Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
A Constituent Institute of Manipal University, Manipal

I SEMESTER M.TECH (CAAD)
END SEMESTER EXAMINATION – NOV. 2017
SUBJECT: GEOMETRICAL MODELLING FOR CAD (MME 5103)
REVISED CREDIT SYSTEM

Time: 3 Hour **Max. Marks: 50**

Note: (i) Missing data, if any, may be appropriately assumed
(ii) Draw sketches as applicable
(iii) Assumptions made must be clearly mentioned

1A. What is data structure? List and explain the different types of data structures. 03

1B. Explain the impact of CAD on Shigley's design procedure. 02

1C. A parabola is defined by $x = 2 + 2u^2$ and $y = 6 + 4u$. A line segment passing through the points (1, 9) and (10, 1) intersects the parabola at two points. Determine the coordinates of the intersection points. Use only parametric representation of curves. 05

2A. A planar Bezier curve is defined by the control points P_o = (2, 2), P_1 = (6, 5), P_2 = (9, 5) and P_3 = (13, 2). A line segment passing through the points (3, 8) and (8, 2) intersects the Bezier curve. Determine the coordinates of the intersection point. 05

2B. For 4 control points and order of the curve $k = 2$, derive the B Spline basis functions. Also write the final B-Spline equations for individual segments. 03

2C. Explain the limitations of Bezier curves that are overcome by the B-Spline curves. 02

3A. A Bezier curve defined by the control points P_o = (2, 10), P_1 = (5, 8), P_2 = (3, 3) and P_3 = (7, 1) is to be revolved about the y axis. The parameter v is used to represent the curve. Determine the points on the revolved surface for $v = 0.4$ and $\phi_y = 90^o$, 180^o, 270^o and 360^o. 05

3B. Write the parametric equation of a Hyperbolic Paraboloid defined by (1, 1, 1), (10, 1, 1), (1, 1, 10) and (10, 10, 10). Determine the coordinates of the points on the surface at (i) $u = 0.4$ and $v = 0.2$ (ii) $u = 0.6$ and $v = 0.8$. 03

3C. What is a Ferguson's Patch? What is its limitation? 02

4A. Write the steps (or draw the flow chart) for the generalized Bresenham's Line algorithm. Compute the pixels for a line to be drawn from start point (10, 2) and end point (5, 11). 05

4B. Explain the importance of the Regularized Boolean operations in CSG method of solid modelling. What is the purpose of carrying out the 'Boundary evaluation' of the CSG models? 03

4C. Explain the logic of shifting from region 1 to region 2 in the mid-point ellipse algorithm. 02

5A. Derive the transformation matrix for obtaining the orthographic projection of a point P on an arbitrary plane of projection. The plane of projection is defined by the direction cosines $\{l, m, n\}$ of its unit normal vector. The plane of projection passes through a reference point (x_r, y_r, z_r). 05

5B. Explain the *z*-buffer algorithm useful in removing the hidden surfaces. 03

5C. How do you determine the Second mass moment of inertia of a distributed mass about the *x* axis? 02

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