

C U SHAH UNIVERSITY
Faculty of Technology and Engineering
B. Tech- SEMESTER-IV June-2015

Subject Code: 4TE04CSE1**Subject Name: Control System Engineering (CSE)****Time:****Total Marks: 70****Instructions:**

1. Make suitable assumptions whenever necessary.
2. Figures to the right indicate full marks.
3. Question one is compulsory.

SECTION 1

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|------------|--|-----------|
| Q-1 | a) Define Stability. | 2 |
| | b) Define Damping factor & Damping ratio. | 2 |
| | c) Explain time varying –time invariant system in control system. | 2 |
| | d) Define nonlinear system. | 1 |
| Q-2 | | 14 |
| | a) State advantages of signal flow graph over block diagram method. | 5 |
| | b) Explain Gain margin & Phase margin. | 5 |
| | c) By means of Routh criterion, determine the stability of the system described by characteristic equation below | 4 |
| | $s^4 + 2s^3 + 8s^2 + 4s + 3 = 0$ | |

OR

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|------------|--|-----------|
| Q-2 | a) Find the number of roots lying in the left half of the s-plane for the characteristic equation. | 14 |
| | $S^5 + 2s^4 - 3s^3 + s^2 + 6s + 1 = 0$ | |
| | b) State advantages and disadvantages of Routh's Criterion. | 5 |
| | c) List out the rules for the construction of root loci. | 4 |
| Q-3 | | 14 |
| | a) Explain Typical Test Signals in control system. | 5 |
| | b) For a unity feedback control system having the open loop transfer function | 5 |
| | $G(s) = \frac{K}{s(s+1)(s+2)}$. evaluate the break away points. | |
| | c) Explain the terms with below. | 4 |
| | (i) Centroid (ii) Breakaway points (iii) Asymptotes | |

OR

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|------------|---|-----------|
| Q-3 | a) Derive Unit-Ramp Response of First – order system. | 14 |
| | b) Explain velocity error, position error & acceleration error. | 5 |
| | c) What is PID controller? Explain the principle of working. | 4 |

SECTION 2

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|------------|--|-----------|
| Q-4 | a) Explain steady state error. | 2 |
| | b) Differentiate open loop control system & closed loop control system. | 2 |
| | c) Define Peak overshoot & Rising time. | 2 |
| | d) State any two advantages of digital control system over a continuous data control system. | 1 |
| Q-5 | | 14 |
| | a) system response of an system is given below | 5 |
| | $c(t) = 1 + 0.2 e^{-60t} - 1.2 e^{-10t}$ | |

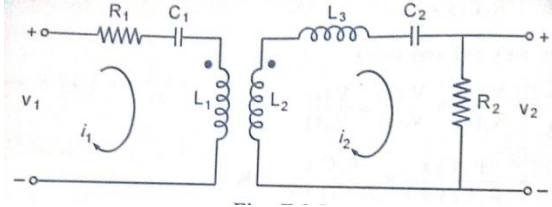
when subjected to unit step input

- (i) Find the expression for closed-loop transfer function,
- (ii) Obtain the undamped natural frequency and damping ratio of the system.

b) Define the terms below:

- (i) Phase cross over frequency
- (ii) Gain cross over frequency

c) Determine the transfer function of the transformer coupled circuit shown in figure below.



OR

Q-5

a) A unity feedback system is characterized by an open loop transfer function

$$G(s) = \frac{K}{s(s+10)}$$

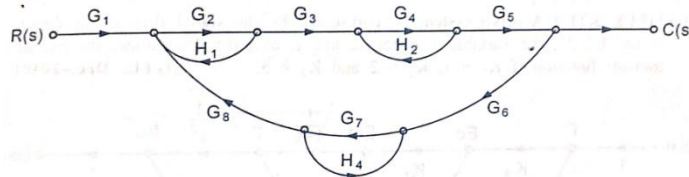
b) State advantages of bode plots.

c) Sketch the bode plot for the transfer function $G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}$.

Q-6

a) Using the block diagram reduction technique find the closed loop transfer function of the system whose block diagram is given below.

b) Find the transfer function for the below figure using signal flow graph.

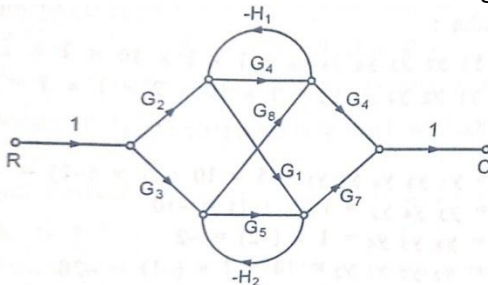


c) Derive the analogous relationship between mechanical and electrical system based on force-voltage analogy.

OR

Q-6

a) Obtain the transfer function from the signal flow graph shown in figure below.



b) For a unity feedback control system shown below, obtain steady state error for step input

$$G(s) = \frac{K}{s^2+14s+50}$$

c) Explain missile launching and guidance closed loop system with necessary block diagram.
