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

Question Paper Code: 54502

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Fourth Semester

Electronics and Instrumentation Engineering

15UEI402 - CONTROL ENGINEERING

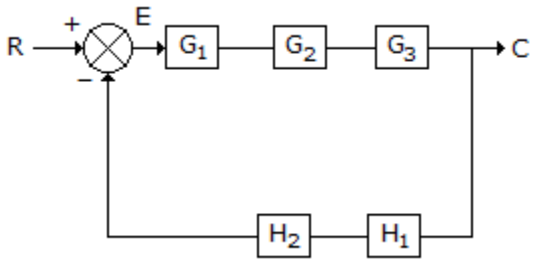
(Regulation 2015)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. What is the overall transfer function (C/R) of the following block diagram if $G = G_1 . G_2 . G_3$ and $H = H_1 . H_2$



(a) $\frac{1}{1+GH}$ (b) $\frac{G}{1+GH}$ (c) $\frac{H}{1+GH}$ (d) $\frac{G}{1-GH}$

2. Closed loop control system should have which of the following properties

   (a) Good Regulation against disturbance
   (b) Desirable response to commands
   (c) Low sensitivity to changes in plant parameters
   (d) All the above

3. A system has a transfer function of $G(s) = \frac{50}{s+50}$, when the response reaches its 63% of its final value

(a) 0.02 sec (b) 0.05 sec (c) 0.10 sec (d) 0.50 sec

4. What is the Laplace transform of impulse input having magnitude 'X'?

(a) X (b) X^2 (c) 1/X (d) 1

5. Bode diagram is a plot of

(a) log (AR) vs. log (f) and (Φ) vs. log (f) (b) log (AR) vs. f and log Φ vs.f
(c) AR vs. log (f) and Φ vs. log (f) (d) none of these

6. A bode magnitude plot of a system has -20dB gain at low frequencies. The system is

(a) Type 0 (b) Type 1
(c) Type 2 (d) Nothing can be deduced about type number

7. Using Routh's criterion, the number of roots lying in the right half S-plane for the characteristic equation $s^4 + 2s^3 + 2s^2 + 3s + 6 = 0$ is

(a) 1 (b) 2 (c) 3 (d) 4

8. Whether the integrator system is stable or not?

(a) Stable (b) Unstable (c) Marginally stable (d) None of the above

9. The number of integrators in a state diagram is equal to number of

(a) State variables (b) Phase variables
(c) State vector (d) Input vector

10. Consider a second order system whose state-space representation is of the form X = AX + Bu. If $x_1(t) = x_2(t)$, the system is

(a) controllable (b) uncontrollable
(c) observable (d) unstable

PART - B (5 x 2 = 10 Marks)

11. Write Masons Gain formula. .

12. What is the best damping ratio to use, why?

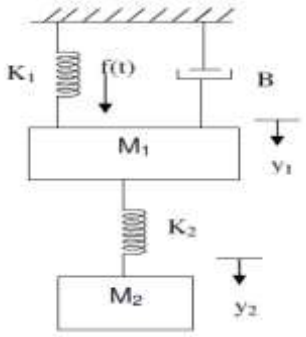
13. Draw the electrical network of lag-lead compensator

14. What control stategy you used to improve the steady state and transient response of a system?

15. What is meant by BIBO stability?

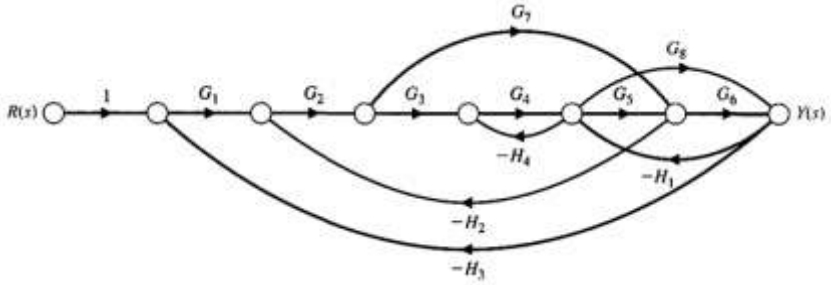
PART - C (5 x 16 = 80 Marks)

16. (a) Determine the transfer function Y2(S)/F(S) of the mechanical system shownin Fig (16)



Or

(b) Find the overall transfer function of the system in which its signal flow graph representation is (16)

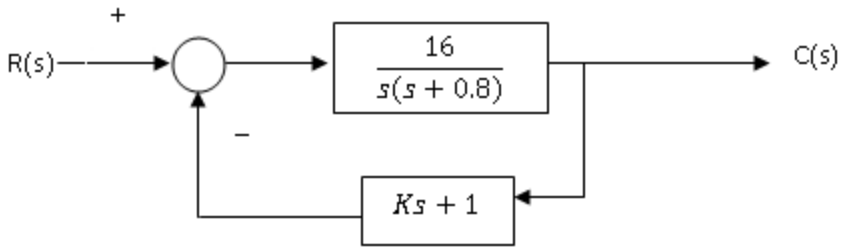


17. (a) (i) Derive the expression for second order system in under damped condition when input is unit step and also draw its response. (12)

(ii) Outline the significance of test signals. (4)

Or

(b) A servo position control system of a trolley mechanism which has a transfer function with velocity feedback system as figure below. What is the response of the system when a unit step signal is given, when the damping ration is 0.5. Find Rise Time, peak time, maximum peak overshoot, settling time. (16)



18. (a) Sketch the bode plot for the transfer function $G(s) = \frac{200(s+2)}{s(s^2+10s+100)}$, find its phase and gain margin. (16)

Or

(b) Given G(s) $= \frac{Ke^{-0.2s}}{s\,(s+2)(s+8)}$. By using Bode plot, find K so that the system is stable with, (i) gain margin equal to 2db and (ii) phase margin equal to 45º. (16)

19. (a) Applying Routh stability criterion and comment the range of stability of the closed loop system which have the characteristic equation as follows
$(s + 2)(s + 4)(s^2 + 6s + 25) + k$. (16)

Or

(b) (i) Apply Routh stability criterion to determine the location of roots on the s-plane and the stability of the system represented by the characteristic equation, $s^6+s^5+3s^4+3s^3+3s^2+2s+1=0$. (10)

(ii) For the system represented by the following characteristic equation say whether the necessary condition for stability is satisfied or not: (i) $s^4+3s^3+4s^2+5s+10=0$ (ii) $s^6-2s^5+s^3+s^2+s+6=0$. (6)

20. (a) Obtain the solution of non-homogeneous state equation using Laplace transform method, and explain Laplace transform method of obtaining e^{At}. (16)

Or

(b) Determine the state model of armature controlled DC motor (16)