MMTE-004

ASSIGNMENT BOOKLET

M.Sc(Mathematics with Applications in Computer Science)
COMPUTER GRAPHICS
(Valid from 1st January, 2026 to 31st December, 2026)

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THE PEOPLE'S
UNIVERSITY

School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi
(For January 2026 cycle)

Dear Student,

Please read the section on assignments in the Programme Guide for elective Courses that we sent you after your enrolment. A weightage of 20%, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. 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:

ROLL NO. : . . . .

NAME : . . . .

ADDRESS : . . . .

. . . .

. . . .

COURSE CODE : . . . .

COURSE TITLE : . . . .

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

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 a 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 Study Centre as per the schedule made by the study centre. **Answer sheets received after the due date shall not be accepted.**

7) This assignment is valid only up to 31st December, 2026. If you fail in this assignment or fail to submit it by 31st December, 2026, then you need to get the assignment for the year 2027 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.**

9) **We strongly suggest that you retain a copy of your answer sheets.**

We wish you good luck.

Assignment

1) a) Have you used or seen computer graphics in day-to-day life? Explain it. (4)

   b) What do you understand by the following terms?
   Colour CRT Monitors, Beam Penetration Method, and Shadow Mask Method. (3)

   c) Compute the following (4)

      i) Resolution (per square inch) of 3×2 inch image that has 768×512 pixels.
      ii) Width of an image having height of 6 inches and an aspect ratio 1.5 .

   d) Suppose we have a video monitor with a display area of measurement 12 inches across and 9.6 inches high. If the resolution is 1280×1024 pixels. What is the diameter of each pixel (in cm)? (4)

2) a) Use an appropriate OpenGL primitive to draw the shape given below: (4)
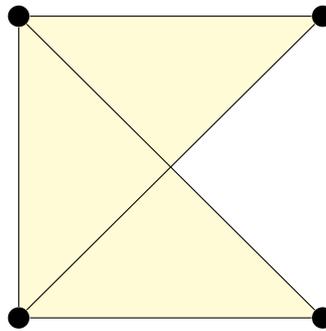
   b) Using the DDA line drawing algorithm, determine the raster points for the line segment joining P(12,4) and Q(4,10). (4)

   c) Write a C code for generating concentric circles. (4)

   d) Using the Midpoint method and taking symmetry into account develop an efficient method for scan converting the curve $y = \frac{x^3}{12}$ in $[-10, 10]$. (3)

3) a) Compare Boundary fill algorithm and Flood fill algorithm. Mention at least two advantages and limitations of both algorithms. Why does boundary fill algorithm fail when boundary is not completely closed? Explain with an example. (6)

   b) Find the normalisation transformation matrix that maps the window with corners at (-2,1) and (6,9) onto a normalised viewport $[0,1] \times [0,1]$. (4)

   c) A quadrilateral with vertices (-3,2), (1,2), (-2,0), and (2,0) is reflected about the y-axis followed by shearing in the x-direction with the shear factor -2. Find the final coordinates. (5)

4) a) Let W be a window having two diagonally opposite corners at (1,1) and (5,4). Trace Cohen-Sutherland Line Clipping Algorithm for the line segment having two end points (0,0) and (4,5). (6)

   b) Obtain the Cubic Bezier Curve equation for the control points $P_0 = (0,0)$, $P_1 = (2,5)$, $P_2 = (5,1)$, $P_3 = (7,3)$. (4)

c)   Let W be a window with corners (0,0), (6,0), (6,5), and (0,5). Clip a triangle with vertices (2,1), (8,3) and (4,7) against the window W using the Liang-Barsky line clipping algorithm. (5)

5)   a)   Transform the scene from the world coordinate system to the viewing coordinate system with viewpoint at (2,-1,3). The view plane normal vector is (3,-2,4) and the view-up vector is (0,1,2). (5)

     b)   An object is rotated about the z-axis with an angle of $30°$ and then it is uniformly scaled up by a factor of 4. Find the resultant transformation matrix. (3)

     c)   Write the syntax of glFrustum() and gluPerspective(). Explain any two parameters of each function. (3)

     d)   Design a program that displays the top, front, and right views of a pyramid using orthographic projection. Explain the difference between single-view and multi-view representations of 3D objects. Why are multi-view projections important? (4)

6)   a)   Design a program that performs continuous rotation of a hexagon about an arbitrary point (x_0, y_0). (3)

     b)   Show that reflection about the line $y = mx$ can be achieved by a sequence of rotation, reflection, and inverse rotation operations. (3)

     c)   The centre of projection coincides with the origin. The projection plane passes through the point $P(1,5,6)$ and has a normal vector $(3,2,-1)$. Obtain the perspective projection transformation. (5)

     d)   A square has opposite vertices at (0,1) and (2,3). Shear the square (4)

        i)   by 1 unit along the x-axis with respect to $y = 1$.
        ii)   by 3 units along the y-axis with respect to $x = 1$.

7)   a)   A cube has two diagonally opposite vertices at (2, 2, 2) and (6, 6, 6). Find the coordinates of all its corners and obtain its projection using an oblique parallel projection with $\alpha = 45°$, $\phi = 30°$. (7)

     b)   Find the uniform cubic B-spline curve generated by the control points (2,1), (6,-3), (9,4), (14,0). (3)