BITS PILANI, DUBAI CAMPUS
Dubai International Academic City
Second Semester 2011-2012

III Year Mechanical | Comprehensive Examination | ME C382 Computer aided design
Time: 180 min. | Date: 07.06.2012 | Marks: 70 | Weightage: 35%

#	**Answer all questions** **Assume suitable data, if required**	**Marks**
1	Explain the priority algorithm related to hidden surfaces with an example	4
2	Describe the boundary representation data structure with an example	4
3	Differentiate hierarchy data base and network data base using an example	4
4	List the different assembly analysis activities	4
5	List the important properties of a Bezier curve	4
6	Consider a triangle with the following vertices: (1,2,4),(4,3,4) and (3,6,4). The triangle is projected from a distance of 8 units along Z axis. Determine the position of the triangle on the viewing plane.	5
7	A straight line having vertices (1,2,2) and (1,2,5) is rotated about the Z axis to trace a surface. Determine the position of a point on the surface at 40% of its length after 45°ccw rotation.	5
8	A bezier curve has the following control points. (1,2), (3,5),(7,3) and (9,7). Determine the equation for the curve and slope of the curve at t=0.5.	5
9	Find the arc length of a curve defined by $x = 4 \sin t$ and $y = 4 \cos t - 4$ in the interval of 0 to 2Π.	5
10	Consider a triangle with vertices as follows: (1,2),(2,5) and (4,3). Determine the position of the triangle if it is rotated 45°ccw about Z axis about its centroid.	10
11	Consider one quarter of a circle is defined by the knot vector, (0, 0, 0,1,1,1). Two such arcs are joined to form a semi circle and two semi circles are then joined to form a full circle. Determine the knot vectors for the two stages.	10
12	Consider a hermite cubic spline curve with end points as (1,2) and (8,9) with a slope of 30° on both the ends. Determine the expressions for the blending functions and construct them with at least 3 points (t= 0, 0.5, 1.0).	10

Formula Sheet

Coons Patch:

$$P(u,v) = [(1-v) \quad u \quad v \quad (1-u)] \begin{pmatrix} P(u,0) \\ P(1,v) \\ P(u,1) \\ P(0,v) \end{pmatrix}$$ Eqns. of the boundary curves

$$-[(1-u)(1-v) \quad u(1-v) \quad (1-u)v \quad uv] \begin{pmatrix} P(0,0) \\ P(1,0) \\ P(0,1) \\ P(1,1) \end{pmatrix}$$ End-points (coordinates)

Revolved surface:

$$P(t, \theta) = [x(t)\cos\theta \quad x(t)\sin\theta \quad z(t)]$$

Bezier curve:

$$P(t) = [t^3 \quad t^2 \quad t \quad 1] \begin{pmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 3 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix} \begin{pmatrix} V_0 \\ V_1 \\ V_2 \\ V_3 \end{pmatrix}$$

HCS curve:

$$P(t) = [t^3 \quad t^2 \quad t \quad 1] \begin{pmatrix} 2 & -2 & 1 & 1 \\ -3 & 3 & -2 & -1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix} \begin{pmatrix} P(0) \\ P(1) \\ P'(0) \\ P'(1) \end{pmatrix}$$

Parabola:

$$x = x_v + Au^2$$
$$y = y_v + 2Au$$
$$z = z_v$$

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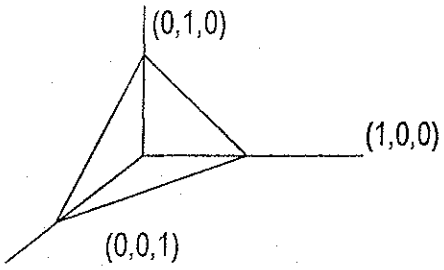
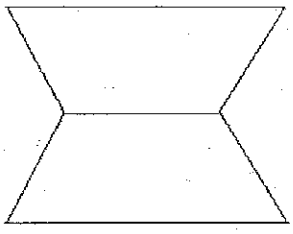
III Year Mechanical | **Test 2 Open book**
ME C382 Computer aided design | **Date: 26-04-2012**
Time: 50 min. | **Weightage: 15%** | **Marks: 30**

