BITS, PILANI-DUBAI, INTERNATIONAL ACADEMIC CITY, DUBAI
SECOND SEMESTER 2007-2008
Comprehensive Examination

Course Name: Computer Aided Design
Course No. : ME UC382
Duration   : 3 Hr

Max Marks: 70
Weightage: 35%
Date: 22-05-08

NOTE:
 i) Write your ID Number on the top immediately on the receipt of this paper.
 ii) **_Maintain the order_** while answering the questions.
 iii) Required values, tables & charts are given in the paper.
 iv) If any data is missing, assume the suitable value with proper justification.

Q.1   **(Marks: 4+4)**
(a) Describe the chronological development in CAD/CAM.
(b) Highlight the applications of CAD in Mechanical Engineering.

Q.2   **(Marks: 4+4)**
(a) What is meant by synthetic curves? Enlist at least three such curve & discuss their significance in engineering applications?
(b) Four points $P_0(a, b)$ $P_1(20,50)$ $P_2(40,40)$ & $P_3(70,c)$ are available for drawing a *B-spline curve* segment. Compute the values of a, b, c such that the curve starts from the point (21,43) & terminates with slope (-1/2).

Q.3   **(Marks: 4+4)**
(a) Consider a paraboliacally blended curve defined by the points $P_1[\,0\ 1\ 0\,]$ $P_2[\,2\ 3\ 0\,]$ $P_3[\,4\ 1\ 0\,]$ & $P_4[\,5\ 2\ 0\,]$. Rotate the curve about x-axis through 360° to obtain the *surface of revolution*. Calculate the point on surface at u = 0.5 & ø= π/3. Also give some is the applications of resulting surface.
(b) Sketch the *Constructive Solid Geometry* tree for the solid S1 shown in above figure-1 & then:
   (i) Check the prefect ness of tree.
   (ii) Calculate the interior nodes.
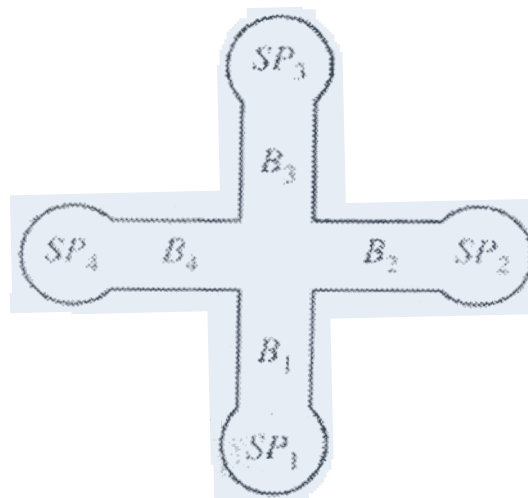
Solid S_1
Figure-1

Q.4
(Marks: 4+4)
(a) What is *assembly* tree? Sketch it for the electric clutch assembly shown in figure-2.
(b) Compare the *shape based* & *product data based exchange* standards. Which has the potential to support industrial automation? Why?
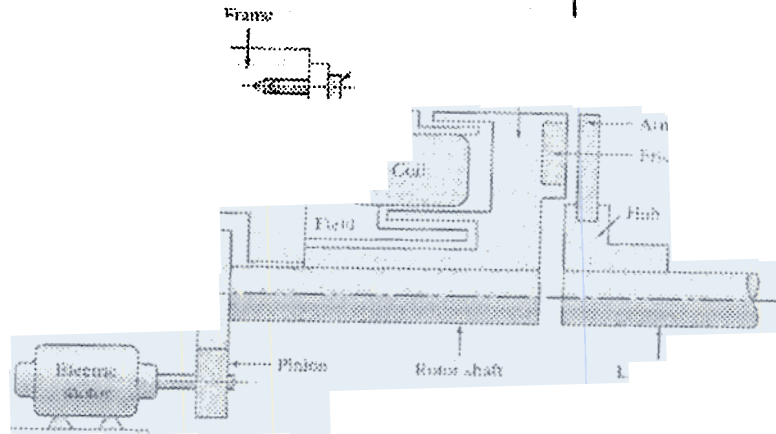

