

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech(ECE)/SEM-5/EC-513/2009-10****2009****CONTROL SYSTEMS**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.**Semi log paper and Graph Sheet/(s) will be provided by the institution***GROUP - A****( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any ten of the following :

$$10 \times 1 = 10$$

- i) A system having transfer function  $G(s) = \frac{1}{2(s + 0.5)}$  is subjected to a unit step input, the steady value of the output is

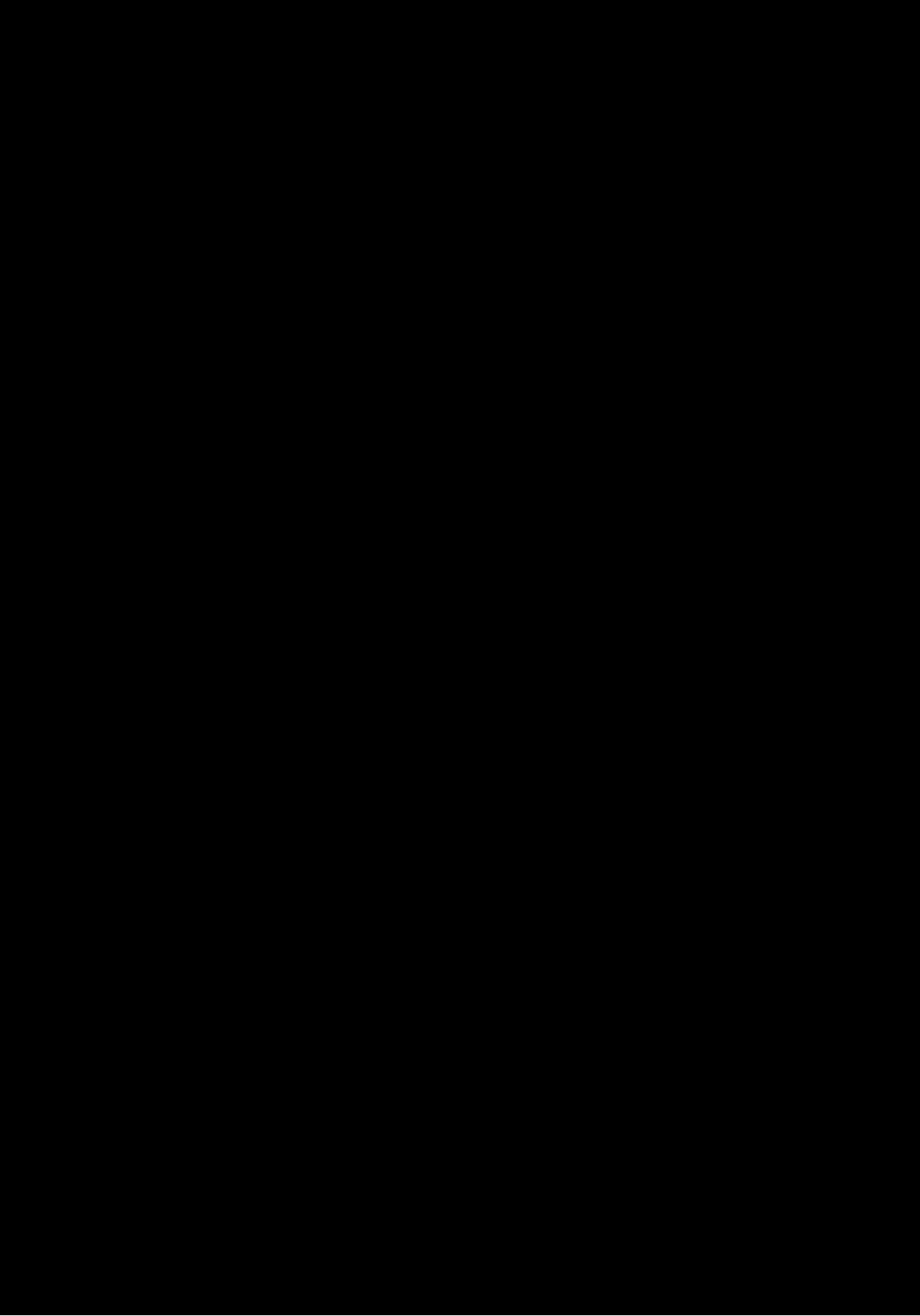
- a) 1                                      b) 2  
c)  $\frac{1}{2}$                                       d)  $\frac{1}{10}$

