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B.E. DEGREE EXAMINATIONS: APRIL/MAY 2011

Fourth Semester

MECHATRONICS ENGINEERING

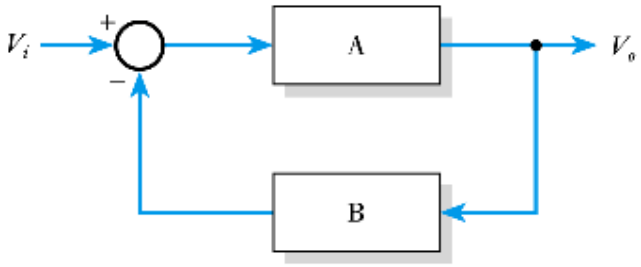
U07MH404: Control System

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. What is the voltage gain of the following arrangement?



a) $(1+AB)/A$ b) $A/(1+AB)$ c) $B/(1+AB)$ d) $(1+AB)/B$

2. Under what conditions does the gain of a feedback system approximate to $1/B$?

a) The loop gain AB << 1. b) The forward path gain A >> 1.

c) The feedback path gain B >> 1. d) The loop gain AB >> 1.

3. In the time domain, the performance measure of a system for relative stability and speed of response are

a) Peak overshoot or damping factor and rise time, settling time or natural frequency.

b) Peak time, percent overshoot, damping ratio.

c) Damping factor, rise time and settling time, damping ratio.

d) Damping factor, percent overshoot and rise time.

4. The characteristics equation of control systems is the relation is formed by

a) Equating to zero the numerator of the transfer function.

b) Equating to zero the denominator of the transfer function.

c) Subtracting the denominator from the numerator of the transfer function and equating to zero

d) Adding the denominator and numerator of the transfer function and equating to zero

5. The steady state error is the error when

a) The Time period is not less than one microsecond.

b) The time period is large and the transient response has decayed.

c) The time period is large but the transient response is still persisting.

d) The time period is large but there is oscillatory behavior of the output.

6. Frequency response of a control system

a) The transient response of a control system to a sinusoidal input signal.

b) The Steady state response of a control system to a sinusoidal input signal.

c) The transient response of a control system to a non-sinusoidal input signal.

d) The Steady state response of a control system to a non-sinusoidal input signal.

7. Root locus technique is applicable to

a) Single loop system. b) Multiple loop system.

c) Single as well as multiple loop systems. d) Not more than two loop systems.

8. A closed loop system is unstable if

a) Both gain margin and phase margin are negative.

b) Gain margin is negative and phase margin is positive.

c) Gain margin is positive and phase margin is negative.

d) Both gain margin and phase margin are positive.

9. In frequency response approach, compensation network is used to alter and reshape the system characteristics represented on an

a) S-plane b) Root locus Diagram c) Polar graph d) Bode plot and Nichols chart.

10. Addition of the compensating network are done when the designer

a) Is not able to alter the design of the process.

b) Wants to change the basic design of the system with a compensating network added to the system.

c) Does not want to compromise on the basic design of the system.

d) Wants study the performance of the system under variable input condition.

PART B (10 x 2 = 20 Marks)

11. Name the two types of electrical analogous for mechanical system.

12. Distinguish between open loop and closed loop systems.

13. Name the test signals used in time response analysis.

14. What is steady state error?

15. List the Frequency domain specifications

16. Compare Bode plot and Nyquist plot analysis.

17. State Nyquist stability Criterion.

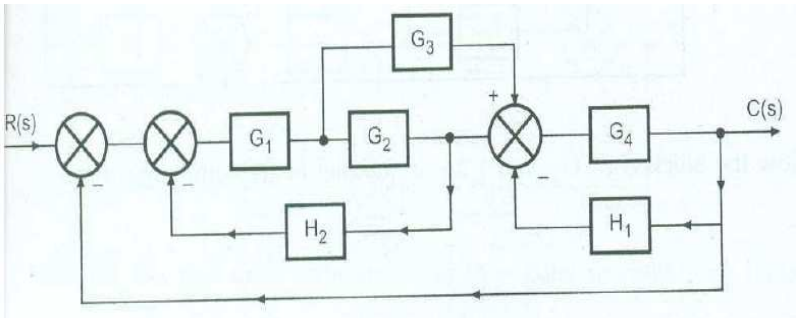
18. What are break away points? How will you find the root locus on real axis?

19. What are the effects of PI controller?

20. What are all the frequency domain specifications needed to design a control system?

PART C (5 x 14 = 70 Marks)

21. a) Reduce the given block diagram and hence obtain the transfer function C(s)/R(s).



(OR)

b) Derive the transfer function for Armature controlled DC servo motor.

22. a) Write short notes about PI,PD,PID controller characteristics.

(OR)

b (i) What is meant by time response? Explain about Steady- state response and Transient response. (7)

(ii) A unity feed-back system is characterized by an open loop T.F G(s) = K/s(s+10) Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K, determine Ts, Tp and Mp for a unit step input. . (7)

23. a) The open loop transfer function of a unity feedback system is G(S) = 1/ S(1+S)(1+2S) Sketch the Polar plot and determine the Gain margin and Phase margin.

(OR)

b) Construct the polar plot for the function GH(S) =2(S+1)/ S^2. Find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin.

24. a) (i) Give short notes on following terms (6)

(a) absolute stability

(b) marginal stability

(c) conditional stability

(ii) By means of RH criterion determine the stability of the system represented by the characteristic equation S4 + 2S3 + 8S2 + 4S + 3 = 0**.** (8)

(OR)

b) The characteristic polynomial of a system is $S^7+9S^6+24S^5+24S^3+24S^2+23S+15=0$. Determine the location of roots on S-plane and hence the stability of the system.

25. a) Realise the basic compensators using electrical network and obtain the transfer function.

(OR)

b) Explain the design procedure for lag- lead compensation.

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