#	**Answer all questions** **Assume suitable data, if required**	**Marks**
1	With an example point (2,3), show that reflection through the line y=-x is equivalent to reflection relative to y axis followed by counter clockwise rotation by 90°	6
2	Magnify the triangle with vertices A (0, 0), B (1, 1), C (5, 2) to twice its size while keeping C (5,2) fixed.	6
3	With an example point (4,5), prove that simultaneous shearing in both directions (x & y directions) is not equal to composition of shear along x axis followed by shear in y axis. Take shear along x axis as 2 units and shear along y axis as 3 units.	6
4	Project the following pyramid for orthographic projection and determine elevation, top view and right view positions. Draw rough sketches for the views.  	6
5	 Construct the network database structure for the above figure.	6

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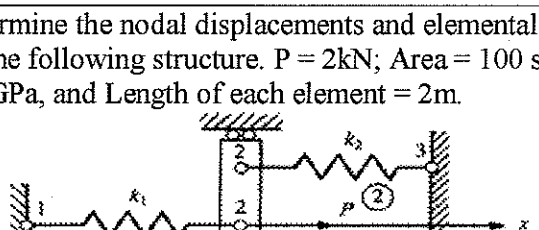
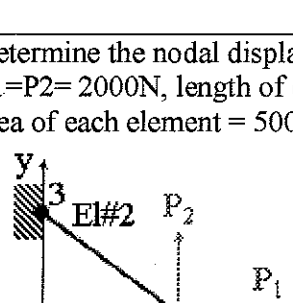
III Year Mechanical
ME C382 Computer aided design
Time: 50 min.

Test 1
Date: 11-03-2012
Weightage: 15%
Marks: 30

#	**Answer all questions** **Assume suitable data, if required**	**Marks**
1	Explain the implementation of CAD with a flow diagram State the potential energy expression for stress analysis of a 1D structure.	6
2	Determine the nodal displacements and elemental displacements for the following structure. P = 2kN; Area = 100 sq.mm, E = 200GPa, and Length of each element = 2m.  	12
3	Determine the nodal displacements for the following structure. P1=P2= 2000N, length of elements 1&2 = 2m each, E = 200GPa, area of each element = 500 sq.mm.  	12

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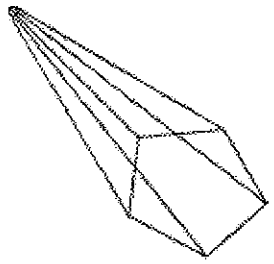
III Year Mechanical
ME C382 Computer aided design — Quiz 2
Date: 22-05-2012 — Weightage: 5%
Time: 20 min. — Marks: 10

Name: **ID No.:**

1. Check the validity of the solid model shown below.



[3]

2. Consider a cube with position matrix (0,0,0),(30,0,0),(0,30,0),(30,30,0), (0,30,30), (30,30,30), (0,0,30) and (30,0,30). A cylinder with centre of its base coinciding (0,0,0) and having a height of 50 units should be placed
   (i) in front face of the cube
   (ii) on top face of the cube.

   The cylinder's base should lie at the centre of the respective faces of the cube. Determine the transformation matrices for the operations. [3]

3. Compare bottom up and top down assembly designs. [2]
4. Mention the disadvantages of CSG modeling [2]

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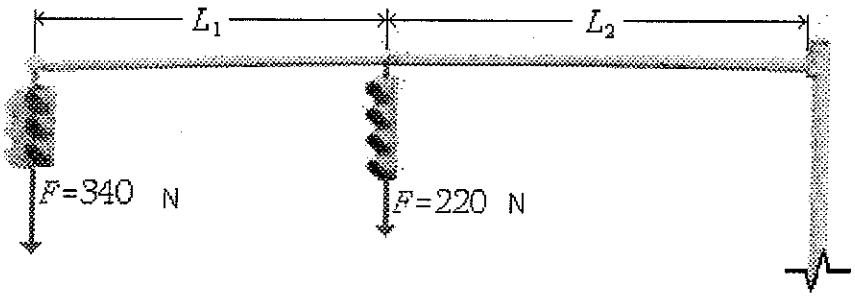
III Year Mechanical
ME C382 Computer aided design
Date: 03-04-2012
Time: 20 min.

Quiz 1 B
Weightage: 5%
Marks: 10

Name: **ID No.:**

1. Determine the nodal displacements for the problem given below.



L1= L2= 250cm. Radius of the cylindrical solid rod = 4cm. E=200GPa. [8 Marks]

2. State the expression for fluid resistance and stiffness matrix formulation for 1D element used in fluid flow network. [2 Marks]