KUMARAGURU college of technology
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Register Number:……..

B.E DEGREE EXAMINATIONS:JUNE 2015

FourthSemester

EEE111 CONTROL SYSTEMS

(Common to Aero/EIE)

(Graph sheet, Polar chart and Semi log sheet will be provided)

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

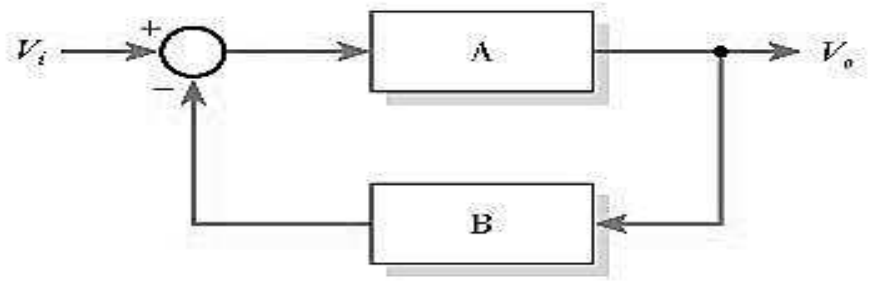
Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. A refrigerator is example for

   a) closed loop system b) on/off control system

   c) open loop system d) process control system

2. 

   a) (1+AB)/A b) A/ (1+AB)

   c) A/(1-AB) d) (1+AB)/B

3. For a type 2 system and unit parabolic input, the steady state error is

   a) 0 b) ∞

   c) 1 d) $1/K_v$

4. The value of damping ratio of 0.6 in the step response of a second order system results in maximum overshoot of

   a) 10 b) 8.54

   c) 7.55 d) 9.44

5. The relative stability of a system is given by

   a) gain margin alone b) phase margin alone

c) both phase and gain margins d) either (a) or (b)

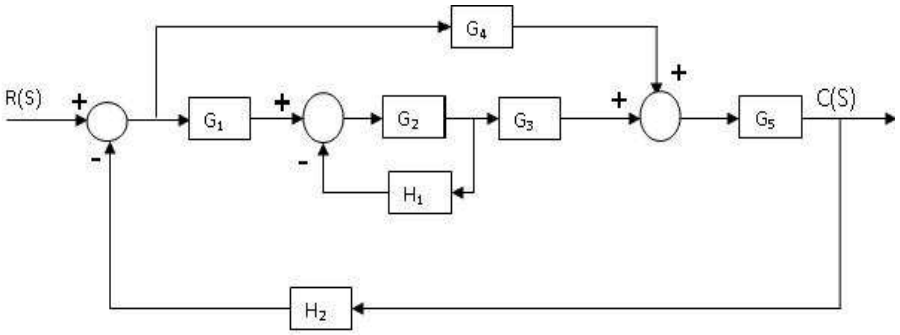
6. Nichol's plot is drawn between
   a) magnitude of network function and ω b) dB magnitude and log ω
   c) dB magnitude and ω d) $\log_e$ (magnitude) and log ω
7. First column elements of Routh's tabulation are 3,5, −2, -8. It means that there
   a) is one root in left half *s* plane b) are two roots in left half *s* plane
   c) are two roots in right half *s* plane d) is one root in right half *s* plane
8. If Nyquist plot has a encirclement of (-1,0) point, the system is stable if
   a) there are no poles of G(*s*) H(*s*) in right-half plane b) there is one pole of G(*s*) H(*s*) in right-half plane
   c) there is no zeros of G(*s*) H(*s*) in right-half plane d) there is no zeros of G(*s*) H(*s*) in left-half plane
9. The lead network for compensation generally consists of
   a) R and L elements b) R and C elements
   c) L and C elements d) R only
10. A lag compensator is essentially a
   a) Low pass filter b) High pass filter
   c) Band pass filter d) Either (a) or (b)

PART B (10 x 2 = 20 Marks)

11. State the advantages of open loop control system.
12. Define loop.
13. Classify the systems based on the damping.
14. Name the time domain specifications.
15. Define gain margin and phase cross over frequency.
16. Write the correlation between overshoot and peak resonance.
17. What are the effects of adding poles to the system transfer function?
18. State Routh Hurwitz stability criterion.
19. What do you mean by a compensator?
20. Draw the pole zero diagram of a lead compensator.

PART C (5 x 14 = 70 Marks)

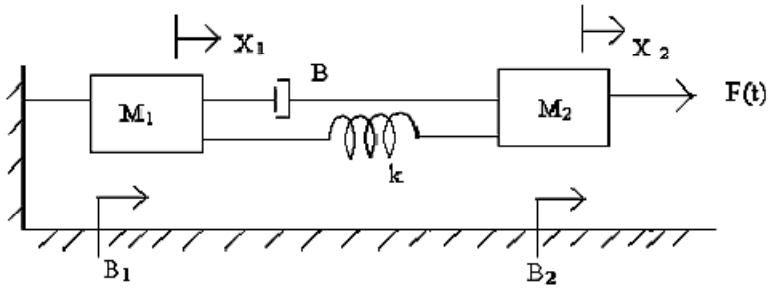
21. a) Find the closed transfer function C(S)/R(S) of the system represented by the block diagram of fig using Mason's gain formula.



(OR)

b) i) Derive the transfer function of armature controlled DC servo motor. (7)

ii) Write the differential equations governing the Mechanical system shown in fig. Draw the force – voltage analogous circuit.



(7)

22. a) Derive an expression for the time response of second order under damped system when the input is unit step.

(OR)

b) Evaluate the static error constants for a unity feed back system having forward path transfer function G(S) = $\frac{50}{S(S+1)}$. Estimate the steady state errors of the system for the input r(t) given by r(t)= $1+2t+t^2$.

23. a) Sketch the Bode diagram for the following transfer function

$$G(S) = 20/ S (1+0.2S) (1+0.02S)$$

(OR)

b) i) Derive an expression for constant M circles. (7)

ii) Sketch the polar plot for the open loop transfer function $G(s)H(S) = \frac{10}{S(5+S)}$ (7)

24. a) Sketch the root locus for a system with open loop transfer function $G(S)H(S) = \frac{K}{S(S+1)(S+3)}$.

(OR)

b) Using Routh stability criterion, determine the stability of the system whose Characteristic equation is given by $S^7+3S^6+7S^5+10\ S^4+11S^3+11S^2+2S+6 =0$.

25. a) Design a suitable lead compensators for a system unity feedback and having open loop transfer function G(S)= K/ S(S+1) to meet the following specifications. (i)The phase margin of the system is 45º, (ii) velocity error constant is less than $\leq 50\ sec^{-1}$.

(OR)

b) i) Derive the transfer function of phase lag compensator. (7)

ii) Explain the design procedure for lag compensator (7)

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