Figure-2

Q.5
(Marks: 4+4)
(a) The *reflection* along the line y=x is equivalent to the reflection along x-axis followed by counter clockwise rotation of θ degree. Find the value of θ.
(b) The pyramid defined by coordinates A (0,0,0),B (2,0,0),C(0,2,0) & D (0,0,2) is rotated by 60° about a line that has the direction V=J+K and passing through point C (0,2,0).Find the coordinate of rotated figure–3.
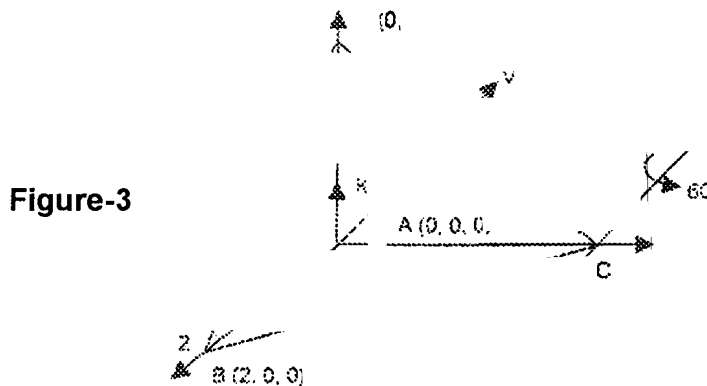

Figure-3

Q.6
(Marks: 4+4)
(a) Explain the techniques of Hidden Line & hidden Surface Removal w.r.t *visual realism* also enlist at least two algorithms for each.
(b) What are the *colour models*? Describe the RGB colour model giving the colour cube with coordinates.

Q.7
(Marks: 4+4)
(a) A journal of nominal diameter 79 mm rotates in a bearing. The upper & lower deviations in hole diameter are respectively +0.05 mm & 0.00 mm, while those for the shaft are respectively -0.03mm & -0.07 mm. Calculate
i) Extreme diameters of the shaft & hole.
ii) Tolerance for hole & shaft.
iii) Indicate the unilateral/Bilateral tolerances.
iv) Maximum & minimum clearance.

(b) Calculate any three *mass properties* for the object shown in figure--4. with following specifications:

    Width of object = 2 "
    Height of object = 3"
    Corner Radius = 0.5"
    Two cylindrical holes of diameter = 0.5"

Select your own material for the object.
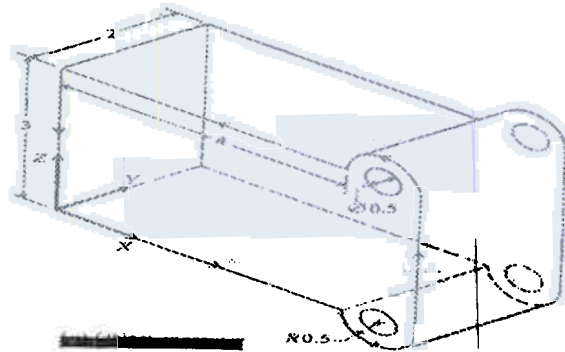