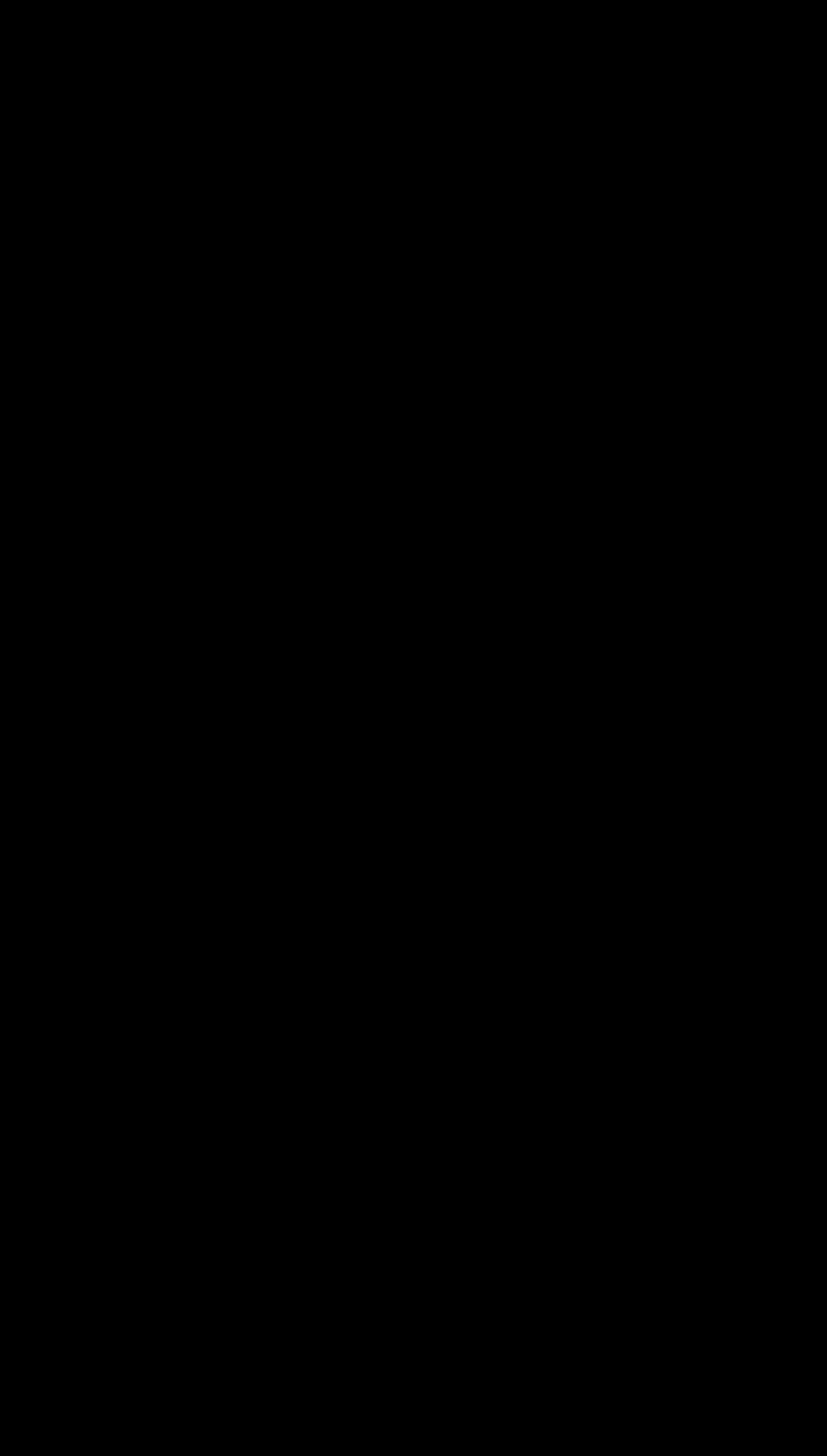
- ii) The natural frequency of oscillations of the output for the equation  $\frac{d^2x}{dt^2} + 1.5 \frac{dx}{dt} + 4x = 1$  is

- a) 0 rad/sec                              b) 1.5 rad/sec  
c) 2 rad/sec                              d) 4 rad/sec.

