Reg. No.



I SEMESTER M.TECH (CAAD) END SEMESTER EXAMINATION – NOV./DEC. 2016 SUBJECT: GEOMETRIC MODELLING FOR CAD (MME 5103) REVISED CREDIT SYSTEM (29/11/2016)

Time: 3 Hour

Max. Marks: 50

Note: (i) Missing data, if any, may be appropriately assumed (ii) Draw the sketch as applicable

- (iii) Assumptions made must be clearly mentioned
- 1A. Explain the construction and working principle of a digitizing tablet. 05
- 1B. Name and explain the steps of implementation of an algorithm that is used to remove 05 the hidden surfaces while displaying a 3D object on a graphics output terminal.
- 2A. Deduce the B-Spline basis functions for 4 control points and order of curve, k = 3. 05 Also write the final B-Spline equations for individual segments of the B-Spline curve.
- 2B. The parametric equations of a parabola are given as $x(u) = 2u^2$ and y(u) = 4u. The 05 curve has its vertex at (3, 1) and the parabola is defined in the range $-3 \le y \le 6$. It is intersected by a straight line segment with end points (2, 8) and (8, -1). Determine the coordinates of the intersection point.
- 3A. A Bezier surface patch is defined by two Bezier curves: one quartic (4th degree) 05 Bezier curve defined along the parameter 'u', and the second is a cubic Bezier curve defined along parameter 'v'.
 - (i) Write the parametric equation of the Bezier surface patch
 - (ii) Express the parametric equation in matrix form.
 - (iii)Draw the schematic representation of the control polyhedra and the Bezier surface
- 3B. A ruled surface is defined by two Bezier curves. One curve has control points 05 (-2, 9, -5), (5, 4, -1) and (9, 3, 3). The other curve has control points (3, 5, 6), (5, 4, 8), (9, 2, 9) and (11, 1, 10).
 - (i) Assuming that the origin of the surface parameters is at (3, 5, 6), compute the coordinates of the point on the surface at u = 0.74 and v = 0.12.
 - (ii) What values of u and v should be considered if the origin of the surface parameters is taken at (-2, 9, -5), in order to get the same point on the surface computed in (i)

- 4A. List the techniques of modelling solids which use the concept: $Vol(A \cup B) = Vol(A) + Vol(B) - Vol(A \cap B)$, where $Vol(A \cap B)$ is rendered NULL. In the above expression, 'Vol' represents ' volume of ', whereas A and B represent solid primitives. Explain the steps involved in any one of the techniques.
- 4B. Determine the coordinates of the pixels to be lit on a raster display terminal for 05 displaying a circle of radius 8 units centered at (3, 5). Use Bresenham's circle algorithm.
- 5A. Deduce the homogeneous transformation matrix for obtaining the perspective 05 projection of a line segment with end points (x_1, y_1, z_1) and (x_2, y_2, z_2) on a projection plane defined by its unit normal vector $l\hat{i} + m\hat{j} + n\hat{k}$. The projection plane passes through a point (x_r, y_r, z_r) . The eye is located at the origin.
- A triangle has vertices (-3, 1), (-2, -4) and (2, -1). It is required to reflect the triangle 05 5B. about a line with end points (-5, 3) and (5, 3). List the sequence of transformations required to obtain the reflection. Determine the coordinates of the reflected triangle.

####

05