

**I SEM. M.TECH. (CAMDA) END SEM. EXAMINATIONS, NOV/DEC 2015**  
**SUBJECT: GEOMETRIC MODELLING FOR CAD [MME 503]**

Time: 3 Hours.

MAX. MARKS: 50

**Instructions to Candidates:**

- ❖ Answer **ANY FIVE FULL** questions.
- ❖ Missing data, if any, may be suitably assumed.

1A) Justify the necessity of *Regularized Boolean* operations in the CSG solid modelling. (3)

1B) What are registers? Explain the functions of the different types of registers. (3)

1C) A Bezier curve is defined by its control points  $P_0 = (2, 1)$ ,  $P_1 = (6, -1)$ ,  $P_2 = (8, 7)$ ,  $P_3 = (12, 2)$  and  $P_4 = (10, -1)$ . Deduce the parametric equation of the curve, denoting the parameter used as 'u'.  $u = 0$  at  $P_0$  and  $u = 1$  at  $P_4$ . Determine the coordinates of the curve at  $u = 30\%$  and  $60\%$ . (4)

2A) What is 'z-buffering algorithm'? Explain its steps of implementation. List its advantages and disadvantages. (5)

2B) Deduce the parametric equation of the bicubic plane surface defined by its four control points shown in Fig. (Q2B). The tangent and the twist vectors may be assumed to be derived from the lines joining the given four points.

Also evaluate the coordinates of the points on the surface at  $u = 0.4$  &  $v = 0.3$ .

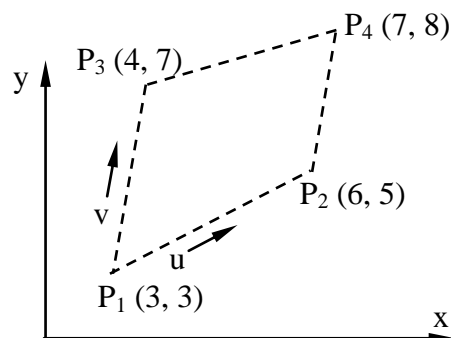


Fig. (Q2B) (5)

3A) Deduce the equations for determining the following mass properties of solid models developed on the Model Coordinate System.

- (i) First moments of inertia      (ii) Second moments of inertia (5)

3B) Compute eight points on the curve  $\frac{(x-3)^2}{81} + \frac{(y-5)^2}{36} = 1$  in the range  $\frac{4\pi}{9} \leq \theta \leq \frac{10\pi}{9}$ . (5)

- 4A) Explain and express the following geometrical entities mathematically:  
 (i) NURBS curve      (ii) B-Spline surface (5)
- 4B) The surface of a cylinder is to be modelled by using two methods: (i) as a tabulated surface, and (ii) as a revolved surface. One generator of the cylindrical surface should have end points coordinates (5, 0) and (5, 10). Develop the parametric equations of the cylindrical surface for both the cases. (5)
- 5A) Explain two methods of reparametrizing curves. (2)
- 5B) List and explain the different types of LAN configurations. (3)
- 5C) A triangle is defined by its vertices (2, 3, 4), (5, 1, 7) and (4, 5, 2). It is rotated about an axis passing through the point (1, 5, 9) counter clockwise by  $100^\circ$ . The direction cosines of the axis are (0.3 0.9 0.3). Compute the coordinates of the vertices of the triangle after rotation. (5)
- 6A) Explain and express the following geometrical entities mathematically:  
 (i) Coon's surface      (ii) Ferguson's patch (5)
- 6B) Rasterize an ellipse with major axis = 12 units and minor axis = 10 units centered at (2, 5) using the mid-point ellipse algorithm only in the region where the magnitude of the slope is less than unity. (5)

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