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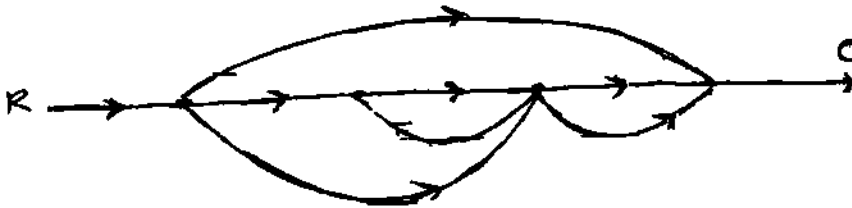
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CS/B.Tech(ECE)/SEM-5/EC-513/2009-10

- xi) State variable approach converts an  $n$ th order system into
- $n$  2nd order differential equations
  - 2 differential equations
  - $n$  1st order differential equations
  - a low order system.
- xii) The number of forward paths in the signal flow graph shown below is



- |      |       |
|------|-------|
| a) 1 | b) 2  |
| c) 3 | d) 5. |

**GROUP - B****( Short Answer Type Questions )**Answer any *three* of the following.  $3 \times 5 = 15$ 

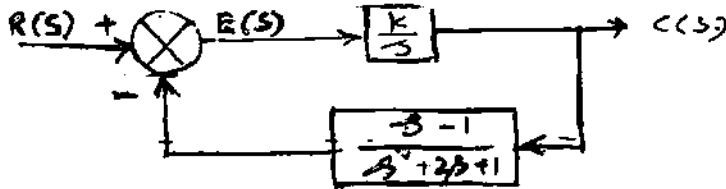
2. A unity feedback heat treatment system has open loop transfer function

$$G(s) = \frac{10000}{(1+s)(1+0.5s)(1+0.02s)}$$

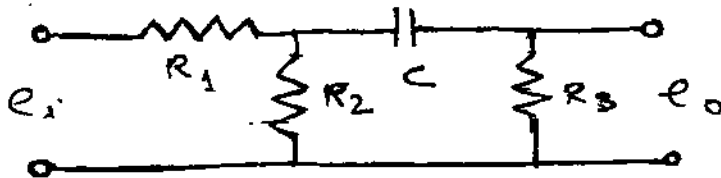
The output set point is 500°C. What is the steady state temperature ?

CS/B.Tech(ECE)/SEM-5/EC-513/2009-10

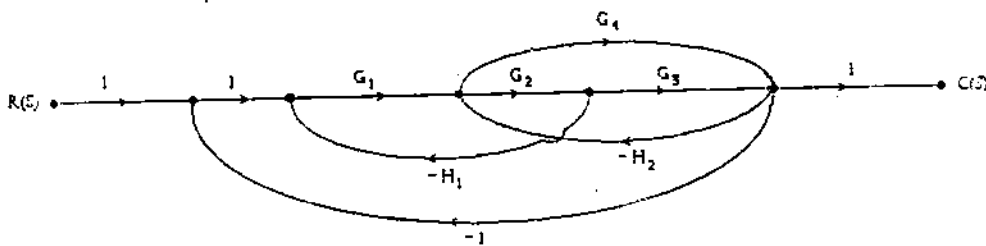
3. Find the range of  $k$  to keep the system shown in figure to be stable.



