

B. Tech.
(Sem. VII) ODD SEMESTER THEORY
EXAMINATION 2013 – 14
COMPUTER AIDED DESIGN
Practice paper by *Deep Chandra Chaurasiya*

Time: 3 Hours**Total Marks:** 100**Note:** – (1) There are total **five** questions. Attempt all question.

(2) Marks are indicated against each question.

(3) In case of numerical problems assume data wherever not provided.

(4) Important topics of the units are shown in **bold**.**UNIT –I:**

Introduction: Introduction to CAD/CAED/CAE, **Elements of CAD**, Essential requirements of CAD, Concepts of integrated CAD/CAM, Necessity & its importance, Engineering Applications

Computer Graphics-I: CAD/CAM systems, Graphics Input devices-cursor control Devices, **Digitizers**, Keyboard terminals, Image scanner, Speech control devices and Touch, panels, Graphics display devices **Cathode Ray Tube**, Random & Raster scan display, **Colour CRT monitors**, **Direct View Storage Tubes**, Flat Panel display, Hard copy printers and plotters

1. Attempt any ~~four~~ of the following: (5×4=20)
- (a) What do you mean by the term Computer Aided Design? Describe the various design related tasks, which are performed by a modern Computer Aided Design system.
 - (b) What are the benefits of computer aided design over the conventional design? What are the application areas of CAD?
 - (c) Explain the concept of integration of CAD/CAM.
 - (d) List various types of Graphics Input Devices used in CAD. Explain functions of each.
 - (e) What are the techniques used in computer graphics for the generation of picture on CRT screen?
How do you obtain colour pictures on the screen?
 - (f) Explain DVST with neat sketch.
 - (g) Explain the operating characteristics and some applications of plasma panels, liquid crystal displays and digitizers.
 - (h) List various types of Hard copy printers and plotters. Explain functions of any two printers and any two plotters.

UNIT – II:

Computer Graphics-II: Graphics standards, Graphics Software, Software Configuration, Graphics Functions, **Output primitives**- Bresenham's line drawing algorithm and Bresenham's circle generating algorithm
Geometric Transformations: **World/device Coordinate Representation**, Windowing and clipping, 2 D Geometric transformations-Translation, Scaling, Shearing, **Rotation & Reflection** Matrix representation, **Composite transformation**, 3 D transformations, multiple transformation

2. Attempt any ~~four~~ of the following: (5×4=20)
- (a) Explain the functions of graphics software.

- (b) Explain Bresenham's line algorithm. Using Bresenham's line algorithm, find the pixel positions along the line path between end points $(20,10)$ and $(30,18)$.
- (c) Write midpoint circle algorithm for a radius ' r ' and screen centre position (x_c, y_c) . Scan converts a circle whose centre is at $(15, 20)$ and radius is 12 units, using this algorithm.
- (d) Discuss various coordinate systems used in CAD system.
- (e) Discuss homogeneous coordinate system/transformation. What do you mean by concatenation?
- (f) Find out the transformed coordinates of a plane triangular lamina having the vertices $(3,-1)$, $(4,1)$ and $(2,1)$ rotated through 90° about the point $(3,-1)$ in counter clockwise direction.
- (g) Find overall transformation matrix for the reflection of a lamina about the line $y=2x+5$.
- (h) Explain composite transformation.

UNIT – III:

Curves: Curves representation, Properties of curve design and representation, **Interpolation vs approximation**, Parametric representation of analytic curves, **Parametric continuity conditions**, Parametric representation of synthetic curves-**Hermite cubic splines-Blending function formulation and its properties**, **Bezier curves-Blending function formulation and its properties**, Composite Bezier curves, *B-spline curves and its properties*, Periodic and non-periodic B-spline curves

3. Attempt any ~~two~~ of the following: (10×2=20)
- (a) Why do you prefer Bezier form of cubic curves over the Hermite form for the interactive computer graphics? Using the Bezier polynomial function, find the cubic Bezier point function in the matrix form and plot the blending function.
 - (b) Distinguish between interpolation and approximation method for generation of a splines. What do you understand by continuity conditions in curves? Differentiate between Bezier, B-spline and Hermite curves.
 - (c) What are the advantages of parametric form of space curve? Write the parametric form of polynomial and find the boundary conditions in matrix for the Hermite splines.
 - (d) Discuss the various properties of Bezier curves. What is the main drawback of Bezier curve? How is it overcome in other form of space curves?
 - (e) Find the equation of a Hermite cubic spline that passes through points $(1,2)$ and $(3,4)$ and whose tangent vectors are the two lines connecting these points with point $(2,7)$.
 - (f) Determine the equation of Bezier curve in parametric form with the following control points $(1,1)$, $(2,5)$, $(4,7)$ and $(3,2)$. Determine nine points on the Bezier curve and plot the curve.

