G 643 (Pages : 3) Reg. No..............................

Name..............................

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electrical and Electronics Engineering

CONTROL SYSTEM—II (E)

(Old Scheme—Prior to 2010 Admissions—Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 marks.

1. Draw the circuit of a lag compensator and derive its transfer function.
2. Sketch and explain the Bode plots of a lead compensator.
3. Find the z transform of $\cos \omega t$.
4. Determine the inverse z transform of $\frac{z-4}{(z-1)\,(z-2)^2}$.
5. Sketch the input-output characteristics of a dead zone and saturation non-linearity and write down its describing function.
6. Explain the concept of phase plane analysis.
7. What is state transition matrix ? What are its properties ?
8. Prove the non-uniqueness of state models of a system.
9. Derive the relation between transfer function and state model.
10. Obtain a state model for the system described by $y(k+2) + 6y(k+1) + 4y(k) = u(k)$.

(10 × 4 = 40 marks)

Part B

Each question carries 12 marks.

11. The open loop transfer function of a unity feedback system is $\frac{k}{s(s+2)^2}$. Design a lead compensator to have a phase margin at least 50° and velocity error co-efficient $20s^{-1}$.

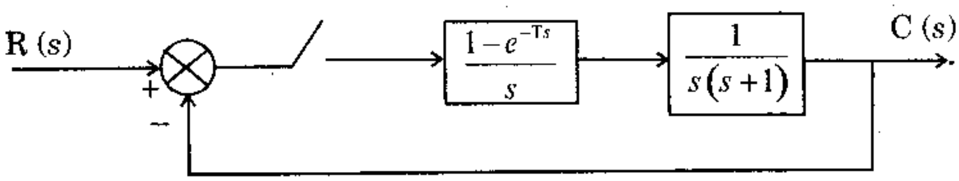
(12 marks)

Or

12. Explain the design of a lag lead compensator using root locus technique. (12 marks)

Turn over

13. Find the closed loop response of the system shown below. Input is unit step and T = 1 sec.

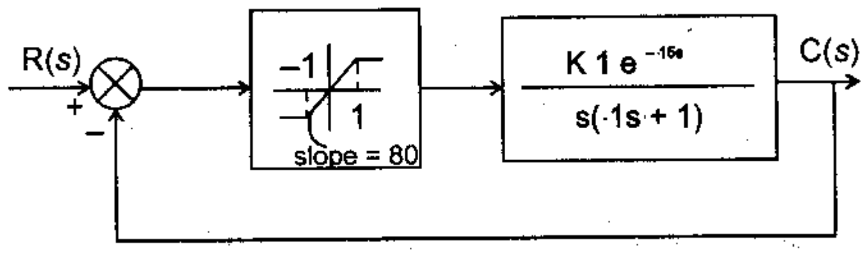


(12 marks)

Or

14. Explain Jury's stability test. Illustrate with an example. (12 marks)

15. Investigate the stability of the system shown below :



(12 marks)

Or

16. Construct the phase trajectory of the system given by $\frac{dx_2}{dx_1} = \frac{4x_1 + 3x_2}{x_1 + x_2}$. Comment on its stability.

(12 marks)

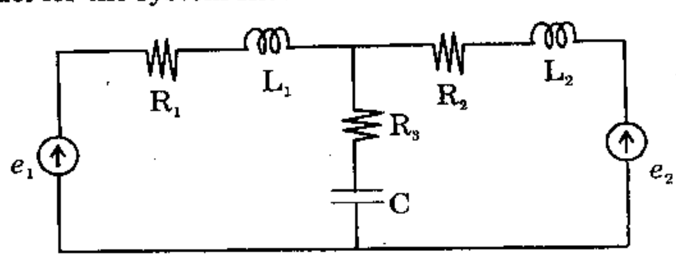
17. Solve the state equations given by :

$$\dot{X} = \begin{bmatrix} 0 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 0 & 3 \end{bmatrix} X, \quad X(0) = [0 \;\; 1 \;\; 0]^T.$$

(12 marks)

Or

18. Obtain a state model for the system shown below :



(12 marks)

19. A system is given by $\dot{X} = \begin{bmatrix} -1 & 0 & 0 \\ 1 & -2 & 0 \\ 2 & 1 & -3 \end{bmatrix} X + \begin{bmatrix} 10 \\ 1 \\ 0 \end{bmatrix} u$. Design a state feedback controller to place the closed poles at $-1 \pm j2, -6$.

(12 marks)

Or

20. Obtain a state model for a system given by $y(k+2) + y(k+1) + 0.16y(k) = u(k+1) + 2u(k)$ and find the state transition matrix.

(12 marks)

[5 × 12 = 60 marks]