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$\geq$300 (iii) Gain margin$\geq$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$\geq$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)

$\dot{x}_1 = x_2, \dot{x}_2 = -sign(x_1) where sign(x_1) = \left(\begin{array}{c} 1 for x_1 > 0 \\ -1 for x_1 \leq 0 \end{array} \right)$ starting from (2,0)

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

(a) $\dot{x}_1 = -x_1 + 2x_1^2 x_2$, $\dot{x}_2 = -x_2$

(b) $\dot{x}_1 = x_2, \dot{x}_2 = -sin(x_1) - x_2$

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