Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December- 2018

Programme Name: B.Tech CSE All Branches — **Semester : V**
Course Name : Computer Graphics — **Time : 3 hrs**
Course Code : CSEG329 — **Max. Marks : 100**
Nos. of page(s) : 3
Instructions:

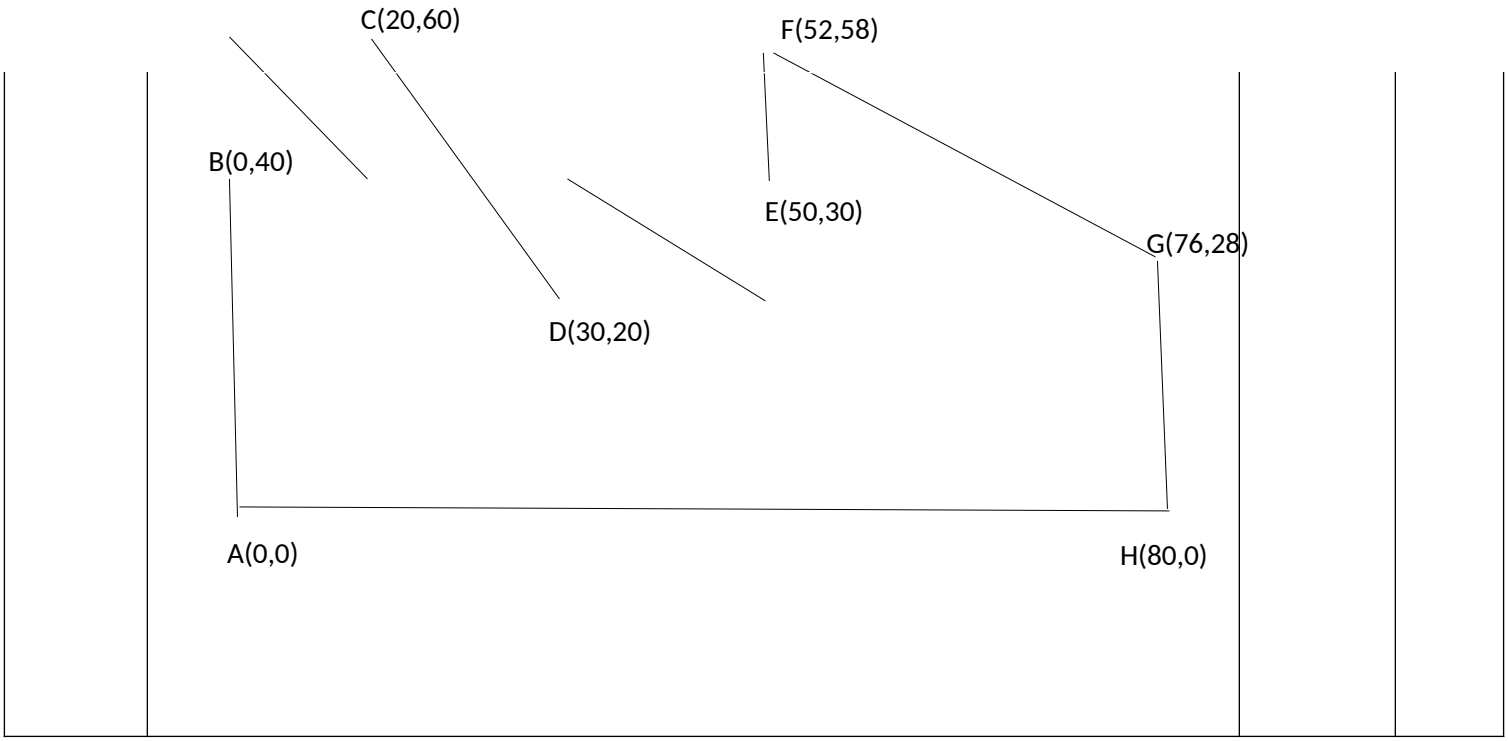
SECTION A (Attempt All)

S. No.		Marks	CO
Q 1	Write short note on Affine Transformations.	**4**	**CO3**
Q2	Is OpenGL platform independent? Justify your answer with proper explanation.	**4**	**CO1**
Q3	Write short note on polygon meshes; discuss various types of meshes and mention which is popular amongst them and why.	**4**	**CO3**
Q4	What are the conditions to be satisfied, in Area-subdivision method, so that a surface not to be divided further?	**4**	**CO5**
Q5	Prove: $\sum_{i=0}^{n} B_{n,i}(t)=1.$, B is Bernstein/Bezier basis.	**4**	**CO4**

