

**MMTE-004**

**ASSIGNMENT BOOKLET**

**(Valid from 1<sup>st</sup> January, 2025 to 31<sup>st</sup> December, 2025)**

**M.Sc. (Mathematics with Applications in Computer Science)**

**COMPUTER GRAPHICS**



**School of Sciences  
Indira Gandhi National Open University  
Maidan Garhi, New Delhi-110068  
(2025)**

Dear Student,

Please read the section on assignments and evaluation in the Programme Guide for Elective Courses that we sent you after your enrolment. A weightage of 20 per cent, as you are aware, has been assigned for continuous evaluation of this course, **which would consist of one tutor-marked assignment**. The assignment is in this booklet.

### Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully.

1) On top of the first page of your answer sheet, please write the details exactly in the following format:

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ROLL NO.: .....

NAME : .....

ADDRESS : .....

.....

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COURSE CODE: .....

COURSE TITLE : .....

ASSIGNMENT NO.: .....

STUDY CENTRE: ..... DATE: .....

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**PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.**

- 2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
- 3) Leave 4 cm margin on the left, top and bottom of your answer sheet.
- 4) Your answers should be precise.
- 5) While solving problems, clearly indicate which part of which question is being solved.
- 6) This assignment is to be submitted to the Programme Centre as per the schedule made by the programme centre. Answer sheets received after the due date shall not be accepted.  
We strongly suggest that you retain a copy of your answer sheets.
- 7) This assignment is valid only upto December, 2025. For submission schedule please read the section on assignments in the programme guide. If you have failed in this assignment or fail to submit it by December, 2025, then you need to get the assignment for the year 2026 and submit it as per the instructions given in the programme guide.
- 8) **You cannot fill the exam form for this course** till you have submitted this assignment. So solve it and **submit it to your study centre at the earliest.**

We wish you good luck.

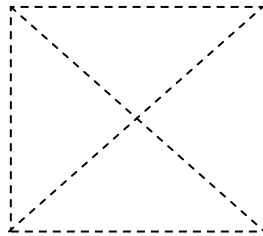
## Assignment

Course Code: MMTE-004

Assignment Code: MMTE-004/TMA/2025

Maximum Marks: 100

1. a) Have you used or seen used computer graphics in day-to-day life? How? Explain. (4)
- b) Explain the difference between the random scan and raster scan display devices. (3)
- c) Consider a non-interlaced raster system with resolution  $1024 \times 1248$ , and retrace rate of 40 frames per second. While displaying a frame, an electron beam spends 2 micro seconds in horizontal retrace, and 100 micro seconds in vertical retrace. Compute the fraction of the total refresh time per frame in retracing of the electron beam. (3)
2. a) Modify the program given in Listing 1 of Unit 2 at page 25 of your SLM to draw the following shape (5)



- b) Compute the pixel positions along the line path of the line joining the points  $A(-1, 1)$  and  $B(7, 9)$  using the DDA Algorithm. (4)
- c) Write a C program to plot the cosine function from 0 to  $2\pi$ , taking symmetry into consideration. (6)
3. a) Write the formula for the cubic Bezier curve with control points  $P_0 = (0, 1)$ ,  $P_1 = (4, 8)$ ,  $P_2 = (5, -1)$  and  $P_4 = (7, 3)$ . (4)
- b) Describe the Odd-Even rule and winding number rule with the help of an example. (4)
- c) Implement the Boundary Fill Algorithm for an 8-connected region. (8)
- d) Explain how will you generate a character using outline font method. (4)
4. a) What will be the new coordinates of the quadrilateral with vertices  $(0, 2)$ ,  $(3, 2)$ ,  $(-1, 0)$  and  $(2, 0)$ , when it is reflected about the  $y$ -axis, and then sheared in the  $x$ -direction by a factor of  $-2$ ? (4)
- b) Find the normalisation transformation that maps a window with opposite corners at  $(2, 1)$  and  $(6, 8)$  to a viewport that is the entire normalized device screen. (4)

- c) Given the clipping window with corners at (0, 2) and (10, 8), trace the Cohen-Sutherland line clipping algorithm for the triangle with vertices (4, -1), (8, 4) and (6, 10). (7)
5. a) Find the uniform cubic B-spline curve generated by the control points (4, 2), (5, -2), (10, 5), (15, -1). (4)
- b) Do 3D translation and scaling commute with each other? Justify. (4)
- c) Suppose your camera is located at (8, 2, 0) and you are looking at (4, 1, 0). If the view-up vector is (1, 4, -1), then how will you transform the scene from the world coordinate system to viewing coordinate system? (7)
6. a) Find the coordinates of all the corners of a cube whose two opposite corners have coordinates (1, 1, 1) and (5, 5, 5). What will be the image of this cube under an oblique parallel projection with  $\alpha = \phi = 45^\circ$ ? Justify. (7)
- b) Write a C program to draw a wireframe model of an octahedron. (8)
- c) Explain the difference between the OpenGL functions `glFrustum ( )` and `gluPerspective ( )`. (5)
- d) Using Liang-Barsky line clipping algorithm, clip the rectangle PQRS with coordinates P(2, 3), Q(6, 3), R(6, 4), S(2, 4) against the clip window with opposite corners at (1, 0) and (4, 6). (5)