support both 2D and 3D data and viewing. It interfaces the application program with the graphics support package.

#### 4. What are the three types of coordinates frames available in GKS?

- World coordinates(WC)
- Normalized Device coordinates(NDC)
- Device coordinates(DC)

#### 5. What are the features of GKS?

- Device independence
- Text/Annotation
- Display management
- Graphic function
  - i. Primitive functions
  - ii. Attribute functions

#### 6. What is Initial Graphics Exchange Specification(IGES)?

IGES is a standard data format for product design and manufacturing information, created and stored in a CAD/CAM system in digital form. It is designed in such a way that it is independent of all CAD/CAM system, so that, the geometric and manufacturing data can be readily transferred from one CAD/CAM system to another.

7. What are the entities in IGES?

Geometric entities  
Non-Geometric entities  
    i. Annotation entities  
    ii. Structure entities

8. What are the data exchange standards?

Initial Graphics Exchange Specification (IGES)  
Standard for Exchange of Product Model Data (STEP)  
Data Exchange File (DXF)  
CALDS etc.

9. What are the Graphics Standards?

Siggraph  
Graphics Kernel System (GKS)  
GM SOLID  
Programmer's Hierarchical Interactive Graphics Standard (PHIGS)

10. What are the six sub sections of IGES file?

Flag section  
Start section  
Global section  
Directory entry section  
Parameter data section  
Terminate section

11. What Is OpenGL?

OpenGL is a software interface to graphics hardware. This interface consists of about 150 distinct commands that you use to specify the objects and operations needed to produce interactive three-dimensional applications.

## **PART-B**

1. What is Graphics standard? And explain the benefits of Graphics standard.
2. Explain briefly about the Graphical kernel system (GKS) and its features.
3. Explain briefly about the Open Graphics Library (OpenGL).
4. What are the Data exchange standards? And explain about IGES and its entities.
5. Explain briefly about STEP and CALS.