SECTION B (Attempt All)

Q6	Use Liang-Barsky line clipping algorithm to find the visible portion of the line P1 (0, 10)-P2 (30, 30) against the window having diagonally opposite corners as (5, 0) and (15, 15). Also, discuss why it is superior to Cohen Sutherland line clipping algorithm.	**10**	**CO2**
Q7	Derive the generalized expression for Cubic B-Spline Curve. Write down the expression for NURBS and explain its advantage over other Curves.	**10**	**CO4**
Q8	A pyramid defined by the coordinates A (0, 0, 0), B (1, 0, 0), C (0, 1, 0) and D (0, 0, 1) is rotated 45° about the line L that has the direction V=J+K and passing through point C (0, 1, 0). Find the coordinates of rotated figure.	**10**	**CO3**
Q9	a. Discuss the working of CRT with proper diagram b. Explain how does one ensure that relative replacement in viewport is same as that of window.	**6+4=10**	**CO1** **CO2**

	Or Derive the points with the help of Bresenham's algorithm for circle generation, write algorithm as well.		**CO3**
	SECTION-C(Attempt All)		
Q10 .	a. A solid tetrahedron given by position vectors A(1,1,1), B(3,1,1), C(2,1,3) and D(2,2,2) and a parallel beam of light source is given by -(i+5j+6k) that falls on tetrahedron. Find the surfaces that are illuminated and the surfaces that are to be shadowed using blackface detection. b. Enumerate the major difference between Bezier Curve, B-Spline Curve and NURBS.	**12 +8=20**	**CO5, CO4**
Q11	a. The position vectors for the vertices of a triangular surface are given by A (10, 0, 0), B (0, 10, 0) and C (0, 0, 10). The normal vector at the vertex A is 10i+11j+11k, B is 11i+10j+11k, and C is 11i+11j+10k. The source for a parallel beam of light is given by L= -0.1924i-0.1924j+.9622k. Find the intensity at the parallel projected point (3, 3) within the projected triangle on the xy plane of the screen using gouraud interpolation technique. The ambient light intensity is 1 and the directional light intensity is 10. Assume Ka=0.5 and Kd=0.3 . Neglect any intensity attenuation and specular effect. b. Transform the square P(0,0), Q(10,0), R(10,10) and S(0,10) into a master picture coordinate system with half of its size with center at (-1,-1). **OR** c. A tetrahedron is given by position vectors A(1,1,-1), B(3,1,-1), C(2,1,-3) and D(2,2,-2). Use Depth Buffer method to find visible planes of the tetrahedron if the viewing plane is XY-Plane i.e. z=0. Take screen resolution of 4*4, and background colour as black (colour value=0). The color of plane ACD is blue(1), CBD is green(2), BAD is cyan(3) and ACB is red(4). d. With respect to Fig 1 and Scan line fill algorithm, answer the following. i. Which vertices will be considered only once and why? ii. Which vertices will be considered twice and why? iii. Which edge will be discarded and why? iv. Give entries for GET and AEL. Fig 1:	**12+8=20** **12+8**	**CO5, CO3** **CO5 CO2**


C(20,60)
F(52,58)
B(0,40)
E(50,30)
G(76,28)
D(30,20)
A(0,0)
H(80,0)

