

### Instructions to candidates

Answer all the questions.

Missing data, if any, may be suitably assumed.

1. A. Find the time available for the electron beam to access and display a pixel for the following data
 

There are 525 horizontal lines, but only 483 are visible  
Refresh rate is 30 frames per second  
Viewing aspect ratio is 4:3  
Each frame has two fields, each containing half of the picture  
Vertical retrace time is equal to 21 scan line time  
Horizontal retrace time is 17%

Also calculate the size of the frame buffer in KB if each pixel uses 24 bits for color representation (RGB). In this case what is the maximum number of different colors possible?

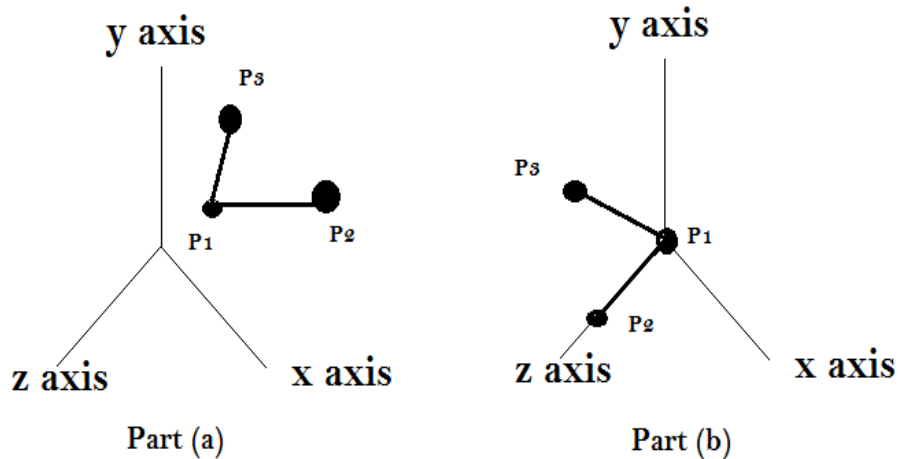
B. Identify and list the similarities and differences between random and raster displays. Show the step by step drawing of a house using random and raster displays.

C. What is DVST? What are the drawbacks of DVST?

[5+3+2]
2. A. Draw a circle of radius 10 using the second order difference version of midpoint circle drawing algorithm. Write all the intermediate steps of processing.
- B. Show the points selected by midpoint line drawing algorithm for drawing a line between (5, 3) and (10, 6). What changes are required to use the same algorithm for drawing a line in the 2<sup>nd</sup> octant?
- C. Write pseudo code for DDA algorithm for line drawing.

[5+3+2]

3. A. What is antialiasing? What are the methods for antialiasing? Write pseudo code for Gupta-Sproull algorithm for antialiasing.
- B. What are the processing steps required to transfer the directed line segments  $P_1P_2$  and  $P_1P_3$  from their position in **part (a)** to their ending position in **part (b)** shown in **Fig. 3.B** using composition of 3D transformations. Write all transformation, their matrices, intermediate transformation matrix and final transformation matrix and diagrams.



**Fig. 3.B**

**C.** What are AEL and SET? Explain with the help of an example how AEL is updated with respect to the SET and the scan lines.

**[5+3+2]**

- 4. A.** Compare parallel and perspective projection with an example. Explain in detail all types of parallel and perspective projection with examples.
- B.** Derive the transformation matrix for 2D rotation. Extend this idea to get transformation matrix for 3D rotation with respect to x, y and z axis.

**C.** How to convert world coordinates to viewing coordinates?

**[5+3+2]**

- 5. A.** Write an OPENGGL program to perform the following:
  - (i)** Zoom in and Zoom out
  - (ii)** Multiple viewport display on the screen for a teapot and cube

**B.** What is the use of OPENGGL? What are the major abstractions in OPENGGL? Write an OPENGGL program to display chess board.

**C.** What are key frame systems? What are the general procedures for morphing? Write example for each procedure

**[5+3+2]**