

MMTE-004

ASSIGNMENT BOOKLET

M.Sc(Mathematics with Applications in Computer Science)
COMPUTER GRAPHICS
(Valid from 1st January, 2021 to 31st December, 2021)



School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi
(For January 2021 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, 2021. If you fail in this assignment or fail to submit it by 31st December, 2021, then you need to get the assignment for the year 2022 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

Course Code: MMTE-004
Assignment Code: MMTE-004/TMA/2021
Maximum Marks: 100

- 1)
 - a) List three important characteristics of video display devices. (3)
 - b) Discriminate between the function of a processor in raster scan and vector scan displays. (3)
 - c) Compute the following : (4)
 - i) Size of 480×320 image at 240 pixels per inch
 - ii) Resolution (per square inch) of 6×4 inch image that has 1024×768 pixels.
 - iii) Height of the resized image 1080×864 to one that is 640 pixels wide with the same aspect ratio.
 - iv) Width of an image having height of 8 inches and an aspect ratio 1.8.
- 2)
 - a) Let the origin be the centre of projection. Find out the perspective projection when the projection plane passes through the point $P(2, 3, -1)$ and has the normal vector $(1, 2, 3)$ (6)
 - b) Draw the letters A and B of English alphabet using multiple Bezier curves. (6)
 - c) Prove or disprove: "Multiplication of transformation matrices for two successive rotations is commutative." (3)
- 3)
 - a) What will be the new coordinates of the triangle with vertices $A(0, 1), B(1, 2)$ and $C(1, 0)$ when :
 - i) it is scaled up by a factor of 2 in such a way that A remains fixed. (2)
 - ii) it is reflected about the line passing through A and C. (2)
 - b) Given a clipping window A $(10, 0), B(20, 0), C(20, 20)$ and $D(10, 20)$, use Cohen Sutherland line clipping algorithm to clip the line segment having two end points $(5, 1)$ and $(25, 30)$. (5)
 - c) Let W be a window with corners $(0, 0), (8, 0), (8, 4)$ and $(0, 4)$. Clip a triangle with vertices $(1, 1), (10, 2)$ and $(5, 9)$ against the window W by tracing Liang Barskey line clipping algorithm. (6)
- 4)
 - a) Write a boundary fill procedure to fill an 8-connected region. (2)
 - b) Given the plane parameters A, B, C and D for all surfaces of an object write a C code to determine whether any specified point is inside or outside the object. (4)
 - c) Determine the blending function for uniform periodic , B-spline curve for $d = 4$ and $d = 5$. (4)
- 5)
 - a) What will be the perspective projection of a unit cube on the plane $x = y$ if it is viewed from the point $(1, 2, 0)$? Justify your answer. (5)
 - b) Transform the scene in the world coordinate system to the viewing coordinate system with viewpoint at $(1, 1, 2)$. The view plane normal vector is $(-4, 2, 5)$ and the view up vector is $(1, 4, 0)$. (3)

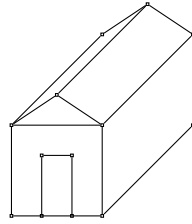


Fig. 1

- c) If the origin is taken as the centre of projection, then what will be the perspective projection when the projection plane passes through the point $P(4,5,3)$ and has normal vector $(1,2,-1)$. (3)
- d) Draw an approximate (i) front view (ii) top view and (iii) view from left of the object shown in Fig. 1. (4)
- 6) a) Suppose a cube is specified in world coordinate system. One of the opposite squares of the cube lies on the xz -plane having vertices $(1,0,1)$, $(1,0,3)$, $(4,0,3)$ and $(4,0,1)$; and another lies in the plane $y = 4$. The lookup vector is $(9,0,10)$ and viewpoint is at $(0,1,2)$. Find out and draw image of the cube in a view plane placed at the xy -plane of the world coordinate system. Also find out how many vanishing point(s) will be there in the projected scene. (8)
- b) Write a code to continuously rotate a pentagon about a corner point in the anti-clockwise direction. (7)
- 7) a) Devise an efficient algorithm that takes advantage of symmetry properties to display a sine function. (4)
- b) Prove that the reflection along the line $y = -x$ is equivalent to reflection along the y -axis followed by a counter-clockwise rotation by 90° . (3)
- c) Shear a square whose opposite vertices are at $(1,1)$ and $(2,2)$ by
- i) 2 units along the x -axis and reference line $y = 0$.
 - ii) 4 units along the y -axis and reference line $x = 0$. (3)
- 8) State whether the following statements are **true** or **false**. Justify your answer with a short-proof or a counter-example. (10)
- a) If the resolution of a printer is 1600 dpi, the number of dots per inch is 400×400 .
 - b) A rectangle may become a square under a suitable translation of axes.
 - c) Perspective projection is an affine transformation.
 - d) A circle generation algorithm can be modified to generate a parabola.
 - e) Liang Barskey line clipping algorithm can be used to clip a pentagon.