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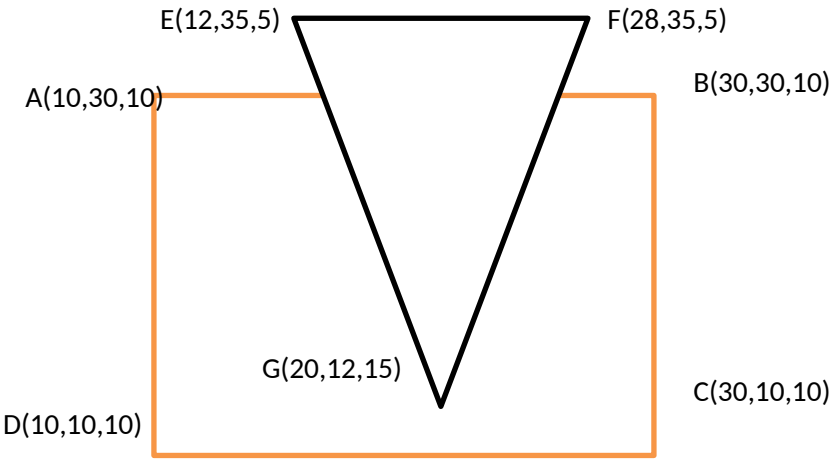
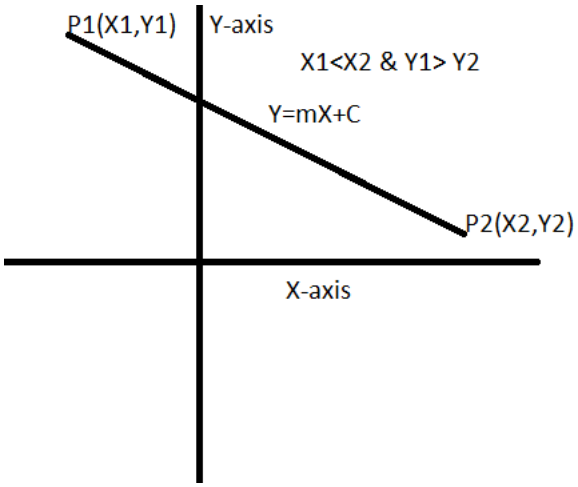
SECTION A (Attempt All)

S. No.		Marks	CO
Q 1	Write short note on Convex Hull property of curves	4	CO4
Q2	State and explain the DDA algorithm for line drawing with proper example, and mention its advantage and disadvantages.	4	CO2
Q3	Differentiate between the object space and image space method of detecting visible surface, give examples for each.	4	CO5
Q4	Write five properties of Bezier curve.	4	CO4
Q5	Is the Flat shading most efficient, if yes/no why?	4	CO5

SECTION B (Attempt All)

Q6	In given figure find out the intensity of pixel (20, 27) using Z Buffer visible surface detection algorithm. Intensity of surface ABCD and EFG are 20 and 30 respectively.  	10	CO5
Q7	Derive the generalized expression for Cubic Spline Curve. Write down the expression for B-Spline and explain it superiority over Bezier curve.	10	CO4

Q8	Derive the decision parameter for the following line with the help of Bresenham's line generation algorithm.  	**10**	**CO2**
Q9	Define Fractals, mention two important characteristics of Fractals. Generate Koch Curve till 3rd Iteration for a equilateral triangle. **OR** Prove that a shear transformation can be expressed in terms of rotation and scaling operations.	**10**	**CO4** **CO3**
	SECTION-C(Attempt all)		
Q10.	1) Give a single 3x3 homogeneous coordinate transformation matrix, which will have the same effect as each of the following transformation sequences. **a.** Scale the image to be twice as large and then translate it 1 unit to the left. **b.** Scale the x direction to be one-half as large and then rotate counterclockwise by 900 about the origin. **c.** Rotate counterclockwise about the origin by 900 and then scale the x direction to be one-half as large. **d.** Translate down ½ unit, right ½ unit, and then rotate counterclockwise by 450. 2) Write down five call back functions in OpenGL and discuss the importance of glFlush () and glutMainLoop () function.	**12+8 Marks**	**CO3** **CO1**
Q11 .	1) An Animation shows a car driving along a road which is specified by a Bezier curve with the following control points:	**10+10**	

X	**0**	**5**	**40**	**50**
Y	**0**	**40**	**5**	**15**

The animation lasts 10 seconds and the key frames are to be computed at 1 second intervals. Calculate the position of car on the road at the start of the 6th second of animation.

CO4

2) Consider following window coordinates A(100, 10), B(160, 10, C(160, 40), D(100, 40). Find the visible portion of the line segments EF, GH and IJ using Cohen Sutherland algorithm, where are E(50,0), F(70,80), G(120, 20),H(140, 80),I(120, 5),J(180, 30).

CO2

Or

3) Assume that at point P on the surface, the normal, light and sight (viewing) vectors are:

n=j

L=-i+2j-k

V=i+1.5j+0.5k

Assuming that there is one object in the scene, d=0 and k=1. The light source is assumed 10 times more intense than the ambient light. The surface is to have a shiny metallic appearance; hence, most of the light is specularly reflected. Thus assume ks=0.8, kd=ka=0.15 and m=5. Note that ks+kd=0.95, which implies that 5% of the energy from the light source is absorbed. Determine the intensity with the help of illumination model. Determine the intensity also when halfway vector is used.

15 +5

CO5
CO3

4) Show that $R_\alpha . R_\beta = R_\beta . R_\alpha = R_{\alpha+\beta}$.