ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)

M.Tech II-Semester Regular Examinations, May 2016

ADVANCED CONTROL SYSTEM DESIGN

(Control Systems Engineering)

Date: **Time: 3 hours** **Max Marks: 60**

Answer ONE Question from each unit
All questions carry equal marks
All parts of the question must be answered at one place only

UNIT-I

1 a) Explain the role of phase lead and phase lag networks in the design of control systems — 4 M

b) Using Bode Plot method, Design a phase lead compensating network to meet the following specifications.
Phase margin>45, velocity constant >100. The open loop transfer function is given by — 8 M

$$G(S) = \frac{K}{S(1+0.1S)(1+0.001S)}$$

(OR)

2 a) Give the steps for the design of lead compensator using root locus method for continuous time systems — 5 M

b) Design a lag compensator using Root locus method for the following plant with unity feedback

$$G_f(S) = \frac{1}{S(1+S)(4+S)(6+S)}$$ — 7 M

Such that the damping ratio ζ= 0.5 and natural frequency ω_n= 2 for the two dominant poles.

UNIT-II

3 a) Give the steps for the design of lead compensator with state variable feedback for continuous time systems — 6M

b) Explain the procedure for transient response compensation of state variable feedback sample data system. — 6M

(OR)

4 a) Explain the compensation of integral square error criterion without constraints for continuous time systems — 5 M

b) For the system shown below with U(t)= 1

$$G(S) = \frac{2(1-S)e^{-s}}{S+2}$$ — 7 M

Find G(S) which minimizes $\int_0^\infty e^2 dt$

UNIT-III

5	a)	Explain about linear quadratic optimal regulators?	6M
	b)	Explain in detail discrete time optimal regulators?	6M

(OR)

6	a)	Derive the transfer function interpretation in achieving integral action?	6M
	b)	Write the application for linear optimal filters, linear quadratic optimal regulators.	6M

UNIT-IV

7	a)	Explain in detail the types of conventional controllers and its applications?	6M
	b)	Explain Ziegler-Nichol's rules for tuning PID controllers.	6M

(OR)

8	a)	Explain in detail the comparison of different types of controllers and compensators.	6M
	b)	Explain the techniques of compensation by Mitrovic'S method in continuous systems.	6M

UNIT-V

9 a) Use Z-plane synthesis to design a compensator in discrete time domain to meet the specifications

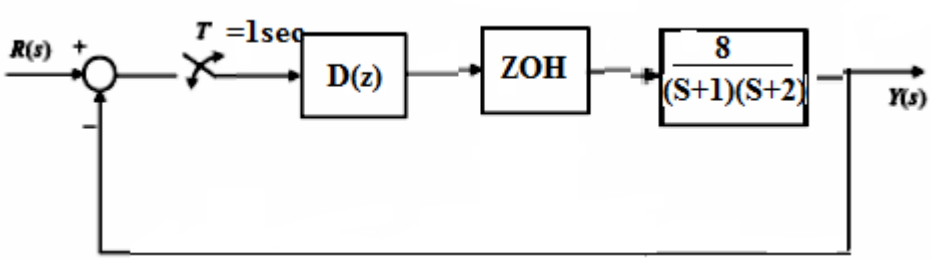
$$G(S) = \frac{8}{(1+S)(2+S)}$$

i) $K_v \geq 5\ sec^{-1}$

ii) Peak over shoot $\leq 20\%$

$T_p \leq 4$ sec

iii) Z= 0.6 — 8M



	b)	Explain the procedure steps involved in the design of lag compensation using S-plane synthesis	4M

(OR)

10	a)	Design of compensator by Dead Beat Performance	4M
	b)	Z-plane Synthesis approach	4M
	c)	State variable feedback compensation for discrete time systems	4M

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