

Total No. of Questions : 8]

SEAT No. :

PB-3704

[Total No. of Pages : 2

[6261]-112

**S.E. (Robotics & Automation Engineering)**  
**CONTROL SYSTEM ENGINEERING**  
**(2019 Pattern) (Semester - IV) (211509)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6. and Q.7 or Q.8.
- 2) Assume suitable data, if necessary.
- 3) Use of electronic pocket calculator is allowed.
- 4) Neat diagrams must be drawn wherever necessary.

**Q1)** a) Explain Routh's array with stability criteria, state advantages and disadvantages of Routh's criteria. [9]

b) If  $G = K/S (S+6) (S+8)$  and  $H(S) = S+2$ . Comment on stability. [8]

OR

**Q2)** a) What is stability? Explain stable, unstable, marginally and conditionally stable system with locations of roots in s plane. [9]

b) i) The System with Characteristics Equation  $Q(S) = S^3 + 2KS^2 + (K + 2)S + 4 = 0$  find range of K for stability [4]

ii) Investigate the stability of system with Characteristics equation  $Q(S) = S^5 + 5S^4 + 10S^3 + 10S^2 + 5S + 1 = 0$  [4]

**Q3)** a) Define phase margin and gain margin. Also draw a 40 db/dec line passing through  $w=1$ , 5 db till  $w=5$ . [8]

b) Derive the expression for Resonant Frequency and Resonant Peak. [9]

OR

**Q4)** a) Draw the polar plot for  $(S) = 1 + as$  [8]

b) Draw a typical frequency response of system and explain different frequency response specifications. [9]

P.T.O.

**Q5) a)** Explain digital control system in detail. Enlist its advantages and Applications. [9]

b) Explain the selection criteria used for PLC. [9]

OR

**Q6) a)** Explain PLC interfacing with I/O devices? What are the different types of command used in PLC. [9]

b) What is sampling? Explain the process of sampling with waveform. [9]

**Q7) a)** Design a lead compensator for the system with open loop transfer function [11]

$G(S)=9/S(S+3)$  to meet following specifications

i) Steady state error for ramp input be less than or equal to 0.05

ii) Phase margin of at least 45 degree

b) Explain the Procedure to design of lead compensator using root locus.[7]

OR

**Q8) a)** Explain the feedback compensator with necessity of compensation. [9]

b) Explain the Procedure to design lead compensator using Bode diagram.[9]

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