Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course : Computer Graphics **Semester : V**
Program : B.Tech. (CSE) **Time : 03 hrs.**
(CCVT/GG/MFT/Big Data/BFSI/ BAO/CSF/OSS/DevOps**)**
Course Code : CSEG3003 **Max. Marks : 100**

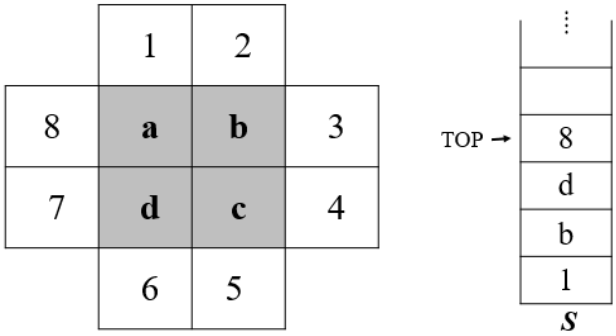
Instructions : Calculators are allowed

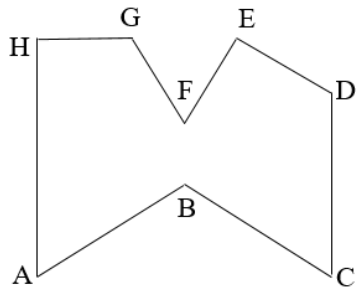
SECTION A

S. No.		Marks	CO
Q 1	How much time is spent in scanning across each row of pixel during screen refresh on a raster system with resolution of 1280×1024 and a refresh rate of 60 frames per second?	**4**	**CO1**
Q 2	Differentiate between Digital Differential Analyzer and Bresenham's algorithms for scan converting line segments.	**4**	**CO2**
Q 3	Determine transformation matrices for applying (a) clockwise rotation on a 2D object by 30˚about origin, (b) shear in *x*-direction on a 2D object by 2 units.	**2+2**	**CO3**
Q 4	Differentiate between Bezier and B-Spline curves.	**4**	**CO4**
Q 5	Discuss local and global illumination with suitable example.	**4**	**CO5**

SECTION B

Q 6	Construct a Bezier curve with control points A (0, 0), B(1, 2), C(3, 2), and D(2, 0). Generate five points of the curve.	**10**	**CO4**
Q 7	Draw the interactive graphics architecture for raster scan display and discuss its various components. Also, mention its drawbacks over random scan display.	**8+2**	**CO1**
Q 8	The spatial arrangement in Fig. 1 shows a region defined by the pixels in the set R = {**a, b, c, d**}. The boundary of region R is defined as B = {**1, 2, 3, 4, 5, 6, 7, 8**}. R is defined by 4-connectivity whereas B is defined by 8-connectivity. Apply the boundary fill algorithm on region R to show the sequence of pixels picked up for filling at each recursion step. Show the content of stack S at each step. Initial state of S is shown in Fig. 1 with pixel **a** selected as seed.	**10**	**CO2**

	 **Fig. 1**		
Q 9	Determine a composite transformation matrix to align a vector V = 3**I** – 2**J** + **K** with N = **I** + **J** + **K**.	**10**	**CO3**
	OR		
	Define affine transformations with example. Perform a 45 degree rotation of a triangle A (0, 0), B (1, 1), C (5, 2) about its center.	**3+7**	**CO3**
	SECTION-C		
Q 10	(a) Determine the transformation matrix to map a 2D object defined in world coordinates (*wx, wy*) to its corresponding device coordinates (*vx, vy*). Find the normalization transformation that maps a window whose lower left corner is at (1, 1) and upper right corner is at (3, 5) onto a viewport that has lower left corner at (-1, -1) and upper right corner at (1, 1). (b) Execute the z-buffer algorithm to illuminate the pixels on an 8×8 display. The surfaces to be probed for visibility are: A: (1, 4, 3), (3, 4, 3), (3, 6, 3), (1, 6, 3). B: (2, 3, 2), (4, 3, 2), (4, 5, 2), (2, 5, 2). C: (4, 1, 1), (7, 1, 1), (4, 4, 1). Assume the intensities of the surfaces A, B, and C as 10, 20, and 30, respectively. Show the content of depth and frame buffer upon each surface processing. (c) Discuss the way z-buffer algorithm computes the depth at each pixel.	**4+4** **8** **4**	**CO3,** **CO5,** **CO5**
Q 11	(a) Explain Cohen-Sutherland line clipping algorithm by giving suitable example. (b) Differentiate between geometric and coordinate transformations. (c) Is flat shading the most efficient amongst the available shading schemes? Justify your answer.	**10** **6** **4**	**CO2, CO3, CO5**
	OR		

	(a) Explain the working of scan-line filling algorithm by discussing its execution on the polyline region given in Fig. 2.  **Fig. 2**	**10**	**CO2,**
	(b) Brief the significance of homogeneous coordinates in graphics transformations.	**5**	**CO3,**
	(c) Discuss a technique to determine the back faces of a polyhedron.	**5**	**CO5**