NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCE

COMPUTER SCIENCE DEPARTMENT

AUGUST EXAMINATIONS 2009

SUBJECT: **COMPUTER GRAPHICS**

CODE: SCS4203

INSTRUCTION TO CANDIDATES
Answer any **five** questions from the **six** questions below.

OPTIONAL ADDITIONAL MATERIALS

Graph paper

Time: 3 hours

QUESTION ONE

a) Write the operational characteristics of the following display technologies:

    i) Plasma displays   [2]

    ii) LCD   [2]

    iii) Raster refresh systems   [2]

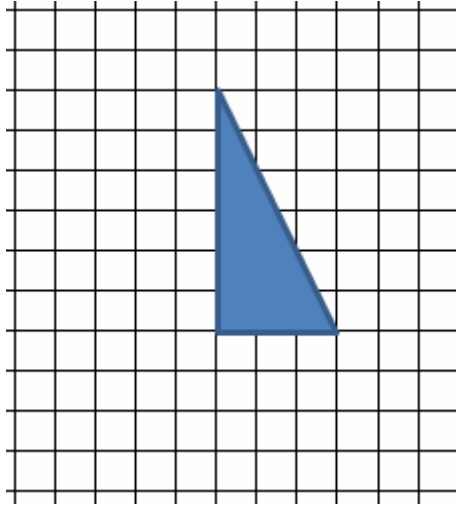   iv) Vector refresh systems   [2]

b) A raster system has a resolution of 1280 x 1024 pixels. What would be frame buffer size
    (in bytes) if 12 bits per pixel are to be stored?   [4]

c)   Describe how a dot matrix printer displays graphic objects   [8]

QUESTION TWO

The diagram below shows a right angled triangle.

Sin 45°= $1/\sqrt{2}$

Sin 30 ° = ½

Sin 60 ° = $\sqrt{3}/2$

(0,0)

a) Starting from the picture above, show the effect of applying the transformation below to the triangle above.

$$\begin{pmatrix} 1 & 0 & 5 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ -1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & -5 \\ 0 & 1 & -4 \\ 0 & 0 & 1 \end{pmatrix}$$

Draw a diagram on a graph paper [10]

b) Compare and contrast interlaced scanning and non-interlaced scanning [6]

c) Give a detailed explanation of the following terms as applied to computer graphics.

   i)   Anti-aliasing

   ii)   Morphing [4]

QUESTION THREE

Below is a summary of Bresenham's line drawing algorithm

a) For a line with end points (20,10) and (30,18) , calculate the pixel positions and fill the following table for k=0 to k=4.

k	p_k	(x_{k+1}, y_{k+1})
0		
1		
2		
3		
4		

[10]

b)   With the aid of a diagram, explain the operation of a shadow mask cathode ray tube.

[10]

QUESTION FOUR

a) Explain the steps of clipping a straight line using the Cohen-Sutherland line clipping algorithm. *(No equations are necessary. Your explanation may be supported by a diagram)* [10]

b) Define ray tracing and give two examples of its application in computer graphics. [4]

c) Clearly describe how you can improve the stair step appearance of displayed primitives generated by a raster algorithm. [6]

QUESTION FIVE

a) (i) Find the matrix that represents rotation of an object by 30 degrees about the origin. [6]

   (ii) What are the new coordinates of a point P(2,-4) after the rotation using the matrix in (i) above? [4]

b) Describe the **Phong** and the **Gourand** shading technique and explain how the two techniques differ from each other. [8]

c) Explain the difference between a color image and a grayscale image. [2]

QUESTION SIX

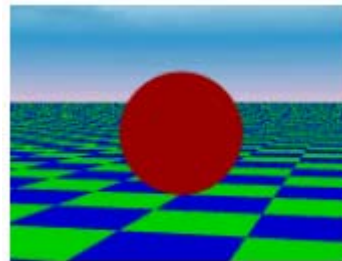*The pictures below represent two components of lighting*

Fig 6a

Fig 6b

a) Name the lighting components represented and write a detailed characterisation of each of the components. [10]

b) With the aid of pseudocode, describe the scan line polygon fill algorithm [10]

END OF QUESTION PAPER