B.E. Seventh Semester (Elect Engg (E & P), Elect and Electro, Elect & Power, Ele. Energy) (CGS)

10457 : Control Systems - II : 7 EE 01 / 7 EP 01 / 7 EL 01

P. Pages : 3 | AU - 2903

Time : Three Hours | Max. Marks : 80

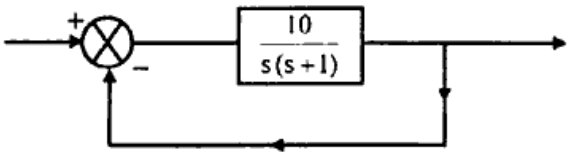
* 0 2 5 2 *

Notes :
1. Answer **three** question from Section A and **three** question from Section B.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answer necessary with the help of neat sketches.
5. All questions carry marks as indicated.
6. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. For the system shown in fig. Design a lead compensator such that the closed loop system will satisfy the following specifications: **13**

i) Static velocity error constant = 20 sec^{-1}.
ii) Phase margin = 50°.
iii) Gain margin $\geq 10\,dB$.



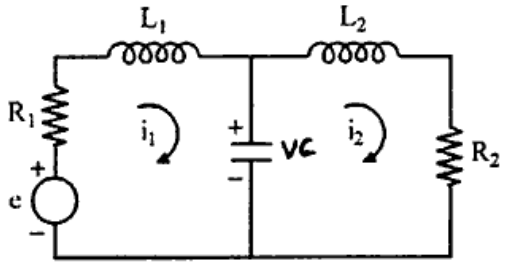
OR

2. a) Explain in detail steps to design Lead Compensator. **7**

b) Draw bode plot and comment on stability for the given system, **6**

$$G(s).H(s) = \frac{100}{s(s+1)(s+5)}.$$

3. a) Obtain the state model of given system using physical variable. **7**

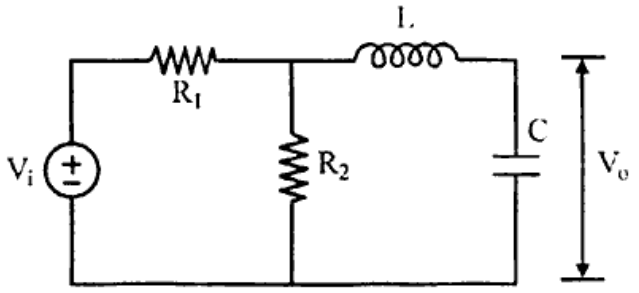


b) Define the terms : **6**

i) State
ii) State variable
iii) State vector
iv) State space

OR

4. a) Obtain the state model of given system using physical variable. 7



b) Derive the derivation for transfer function from state model. 6

5. a) Consider a system describe by $X' = AX + Bu$, obtain feedback matrix, it is desired to have close loop poles at $S = -1 \pm j2, S = -10$ 7

Where, $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix}; B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$.

b) Explain the following terms : 7
i) Controllability of the system.
ii) Observability of the system.

OR

6. a) State and explain Gilbert's and Kalman's test to check controllability and observability of the system. 7

b) A system is described by, 7

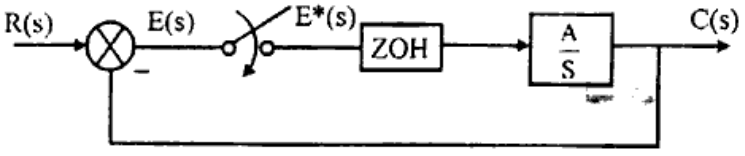
$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}; B = \begin{bmatrix} 0 \\ 0 \\ 6 \end{bmatrix}$.

Find feedback matrix, K, for this system the following specifications are to be met.
$\xi = 0.5, \omega_n = 2\,\text{rad/sec}$.

from the design specification form the equation $s^2 + 2\xi\omega_n s + \omega_n^2$ obtain its closed loop poles. Consider third closed loop pole at $s = -10\omega_n$.

SECTION – B

7. a) Determine Pulse transfer function for the system shown in fig. 7
Assume T = 1 sec.

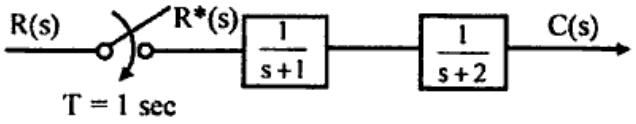


b) Find the stability of the system by Jury's test. **7**

$f(z) = z^4 - 1.7z^3 + 1.04z^2 - 0.268z + 0.02.$

OR

8. a) Determine pulse transfer function of the system shown in figure. **7**



b) Find inverse Z-transform of given difference equation, **7**

$x(n+2) + 3x(n+1) + 2x(n) = 0$

where, $x(-1) = -1/2$ and $x(-2) = 3/4$.

9. a) Obtain the describing function for deadzone with saturation. **7**

b) Obtain the describing function for relay with deadzone. **6**

OR

10. a) Obtain the describing function for following: **7**

i) Ideal Relay.

ii) Saturation.

b) What is describing function? State assumption and limitation of describing function method. **6**

11. a) Give classification of singular points and sketch phase trajectory for each. **7**

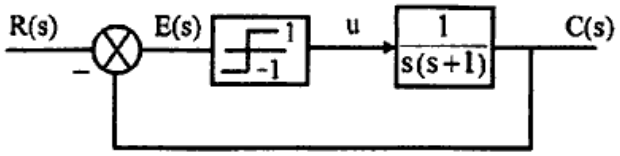
b) Draw phase trajectory for the system. **6**

$\ddot{X} + \frac{g}{\ell} \sin x = 0$

OR

12. Consider a non-linear as ideal relay. Obtain the phase plane trajectory with isocline method. **13**

Where e' (0) = 0, e (0) = 1.



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