(4 Hours) [Total Marks : 100

MASTER

N.B. (1) Question Nos. **1** and **6** are **compulsory**.
(2) Attempt any **two** from the remaining in **each** section.
(3) Answers to the **two** sections must be written in **separate** answer-books.
(4) Assume **suitable** data if **necessary**.

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19/5/07.

Section I

1. (a) Write geometric transformation to magnity a triangle about a point R and find the mirror image about line having Y intercept as 8 . The slope of the line is 1·5. The coordinates of the triangle are P(10, 12), Q(14, 13), R(12, 16). **10**

   (b) A pyramid defined by ABCD, A(0, 0, 0), B(1, 0, 0), C(0, 1, 0), D(0, 0, 1) is rotated in 45° about a line 'L' which has direction along $\bar{V} = \bar{j} + \bar{k}$ and passing through point 'P' having coordinates (0, 1, 0). Find the coordinates of rotated pyramid. **8**

2. (a) Explain Cohen Sutherland algorithm. **8**

   (b) Write Sutherland-Hodgman Algorithm for polygon clipping and explain the same with the help of a rectangular clipping polygon and a polygon to be clipped having atleast 8 sides. Show the vertex output list after clipping each edge of the polygon to be clipped in turn against each edge of the clipping polygon. **8**

3. Develop a class for two dimensional using C++. The class should incorporate member functions for translation, rotation, mirror image and scaling in addition to functions for matrix multiplication, data input and display. Write appropriate comment statements. **16**

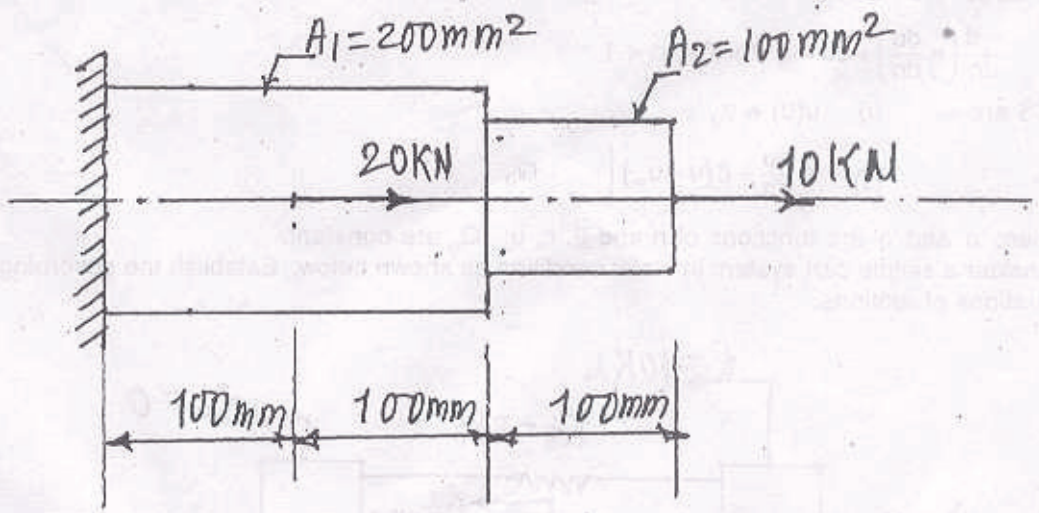
4. (a) With the help of suitable job explain part programming. Using G-codes and M-codes. **8**

   (b) Derive parametric equations for line, circle, ellipse and parabola. **8**

5. Write short notes on following (any **four**) :— **16**
   (a) Advantages and disadvantages of CNC machines
   (b) Concurrent engineering
   (c) Role of Solid Modeling in CAD
   (d) Elements of APT language
   (e) FMS.

Section II

6. (a) Analyse the bar using one dimensional element and compare the result with those calculated theoritically wherever possible. Assume E = 200 GPa. **10**



   (b) Find the value of M_{12} where **8**

$$M_{ij} = \int_0^{h_e} x^2 \phi_i \phi_j \qquad \phi_1 = 1 - \frac{\bar{x}}{h_e}$$

