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

Question Paper Code: 54502

B.E. / B.Tech. DEGREE EXAMINATION, MAY 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. The transfer function is defined only for

   (a) Linear time varying system
   (b) Linear time invariant system
   (c) Both Linear and nonlinear system
   (d) Time invariant as well as time varying system

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. The second order system with the transfer function $\frac{4}{S^2+2S+4}$ has a damping ratio of

   (a) 2.0 (b) 0.5 (c) 1.0 (d) 4.0

5. A transfer function of a system is $G(s) = \frac{10((1+0.2s)}{(1+0.5s)}$ .The phase shift at $\omega = 0\ and\ \omega = \infty$, will be respectively

   (a) $90°\ and\ 0°$ (b) $-180°\ and\ 180°$
   (c) $-90°\ and\ 90°$ (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. 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

PART - B (5 x 2 = 10 Marks)

11. Give the advantages of open loop system.

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

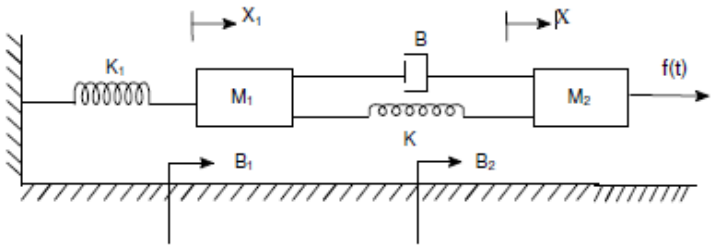
13. Draw the electrical network of lag-lead compensator

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

15. Define state.

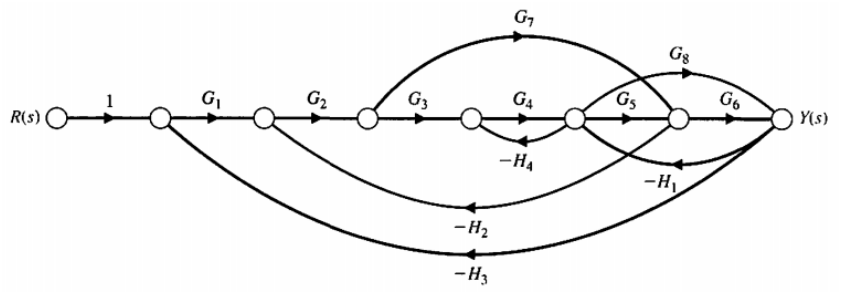
PART - C (5 x 16 = 80 Marks)

16. (a) Write the differential equations governing the mechanical system shown in below figure and determine the transfer function. (16)



Or

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



17. (a) (i) A unity feedback system with open loop transfer function $G(s) = \frac{0.4s + 1}{s(s + 0.6)}$.

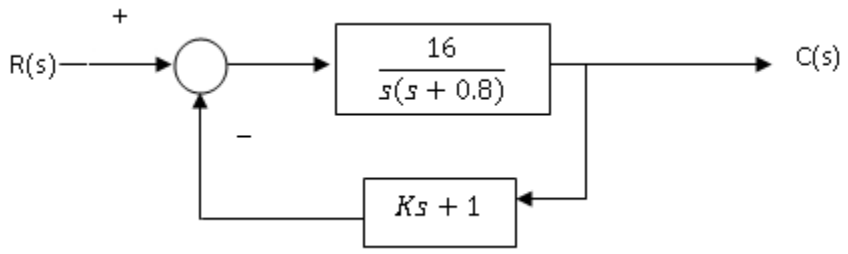
Determine its transient response for unit step input. (8)

(ii) A unity feedback system the open loop transfer function $G(s) = \frac{K}{s(s + 10)}$.

Determine the gain K, so that the system will have a damping ratio of 0.5. Also find setting time for 2% error, Peak time, rise time, percentage of peak overshoot. (8)

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) Consider the unity feedback system type 1 system with open loop transfer function $G(s) = \frac{K}{s^2(0.2s+1)}$, Assume that system is required to be compensated to meet the following specifications.

(i) Acceleration error constant K_a=10

(ii) Phase margin $\geq 35°$. (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) The characteristic polynomial of a system is $s^7+5s^6+9s^5+9s^4+4s^3+20s^2+36s+36=0$. Determine the location of roots on the s-plane and the stability of the system. (10)

(ii) Write the the procedure for constructing Routh array with a row of all zeros. (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) (b) Determine the state model of armature controlled DC motor. (16)

———————