Figure-4

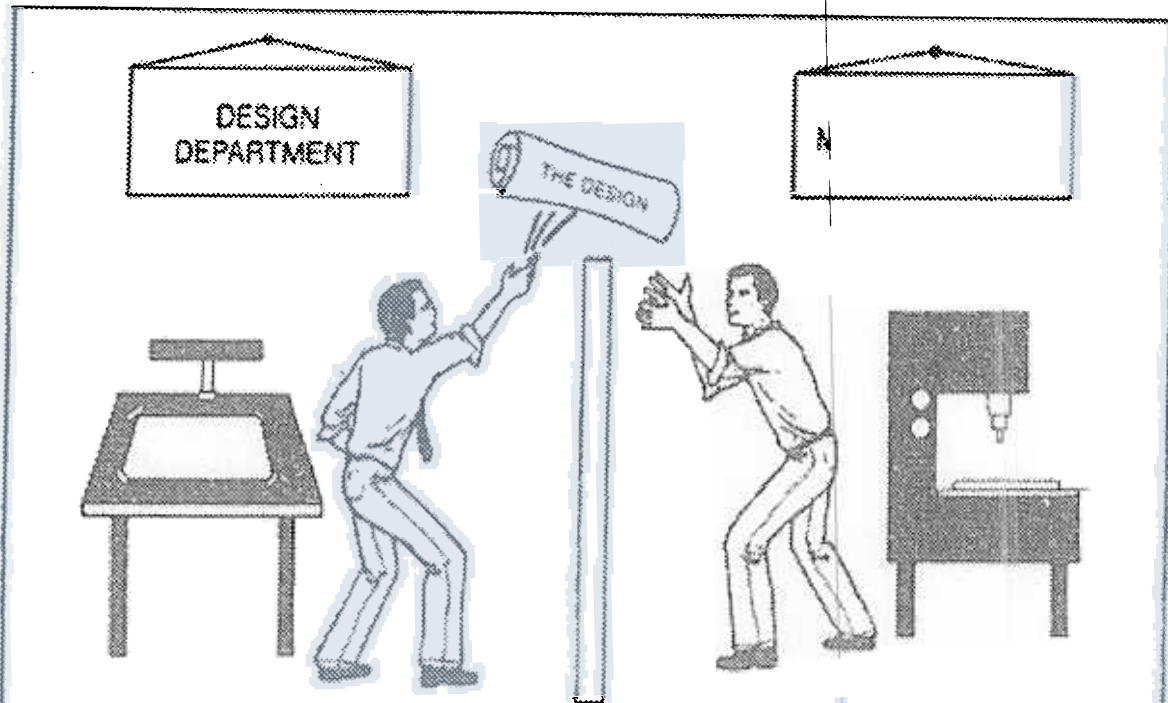## Q.8
(Marks: 4+4)

(a)   Describe the general procedure for the *Finite Element Method*.

(b)   Derive the functional Π for any 2-D continuum problem & design a *triangular cubic element* for the same.

Q.9
(Marks: 3+3)

(a)   Draw a model of *CAD/CAM Integration* showing the common data base.

(b)   Comment on the following Diagrams.

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BITS, PILANI-DUBAI, INTERNATIONAL ACADEMIC CITY, DUBAI
SECOND SEMESTER 2007-2008

TEST-2 (Open Book)

Course Name: Computer Aided Design
Course No. : ME UC382
Duration : 50 Minutes

Max Marks: 30
Weightage: 15%
Date: 13-04-2008

NOTE: i) Write your ID Number on the top immediately on the receipt of this paper.
ii) Maintain the order while answering the questions.
iii) Required values, tables & charts are given in the paper.
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Q.1 A geometric curve defined by n+1 control points P_i is given by following equation:

$$P(u) = \sum_{i=0}^{n} P_i N_{i,k}(u)$$

Where the parameter u ranges between $0 \le u < U_{max}$ & the other symbols have their usual meaning as per text book. Name this curve & amend the above equation if this curve passes through four control points $[2\ 2\ 0]^T$ $[2\ 3\ 0]^T$ $[3\ 3\ 0]^T$ $[3\ 2\ 0]^T$.
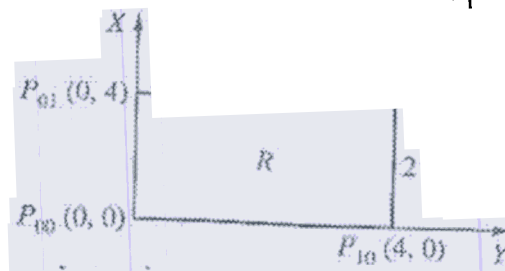
(Marks:2+8)

