MECHANICAL ENGINEERING 4th YEAR EXAMINATION, 2017

(1st Semester Supplementary)

Elective II – Computer Aided Design

Time: Three hours Full Marks: 100

Answer any five questions

(Parts of a question are to be answered serially in single attempt)

1a) The requirements of two materials (A and B) in one unit of the products (1 and 2) are shown in the table below. The total availability of the materials and the profit per unit of the products are shown in the table. Determine the required product mix to maximize the profit by simplex method.

b) Make graphical representation of the product mix at the different stages of the solution.

c) Identify slack variables in the solution algorithm and state their significance.

material	product 1	product 2	availability
A (in kg)	10	3	100
B (in kg)	4	12	150
Profit/unit (Rs.)	5/=	8/=	

12+3+5

2a) Derive the global stiffness matrix of the rod element, as shown in figure Q2(a).

b) Find the global stiffness matrix for the pin-jointed truss shown in figure Q2(b) and determine displacement of point 2 if the bars are made of same material, have identical cross-section and load P is 250 N.

10+10

3 a1) Explain "computer graphics" and indicate it's application areas citing appropriate examples.

a2) Describe the sub-sytems of the graphics pipeline.

a3) Write the full forms of: BPP, VGA, RBG and PIXEL.

b1) What is meant by homogeneous coordinate?

b2) Write the transformation matrix in homogeneous coordinates for:

i) Translation, ii) Rotation and iii) X-shear.

b3) A line PQ is to be rotated about its mid-point through angle ϑ in clockwise direction. Obtain the concatenated matrix for the transformation and also provide the new coordinates of PQ.

(4+4+2) + (3+3+4)

4 a) State the importance of curve and surface modeling in computer graphics.

b) Describe the parametric representation of a curve and in this connection explain knot vector.

c) Using the appropriate boundary conditions, obtain Hermite polynomial basis function for a natural cubic spline curve.

d) Make graphical representation of the Hermite polynomial basis functions and state their physical significance.

(4+4+8+4)

5a) How a surface is modeled by polygon meshes?

b) Discuss about the geometric data tables and consistency checking conditions.

c) Classify different projection methods and describe them.

d) State the generalized 3D transformation matrix for single point perspective projection.

(4+6)+(5+5)

6) Write short notes (any four):

i) Theorem of stationery potential energy

ii) Bézier curves

iii) Character generation technique

iv) Techniques for anti-aliasing

v) Abstract data type

4 x 5

-- X --

Figure Q2(a)

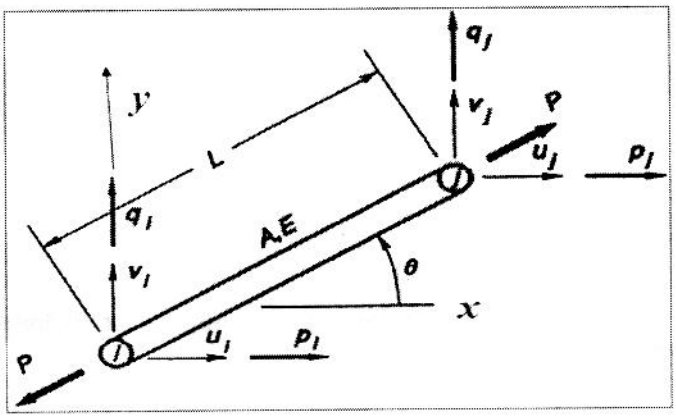

Figure Q2(b)