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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth semester B.Tech examinations (S), September 2020

Course Code: EE304

Course Name: ADVANCED CONTROL THEORY

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1	What is a PI controller? What are its effects on the system performance?	(5)
2	What is a lead compensator? Obtain its frequency response characteristics	(5)
3	What is state space? What are the advantages of state space analysis?	(5)
4	What is pulse transfer function? What is the stability criterion of a sampled.data control system?	(5)
5	Mention any two characteristics of Nonlinear systems. What are limit cycles?	(5)
6	Define Describing function. What is the difference between stability analysis of linear and nonlinear systems?	(5)
7	What is the difference between describing function and phase plane method of stability analysis?	(5)
8	Explain Liapunov direct method of stability for nonlinear systems.	(5)

PART B

Answer any two full questions, each carries10 marks.

9	The open loop transfer function of a unity feedback control system is given by G(S) = K/[S(1+0.5S)(1+0.2S)]. It is desired that (i) the steady state error to unit ramp input is less than 0.125 (ii) Phase margin≥300 (iii) Gain margin≥10 db. Design a suitable compensator.	(10)
10	Design a suitable compensator for a unity feedback system with open loop transfer function G(S)=K/[S(S+4)(S+7)] to satisfy the following specifications. (1)Percentage overshoot=12.63% (2)Natural frequency of oscillation=8 rad/sec(3)Velocity error constant≥2.5.	(10)
11	Explain the Ziegler-Nichols method of tuning a PID controller when (a) dynamic model is known (b) dynamic model is not known.	(10)

PART C

Answer any two full questions, each carries10 marks.

12 a) Obtain the state model of the system whose transfer function is given by (5)

$Y(s)/U(s)= 10/[s^3+4s^2+2s+1]$

b) Obtain the state model of a field controlled DC motor. (5)

13 A discrete time system is described by the difference equation (10)

$y(k+2)+5y(k+1)+6y(k)=u(k)$

$y(0)=y(1)=0$; $T=1$ sec.

(a) Determine state model in a canonical form (b) Find the state transition matrix

14 Check the stability of the sampled data control system with the following characteristic equation using Jury's stability test $z^4-1.7z^3+1.04z^2-0.268z+0.024=0$ (10)

PART D

Answer any two full questions, each carries 10 marks.

15 Derive the Describing function of saturation with deadzone. (10)

16 Construct the phase trajectory for the system (10)

$\dot{x_1} = x_2, \dot{x_2} = -sign(x_1) where sign(x_1) = \begin{cases} 1 for x_1 > 0 \\ -1 for x_1 \leq 0 \end{cases}$ starting from (2,0)

17 Test the stability of the system using Lyapunov stability theorem (10)

(a) $\dot{x_1} = -x_1 + 2x_1^2x_2, \dot{x_2} = -x_2$

(b) $\dot{x_1} = x_2, \dot{x_2} = -sin(x_1) - x_2$

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