Code No: 118AB

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year II Semester Examinations, April - 2018
ADVANCED CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) Write the advantages of lag compensator. [2]
b) State Nyquist stability criterion. [3]
c) What is Lyapunov function? [2]
d) What is positive definiteness and semi definiteness? Also give examples. [3]
e) What is limit cycles in phase portrait. [2]
f) Write the limitations of isoclines method for constructing phase trajectories. [3]
g) What is meant by Jump resonance? [2]
h) State the assumptions of describing function analysis. [3]
i) Write the properties of state transition matrix. [2]
j) Define state controllability of the system. Also write its expression. [3]

PART - B

(50 Marks)

2. The open loop transfer function of a unity feedback system is given by $G(s) = \frac{10}{s(1+s)(1+2s)}$ Sketch the polar plot and determine phase margin and gain margin. [10]

OR

3.a) What is a lag-lead compensator? Draw its bodeplot.
b) Write the procedure to design a lead compensator in frequency domain. [5+5]

4. State and explain Lyapunov stability and instability theorems in detail. [10]

OR

5. Determine the stability of the system described by $\dot{x}=Ax$, where $A = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$ by using Lyapunov theorem. Also determine suitable Lyapunov function. [10]

6.a) Describe the stability analysis of nonlinear systems using phase trajectories.
b) Explain the singular points with respect to nature of eigenvalues. Also draw its respective phase portrait. [5+5]

OR

7. A linear second order system with $\ddot{x} + 2\zeta\omega_n\dot{x}+\omega_n{}^2=0$ where $\zeta = 0.02$, $\omega_n = 10$ rad/s with $x(0)=0.8$ and $\dot{x}(0)=0$. Construct the phase trajectories using method of isoclines. [10]

8.a) Discuss various nonlinearities in physical systems.

b) Explain the stability analysis using describing function method. [5+5]

OR

9. Obtain the describing function for saturation with dead-zone nonlinearity. [10]

10.a) Develop the state model for a series RLC circuit excited with a voltage source V and current flowing in the circuit is i(t).

b) Define the following:

i) State vector (ii) State variable (iii) State diagram. [5+5]

OR

11.a) Determine the solution of a homogeneous state equation.

b) Explain the concept of diagonalization in state space analysis. [5+5]

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