4. Determine the transfer function of the network shown in figure relating  $E_o(s)$  &  $E_i(s)$

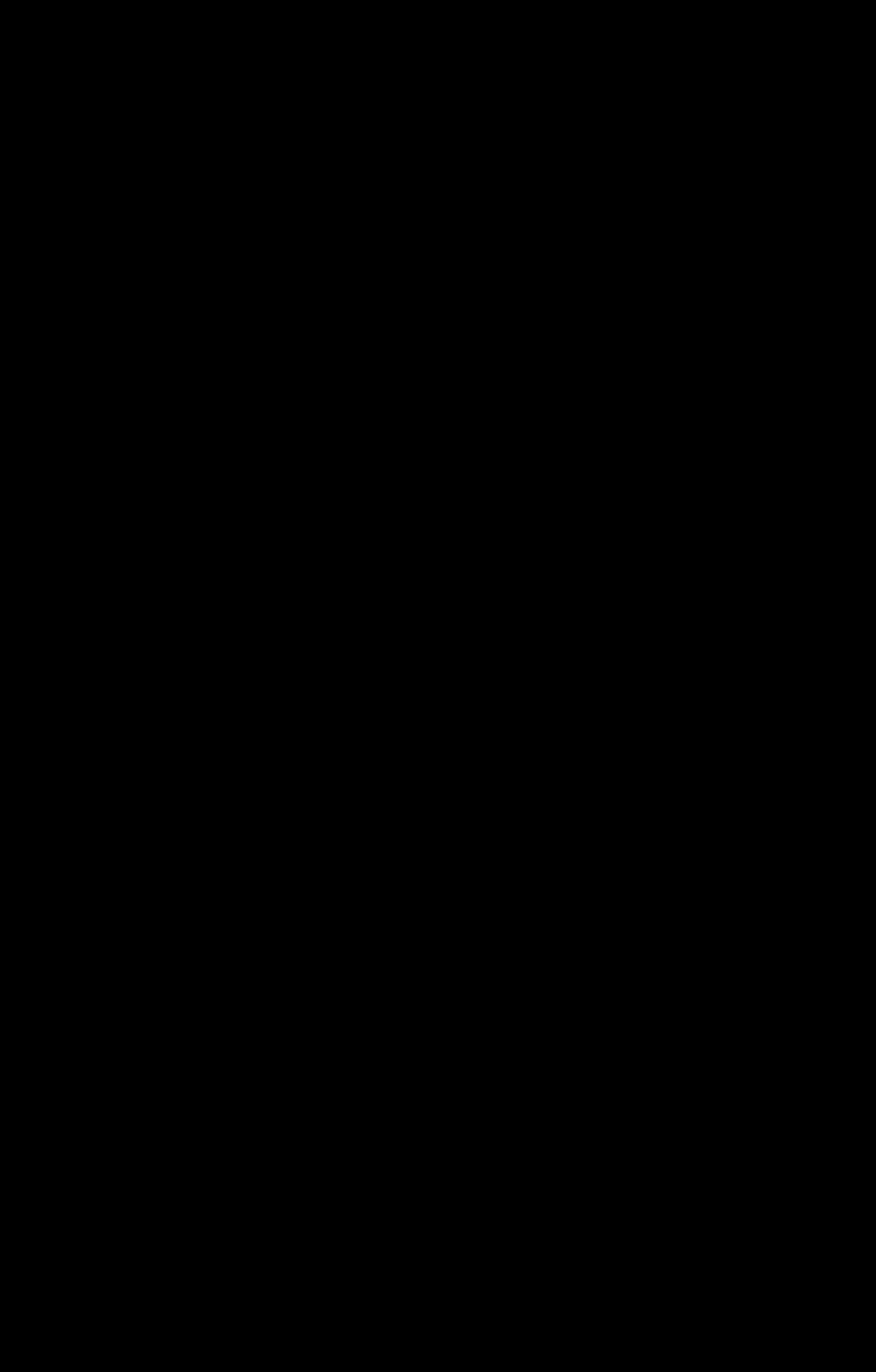


5. Find the transfer function from the following signal flow graph using Mason's gain formula.



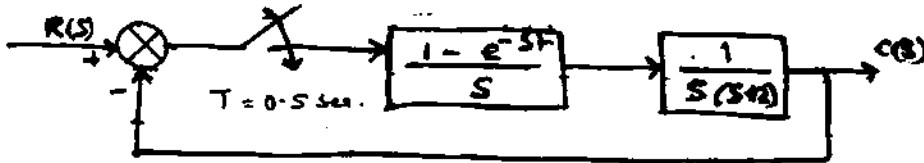
6. Construct the state model for a system characterized by the differential equation

$$\ddot{y} + 5\dot{y} + 6y = 4.$$



CS/B.Tech(ECE)/SEM-5/EC-513/2009-10

10. a) Find Z transform of  $\cos wt$ .
- b) Obtain Z transfer function for the block diagram shown in the figure.



5 + 10

11. a) Explain with an example the steps to find the phase trajectory of a second order system using method of isoclines.
- b) Write a note on PID controller.

10 + 5