A line segment with end points $P_1[1\ 1\ 0]$ & $P_2[6\ 2\ 0]$ lying in XY plane, Rotating this line about X –axis yields a conical surface. Determine the point on this surface at U = 0.5, Φ= 60°.   ***(Marks:4)***
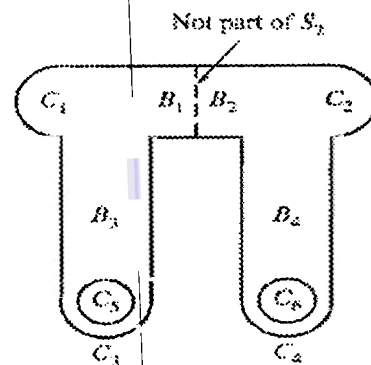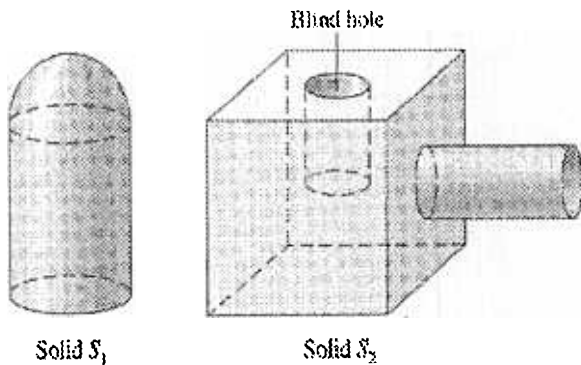
Find the equation of Bezier surface to cover the region R. Also find the surface vector & its mid point.   ***(Marks:4)***

Q.4   Verify the validity of the following solids S1 & S2 using Euler equation.   ***(Marks:3+3)***

Solid S_1 Solid S_2 Solid S3

Q.5   Sketch the CSG tree for the solid S3 shown in above figure.   ***(Marks: 3)***

Q.6   Differentiate between B-rep & C-rep methods of solid modeling.   ***(Marks: 3)***

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SECOND SEMESTER 2007-2008

TEST-1 (Closed Book)

Course Name: Computer Aided Design
Course No.   : ME UC382
Duration   : 50 Minutes

Max Marks: 30
Weightage: 15%
Date: 02-03-2008

NOTE:
i) Write your ID Number on the top immediately on the receipt of this paper.
ii) Maintain the order while answering the questions.
iii) Required values, tables & charts are given in the paper.
iv) If any data is missing, assume the suitable value with proper justification.
v) Attempt all the questions.

Q.1 How computer aided design differs from conventional design? List the benefits & application of CAD.
(Marks:2+2)

Q.2 Draw the product cycle giving the different steps of design & manufacturing along with CAD/CAM tools.
(Marks:2+2)

Q.3 What do you understand by Micro Computer based CAD? List the Hardware & software required for running the CATIA V5 R17 at your Desktop.
(Marks:2+2)

Q.4 Differentiate between the following:
i) RAM & ROM.?
ii) Mouse & track ball.
(Marks:2+2)

Q.5 Explain the parametric & non parametric representation of curves with suitable example.
(Marks:2+2)

Q.6 For the Position vectors $P_1[1\ 2]$ & $P_2[4\ 3]$, determine the parametric representation of line segments between them. Also determine the slope & tangent vector of the line segments.
(Marks:2+2)

Q.7 Explain C^0, C^1 and C^2 continuity of synthetic curves.
(Marks:1+1+1)

Q.8 Fit a Bezier curve having the following control points: $P_0(1,1)$ $P_1(3,6)$ $P_2(5,7)$ & $P_3(7,4)$. Find out points at u= 0.4 & 0.6.
(Marks:2+1)