GUJARAT TECHNOLOGICAL UNIVERSITY
BE- VIIIth SEMESTER–EXAMINATION – MAY- 2012

Subject code: 180205   **Date: 08/05/2012**
Subject Name: Automotive CAD
**Time: 10:30 am – 01:00 pm**   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain in detail the various capabilities, limitation and application of any one 3-D CAD package software and also write steps for building up a computerized geometric solid model of a Hexagonal nut of M8. **07**

(b) Prepare an algorithm and 'C' program for computer aided design of a helical coil spring for a machine subjected to a load of W. Select suitable material and factor of safety. Calculate the diameter of wire and number of turns in the program such that deflection should not exceed δ_{max}. **07**

Q.2 **(a)** Describe the role of CAD in automobile engineering and benefits of CAD . **04**

(b) Explain the post processor and pre processor in the finite element analysis. **04**

(c) Apply Gauss elimination method to solve the equation:
x-3y+4z=2 , 2x +3y + z = 3;   - x +2y +3z = 5; **06**

OR

(c) Develop a 'C' program to implement the newton raphson method to find the root of equation $x^3 - 4x- 9 = 0$. **06**

Q.3 **(a)** With the help of sketches, explain various types of elements used in finite element analysis and their applications. **04**

(b) Consider the bar in Figure 1.Determine the nodal displacements, element stresses, and support reactions using penalty approach. **10**
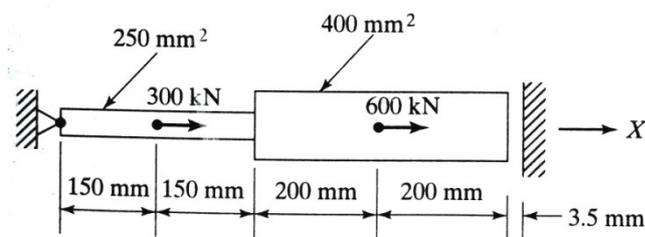
$E = 200 \times 10^9 \text{ N/m}^2$

Figure 1.

Q.3 **(a)** Explain types of mesh generation in finite element analysis **04**

(b) An axial load $P=300 \times 10^3$ N is applied at 20^0C to the road as shown in figure 2. The temperature is then raised to 60^0C Determine the nodal displacement and element stresses. **10**
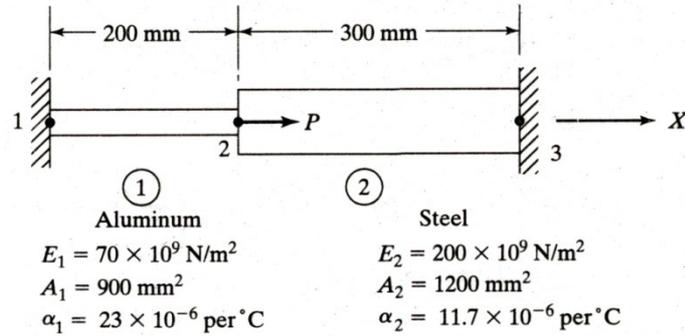

Aluminum

$E_1 = 70 \times 10^9$ N/m^2
$A_1 = 900$ mm^2
$\alpha_1 = 23 \times 10^{-6}$ per °C

Steel

$E_2 = 200 \times 10^9$ N/m^2
$A_2 = 1200$ mm^2
$\alpha_2 = 11.7 \times 10^{-6}$ per °C

Figure 2.

Q.4 **(a)** Draw the flow chart and write a 'C' program for generation of line whose slope is more than 45^0 using Bresenham's algorithm. **07**

(b) Consider a triangle ABC having co-ordinates A(5 5) B (8 5) and C (5,12). Determine the new vertex position if it is mirrored about a line X= 0.5Y - 2 **07**

Q.4 **(a)** Prove that three dimensional rotations are non commutative when more than one rotation is to be made. **05**

(b) Reflect the diamond shaped polygon whose vertices are A (-1, 0), B (0 -2), C (1 ,0) and D (0,2) about line x=2. **05**

(c) What is geometric modeling? Explain wire frame model stating its advantages and disadvantages **04**

Q.5 **(a)** What is optimization? Describe procedure for formulation of optimization problems. **07**

(b) Prepare an algorithm and C-program to design a clutch for a vehicle transmitting power P with speed n rpm of the prime mover. Calculate the axial force required for engagement of clutch **07**

Q.5 **(a)** Prepare a C-program to design an internal expanding shoe brake to stop a vehicle weighing W kg to be stopped within 't' seconds by distance of 's'. Calculate the width of shoe by selecting suitable material. **07**

(b) Explain in detail the raster scan and vector scan techniques of displaying graphics. **04**

(c) What is homogeneous co ordinate system ? Explain its importance in CAD. **03**

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