Reg. No. : | | | | | | | | | | |

Question Paper Code: 41541

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fourth Semester

Electronics and Instrumentation Engineering

14UEI401 - CONTROL ENGINEERING

(Regulation 2014)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which of the following is an open loop control system?

   (a) Field controlled D.C. motor   (b) Ward leonard control
   (c) Metadyne   (d) Stroboscope

2. The transfer function is applicable to which of the following

   (a) Linear and time-in variant systems   (b) Linear and time-variant systems
   (c) Linear systems   (d) Non-linear systems

3. Static error co-efficients are used as a measure of the effectiveness of closed loop systems for specified ________ input signal.

   (a) acceleration   (b) velocity
   (c) position   (d) all the above

4. The type 0 system has ______ at the origin.

   (a) no pole   (b) net pole
   (c) simple pole   (d) two poles

5. Phase margin of a system is used to specify which of the following?

   (a) Frequency response   (b) Absolute stability
   (c) Relative stability   (d) Time response

6. A phase lag lead network introduces in the output

   (a) lag at all frequencies
   (b) lag at high frequencies and lead at low frequencies
   (c) lag at low frequencies and lead at high frequency
   (d) none of these

7. A technique which is not applicable to nonlinear system

   (a) Nyquist Criterion (b) Quasi linearization
   (c) Functional analysis (d) Phase-plane representation

8. A technique which gives quick transient and stability response

   (a) Root locus (b) Bode (c) Nyquist (d) Nichols

9. Can be extended to systems which are time-varying?

   (a) Bode-Nyquist stability methods (b) Transfer functions
   (c) Root locus design (d) State model representatives

10. Which among the following are the interconnected units of state diagram representation?

   (a) Scalars (b) Adders (c) Integrators (d) All the above

PART - B (5 x 2 = 10 Marks)

11. What are the characteristics of negative feedback?

12. List the test signals used to find the time response in control systems.

13. What is resonant frequency?

14. Define Nyquist stability criterion.

15. Define controllability and observability.

PART - C (5 x 16 = 80 Marks)

16. (a) Determine the transfer function $\frac{C(s)}{R(s)}$ of the system shown in Figure. 1. (16)

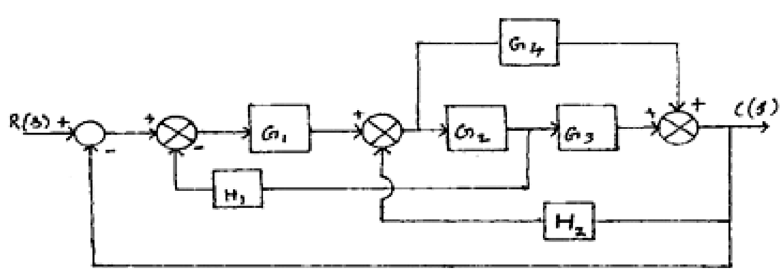
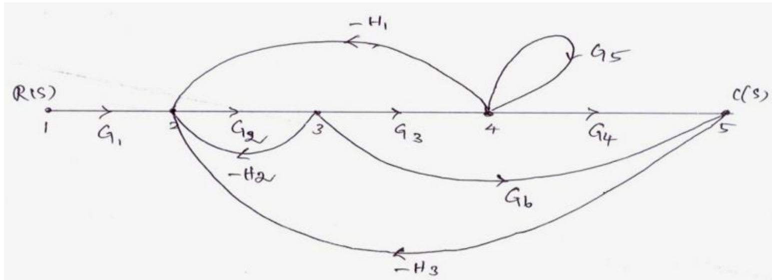


Figure 1

Or

(b) Find the overall gain C(s)/R(s) for the signal flow graph shown in figure. (16)



17. (a) Derive the response of second order system for under damped case and when input is unit step input. (16)

Or

(b) Consider a unity feedback system with a closed loop transfer function C(s)/R(s)= $(Ks+b)/(s^2+as+b)$.Determine the open loop transfer function G(s).Show that the steady state error with unit ramp input is given by (a-k)/b. (16)

18. (a) Design a phase lead compensator for the system shown in fig. to satisfy the following specifications (i) the phase margin of the system ≥45◦ (ii) steady state error for a unit ramp input ≤ 1/15 (iii) the gain cross over frequency of the system must be less than 7.5 rad/sec. (16)

Or

(b) Sketch Bode plot for the following transfer function and determine the system gain k for the gain cross over frequency to be 5 rad/sec.

$$G(s) = KS^2 / (1+0.2S)(1+0.02S). \quad (16)$$

19. (a) Sketch the root locus of the system whose open loop transfer function is G(s) = K/S(S+2)(S+4). Find the value of K so that the damping ratio of closed loop system is 0.5. (16)

Or

(b) Using Routh criterion determine the stability of the system represented by the characteristics equation $s^5+4s^4+8s^3+8s^2+7s+4=0$. Comment on the location of the roots of characteristics equation. (16)

20. (a) Determine whether the system is completely controllable and observable

$$A=\begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix};\ B=\begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix};\ C=[1 \quad 0 \quad 0]. \quad (16)$$

Or

(b) Determine the canonical state model of the system, whose transfer function is $T(s) = \frac{2(s+5)}{((s+2)(s+3)(s+4))}$. (16)