Register Number: ……..

B.E DEGREE EXAMINATIONS: MAY/JUNE 2013

Fourth Semester

EEE 111 : CONTROL SYSTEMS

(Common to AERO and EIE)

(Graph sheet, semi log sheet and polar graph are provided)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Electrical analogous of Mass in the mechanical system is

   a) Inductance b) Capacitance

   c) Voltage d) Current

2. Signal flow graph is used to find

   a) stability of the system b) Controlability of the system

   c) Transfer function of the system d) All of the above

3. Type and order of the transfer function $\frac{S}{S^2(S+1)(S+3)}$ is

   a) 4,2 b) 2,4

   c) 2,1 d) 4,1

4. Velocity error constant of type 0 order 1 system is

   a) 0 b) 1

   c) infinite d) none of the above

5. The magnitude at cutoff frequency is called

   a) gain margin b) magnitude

   c) cutoff rate d) none of the above

6. Bandwidth in Nichol's chart is given by the frequency at the intersection point of G(jw)locus with

   a) 3db line b) - 3 db line

   c) 0 db line d) none of the above

7. The example for critically stable system is

   a) RC circuit b) RL circuit

   c) Pendulum d) none of the above

8. The number of sign changes in first column of Routh array is two then number of roots in RHS of S plane is_____

   a) 4 b) 3

   c) 1 d) 2

9. The value of α (alpha) in lead compensator is _____ one.

   a) Less b) Greater than

   c) Equal to d) None of the above

10. Lag-Lead compensator is used to improve the

    a) steady state performance b) transient performance

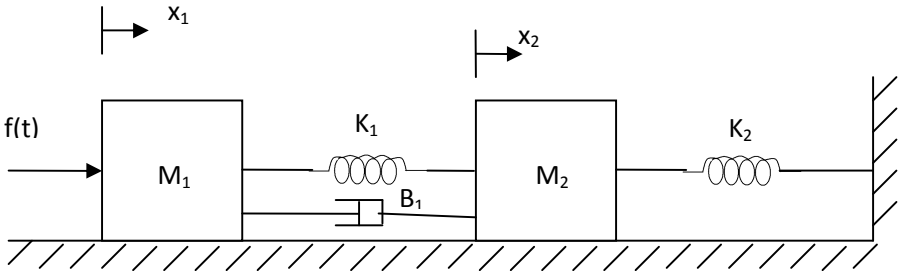
    c) both d) none of the above

PART B (10 x 2 = 20 Marks)

11. What are the basic components of a closed loop control system?
12. State Mason's gain formula.
13. Mention the test signals used to determine time response.
14. Define rise time for a second order under damped system.
15. Write the procedure to find gain and phase margin in polar plot.
16. Mention any three frequency domain specifications.
17. Define conditionally stable system.
18. State Nyquist stability criterion
19. What is compensation?
20. What are the merits of lead – lag network?

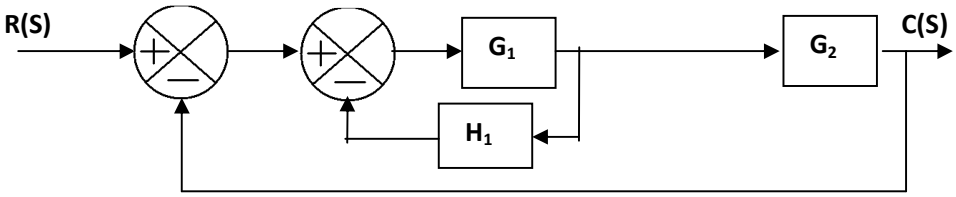
PART C (5 x 14 = 70 Marks)

21. a) Draw the voltage and current analogs for the following mechanical system and also derive the transfer function $X_1(s)/F(s)$.

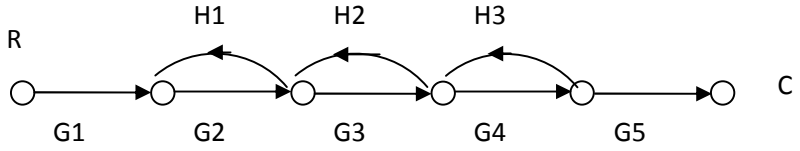


(OR)

b) (i) Determine the overall transfer function of the following block diagram. (6)



(ii) Using Mason's gain formula find C/R. (8)



22. a) Derive the unit step response of second order under damped system and also draw the response.

(OR)

b) Determine the generalized(dynamic) error coefficients and steady state error for a system whose open loop transfer function is G(S) = 1/ { s (s+1)(s+10) }and the feedback transfer function is H(S) = (s+2) with input of $r(t) = 6 + t + t^2$

23. a) A unity feedback control system has $G(s) = \frac{80}{s(s+2)(s+20)}$. Draw the bode plot. Determine Gain margin, phase margin, gain cross over frequency and phase cross over frequency.

(OR)

b) (i) The open loop transfer function of a unity feed back system is (10)

$G(S) = 1/ \{S (1+S) (1+2S)\}$ .Sketch the Polar plot and determine the Gain margin and Phase margin.

(ii) How to determine the closed loop response from open loop response? (4)

24. a) (i) Check the stability of a system with characteristic equation (8)

$s^5 + s^4 + 2s^3 + 2 s^2 + 3 s + 15 = 0$ using the Routh Hurwitz criterion.

(ii) Write the procedure to draw the Nyquist plot (6)

(OR)

b) A unity feedback control system has an open loop transfer function

$G(S) = K / \{s (s^2 + 4s + 13)\}$. sketch the root locus.

25. a) Describe the design procedure for a lead compensator.

(OR)

b) A unity feedback system has an open loop TF

$$G(S) = \frac{K}{S(S+1)(0.2S+1)}$$

Design a suitable Lag compensator to achieve Kv=8 ,Phase margin > 40 deg. with usual notations

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