UNIT – IV:

3D Graphics: Polygon surfaces-Polygon mesh representations, **Quadric and Superquadric surfaces** and **blobby objects**; Solid modeling-Solid entities, Fundamentals of Solid modeling-Set theory, regularized set operations; Half spaces, **Boundary representation**, **Constructive solid geometry**, Sweep representation, Color models

Application commands for AutoCAD & ProE software

4. Attempt any ~~two~~ of the following: (10×2=20)
- (a) Discuss various types of quadric and super quadric surfaces available in graphics packages. What do you understand by the Blobby objects? How do you model them?
- (b) Write brief notes on the following:
- i. Solid modelling and solid entities
 - ii. Boolean operations
 - iii. Boundary representation
 - iv. Constructive solid geometry
 - v. Half space
 - vi. Colour model
- (c) Explain constructive solid geometry. What is the role of primitives and boolean operations in CSG? Explain with suitable examples.
- (d)
- i. Explain, with suitable examples, the procedure for the creation of a line in Cartesian coordinate method, incremental form and polar coordinate form using AutoCAD.
 - ii. How do you draw a circle by three points, two point and centre point methods in an AutoCAD software? Explain with suitable data.
- (e) Write 5 drawing commands and 5 editing commands in AutoCAD.
- (f) Explain how the following commands work in AutoCAD with example:
- | | |
|-------------------|----------------|
| i. Mirror | viii. Polyline |
| ii. Trim | ix. Chamfer |
| iii. Array | x. Move |
| iv. Copy | xi. Offset |
| v. Rotate | xii. Fillet |
| vi. Osnap | xiii. Scale |
| vii. Hatch | |

UNIT – V:

Numerical Methods: Introduction, Errors in numbers, Binary representation of numbers, **Root finding**-Bisection method, Newton Raphson method, Curve fitting-**Least square method**, Numerical differentiation-Newton's interpolation, **Numerical Integration**-Trapezoidal and Simpson method

Finite Element Method: Introduction, Principles of Finite elements modelling, Stiffness matrix/displacement matrix, Stiffness matrix for **spring system, bar & beam elements, bar elements in 2D space** (truss element)

5. Attempt any ~~two~~ of the following: (10×2=20)
- (a) What are the salient features of Newton – Raphson iteration method? Using this method, find the roots of the equation $e^x - 3 \cos \pi x = 0$
- (b) Find the approximate value of $I = \int_0^\pi (3 \cos x + 5) dx$, Using (i) Trapezoidal rule and (ii) Simpson's rule and Find the error.

(c)

- i. Explain general methodology of solving a design problem using finite method. Also write the advantages of FEM.
- ii. Describe least square fitting of straight line $y=mx+c$ to various data for x and y and find the constants m and c .
- iii. Describe Trapezoidal and Simpson method of numerical integration and compare the two.

(d) The table below gives the temperature T ($^{\circ}\text{C}$) and the length L (mm) of a heated rod. If $L=AT+B$.

Find the values of A and B for the best fit curve

T	20	30	40	50	60	70
L	100.3	100.4	100.5	100.7	100.9	101.0

(e) Determine the nodal displacement, element stresses and support reactions of the axially loaded bar as shown in Figure 1. Take $E=200\text{GPa}$, $P=30\text{kN}$.

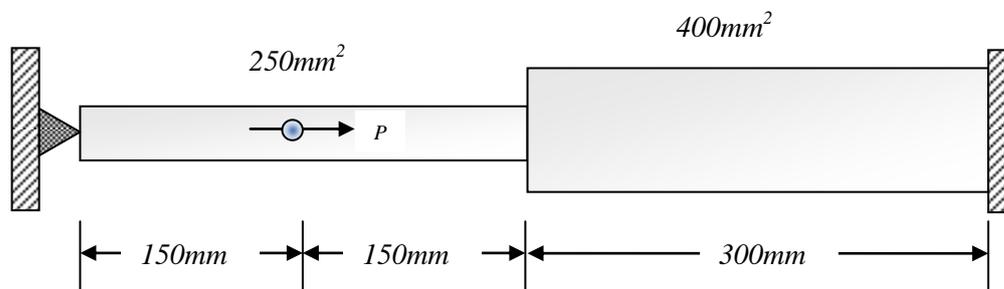


Figure 1

(f) Given that:

X	1	1.1	1.2	1.3	1.4	1.5	1.6
y	7.98	8.40	8.78	9.13	9.45	9.75	10.03

Find $\frac{dy}{dx}$ at $x=1.1$