$$\phi_2 = 1 - \frac{\bar{x}}{h_e}$$

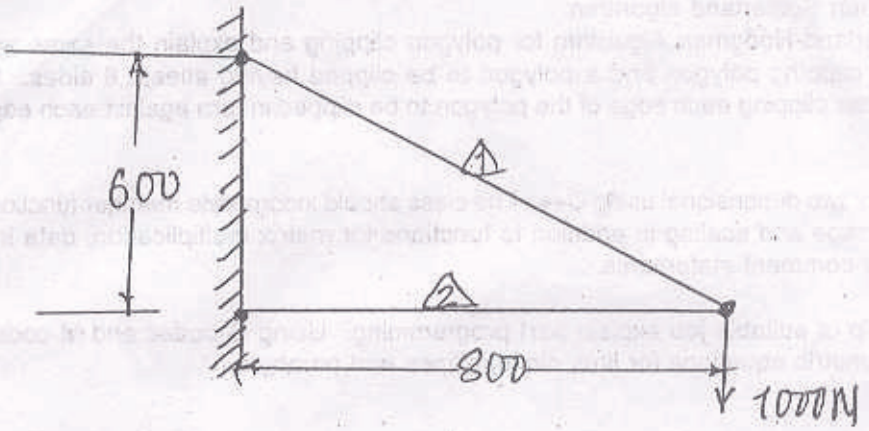
1	1				
2	1/2	1/2			
3	1/6	4/6	1/6		
4	1/8	3/8	3/8	1/8	
5	7/90	32/90	12/90	32/90	7/90

7. (a) Write the advantages of weak form. 4

(b) Analyse the truss shown in **figure** for axial forces using FE method. Also find out unknown displacements. 12

$E = 2 \times 10^5$ MPa

Element	Area	Length
1	50 mm^2	1000 mm
2	40 mm^2	800 mm



8. Solve the following Differential Equation :

$y'' - 64y + 10 = 0$

Given : $y(0) = 0$

$y(1) = 0$

Find : $u(0{\cdot}25)$, $y(0{\cdot}5)$ and $y(0{\cdot}75)$; $0 \le x \le 1$ using —

(a) Finite Difference Method 6

(b) Galerkin or Subdomain Method. 7

9. (a) Construct the weak form of the following one dimensional heat conduction/convection :—

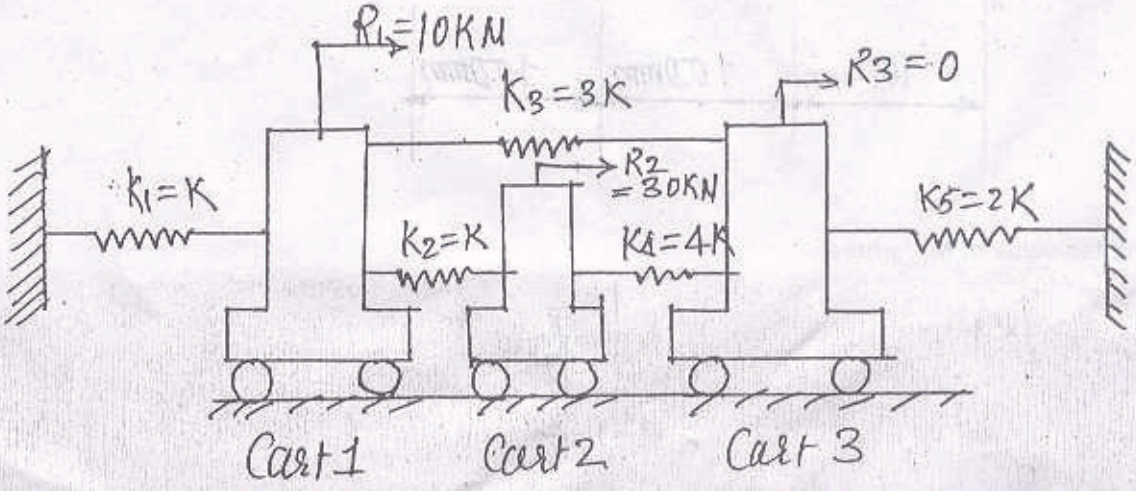
$$\frac{-d}{dn}\left(a\frac{du}{dn}\right) + cu = q \quad \text{for } 0 < n < 1$$

BCS are — (i) $u(0) = u_0$

(ii) $$a\frac{du}{dn} + \beta(u - u_\infty)\Big|_{n=7} = Q_0$$

Where 'a' and 'q' are functions of n and β, c, u_∞, Q_0 are constant.

(b) Consider a simple cart system in static condition as shown below. Establish the governing differential equations of motions. 8



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10. A steel fin of diameter 2 cm, length 10 cm and thermal conductivity 80 W/m°K is exposed to ambient air at 40°C with a heat transfer coefficient 100 W/m² °K. One end of the fin is maintained at a temperature of 540°C and the other end is insulated. Governing DE is 16

$$\frac{d^2\theta}{dx^2} - m^2\theta = 0 \quad \theta = T_x - T_\infty$$

where $m^2 = \frac{Ph}{KA}$ and $\Omega \equiv 0 \leq x \leq l$.

P = Perimeter; A – C. S. area
h = Heat Transfer Coefficient
K = Thermal Conductivity
T_∞ = Ambient Temperature
T_x = Local Temperature of fin.
