Paper Code: EME-701	Roll No.									

B.Tech.
(SEM VII) ODD SEMESTER EXAMINATION2015-16
COMPUTER AIDED DESIGN (CAD)

Time: 3 hours **Max. marks: 100**

Note: *Question No.1 is compulsory; attempt 4 more questions as instructed, marks are indicated therein. Assume suitably any missing /inappropriate data/information, if any.*

Q.1 Answer the following as asked for (1+1)x10 = 20 marks

(a) Write full form of (i) CRT (old-styled TV & monitors) and (ii) OOP (in C++).
(b) Write full form of (i) L & T (Construction company) and (ii) BARC (research organization).
(c) Write the name of the primary & secondary colors abbreviated as (i) RGB and (ii) CMY
(d) Write (i) Binary number for 35 and (ii) Find my Age of which binary number is 1000100.
(e) At present, who are (i) Jack Ma (ii) Mark Zuckerberg ?
(f) At present who are these Indian-origin persons (i) Satya Nadela and (ii) Sunder Pichai
(g) Name the persons who established the company-named (i) Apple and (ii) Infosys
(h) Draw logic-gates symbol(s) of (i) OR and (ii) XOR
(i) Write/briefly-explain the meaning of the term(s) (i) Pixel and (ii) Resolution
(j) Initially it was thought that the wealth can be generated, of-course in addition to 'services', only in 'farms' & 'factories'; but now in the modern computer-era it is well known that even much- more wealth can be generated elsewhere; the questions are (i) where and (ii) how ?

Q.2 Answer *any two* of the following 10 x 2 = 20 marks

(a) Explain (i) Conventional Design versus CAD, (ii) 'if else' decision-control, (iii) 'while( )' *or* 'for( )' loop (s) and (iv) Features of C++ over C.
(b) Write formulae & steps for design of a solid circular shaft (to find shaft-dia) and then write a 'user friendly' & good 'computer- program' for it in C/C++-language.
(c) Briefly describe (i) Raster scan display, (ii) Random scan display and (iii) Modeling / World / Normalized / Device Coordinates and (iv) Homogeneous-Transformation Matrices for Translation, Rotation & Scaling for 2-D objects

Q.3 Answer *any two* of the following 10 x 2 = 20 marks

(a) (i) Using Bresenham's Line-drawing algorithm (or DDA algorithm), draw the pixel-points between the points A & B. Given A =(0,0) and B = (10,8).
(ii) Using mid-point circle-drawing algorithm, draw the pixel-points for portion ($1/8^{th}$) of circle, which has its centre at origin (0,0) and has radius of 12 pixels. Also, just only-mention how circle could be achieved.

(b)(i) Prove mathematically through matrix-multiplication, that two successive-translation is additive, two successive-rotation is also additive but two successive-scaling is multiplicative.
(ii) Show that the transformation matrix for 'Reflection about a line y = x ' is equivalent to 'Reflection about x-axis followed by CCW Rotation by 90^o ' .

(c) (i) Derive the concatenated (composite) matrix [M] for geometric-transformation for anti-clockwise rotation (by angle θ) of an object about a certain pivot-point (x_o , y_o).
(ii) Consider a triangle ABC; A = (0,0), B = (4,0), C = (2,6). Find using the concatenated matrix [M] obtained-earlier the new coordinates of the vertices if the triangle is rotated about a vertex-point B clockwise by 90^o.

Q.4 Answer *any two* of the following 10 x 2 = 20 marks

(a) In respect to curve-representation briefly explain what do understand by (i)Interpolation & Approximation, (ii) Continuities for piecewise curve-segments, (iii) Parametric representation of curves and (iv) Conic-section Curves.

(b) (i) Derive the Hermite-matrix for a cubic Hermite-spline curve and (ii) find the expressions for blending-functions and show its plots with the parameter u ($0 < u < 1$).

(c) (i) Beginning with the generalized Bezier formula for parametric-curve, derive the Bezier-matrix for a cubic Bezier curve. (ii) Also, write its properties and show some typical examples of the Bezier curves showing that it lies within the convex-hull.

Q.5 Write short notes on *any four* of the following 5 x 4 = 20 marks

(a) 3-D Graphics for solids with Euclidean surfaces
(b) Super-ellipse shapes & super-ellipsoid
(c) Sweep representation for Solid-modeling
(d) C-representation versus B-representation Solid-modeling
(e) Importance of Rendering, Color, Illumination to Solids
(f) AutoCAD or Pro-Engineer
(g) Least-square-error (RMS) curve (say, straight-line) fitting.

Q.6 Answer *any two* of the following 10 x 2 = 20 marks

(a) (i) Using Newton-Raphson method for root-finding, do two iterations manually to find the root of the equation $x^2 - 45 = 0$. Start with a suitable guess.
(ii) Also, write a computer-program in C/C++ language for the above problem to have an accuracy up to 5^{th} place of decimal.

(a) (i)If the function is $y = f(x) = x^3 - x^2 + x + 2$, find the first & second differentials at $x = 0$; take interval $h = 0.1$.
(ii) Do numerical-integration of the following integral using Simpson's rule

$$\int_0^{\pi} (5\cos\theta + 2)\, d\theta \quad .$$

(c) For the axially loaded bar-members shown in the figure, determine using the Finite-Element-Method (FEM) the (i) Nodal-displacement at node-2 and (ii) Reactions R_1 & R_2 at the nodes 1 & 3 which are the fixed- ends and (iii) also find stresses in the Element-1 & Element-2 . Stiffness of a bar-element is known to be as $k = A.E / L$.

Given:

Area & Length of Aluminum-rod $A_{Al} = 40 \times 10^{-4}$ m^2 , $L_{Al} = 1$ m
Area & Length of Brass-rod $A_{Brass} = 12 \times 10^{-4}$ m^2 , $L_{Brass} = 2$ m
Modulus of Elasticity $E_{Al} = 75$ GPa
Modulus of Elasticity $E_{Brass} = 100$ GPa

Axial load on node 2 = 500 kN towards right,

Note that the node-1 & node-3 are fixed-ends; somewhere at the junction-point in-between nodes 1 & 3 at node 2 a force P = 500 kN is acting on right-side as shown in the figure.