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

Question Paper Code: 54052

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

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. Control of industrial process by automatic rather than manual means is often called as

   (a) Negative feedback (b) Automation
   (c) A design gap (d) A specification

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. If a pole is moved along a radial line extending from the origin, what will the responses have in common?

   (a) % overshoot same (b) % overshoot differ
   (c) 1% overshoot decay 1/3 ratio (d) none of these

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. For the closed loop system to be a stable one , the _____ of the $1 + G(s)H(s)$ must lie in the left half of the s plane

   (a) Poles (b) Zeros (c) Asymptotes (d) Pair of poles

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. Define laplace transforn and mention its advantage.

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

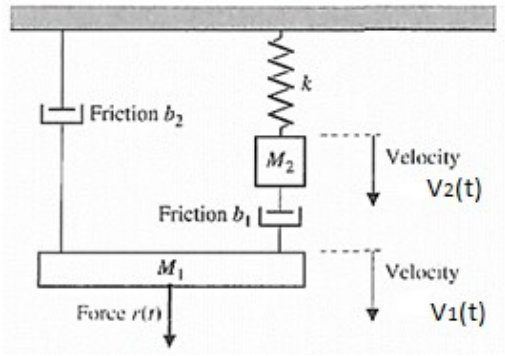
13. On what aspect, the initial and final value theorem is used in control system analysis.

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

15. List the limitations of classical tranfer function model.

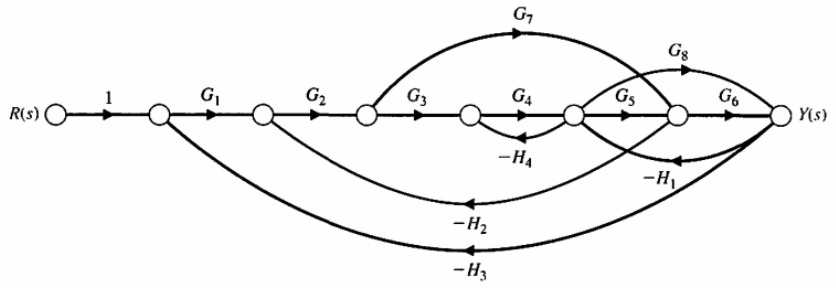
PART - C (5 x 16 = 80 Marks)

16. (a) Derive $V_1(s)/R(s)$ the Force current analogy by transforming the given mechanical system. (16)



Or

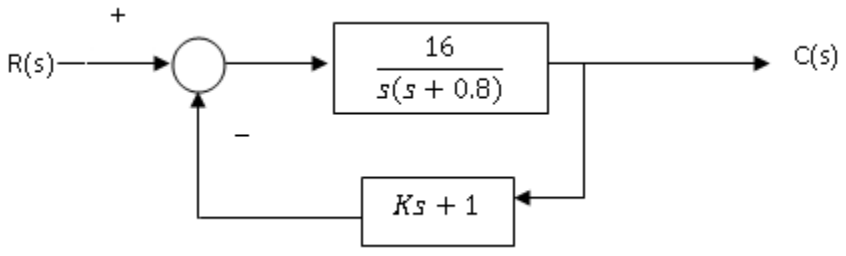
(b) Find the overall transfer function of the system in which its signal flow graph representation is (16)



17. (a) Derive the expression for second order system in under damped condition when input is unit step and also draw its response. (16)

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) Construct the Nyquist plot for the feedback control system whose open loop transfer function is given by $\frac{5}{s(1-s)}$. And comment the stability of open loop and closed loop. (16)

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) Derive the two state variable modes for the system which has the transfer function of

$$\frac{y(s)}{u(s)} = \frac{50(1+0.2s)}{s(s+0.5)(s+0.02)}$$

(i) One which the system companion form II

(ii) One which the system matrix is Diagonal (16)