USN

10ME/PM82

Eighth Semester B.E. Degree Examination, June/July 2014

Control Engineering

Time: 3 hrs.

Max. Marks: 100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Distinguish between open-loop and closed loop systems with examples. **(05 Marks)**

b. Explain the requirements of a control system. **(05 Marks)**

c. Explain following controller. State its characteristics:

i) Proportional plus derivative control action

ii) Proportional plus integral plus derivative control action. **(10 Marks)**

2 a. Write the equilibrium equations for the mechanical system shown in Fig.Q2(a), hence obtain the F-I analogous system.

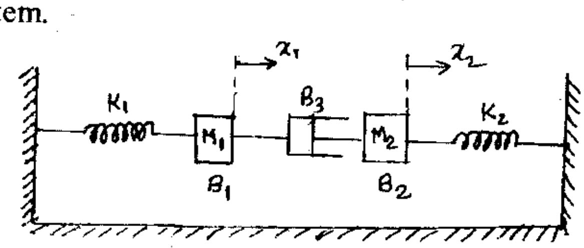

Fig.Q2(a) **(10 Marks)**

b. Obtain the transfer function of field controlled DC motor. **(10 Marks)**

3 a. Reduce the block diagram and obtain its transfer function $\frac{C(s)}{R(s)}$.

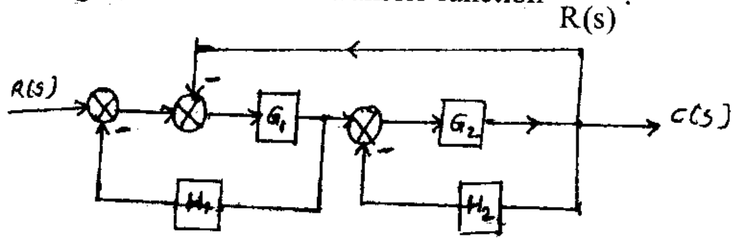

Fig.Q3(a) **(10 Marks)**

b. Find $\frac{C(s)}{R(s)}$ by Mason's gain formula.

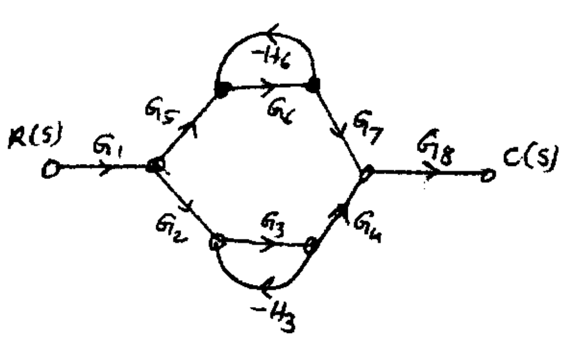

Fig.Q3(b) **(10 Marks)**

4 a. Obtain an expression for time response of the first order system subjected to unit step input. **(08 Marks)**

b. Determine the damping ratio and natural frequency for the system whose maximum overshoot response is 0.2 and peak time is 1 sec. Find rise time and settling time. **(06 Marks)**

c. State whether the system is stable or unstable $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$ using Routh's stability criterion. **(06 Marks)**

PART – B

5 a. Sketch the polar plot of TF $G(s)H(s) = \frac{1}{(1+5s)(1+10s)}$. **(06 Marks)**

b. Sketch the Nyquist plot for a system, whose transfer function, $G(s)H(s) = \frac{K}{s(s+4)(s+8)}$. Determine the range of values of K for which the system is stable. **(14 Marks)**

6 For a system $G(s)H(s) = \frac{242(s+5)}{s(s+1)(s^2+5s+121)}$, sketch the Bode plot. Find ω_{pc} and ω_{gc}, GM, PM. Comment on stability. **(20 Marks)**

7 For a unity feedback system, $G(s)H(s) = \frac{K}{s(s+4)(s+2)}$, sketch the rough nature of the root locus, showing all details on it. **(20 Marks)**

8 a. What is compensation? How are compensators classified? **(06 Marks)**

b. Write notes on:
i) Lead compensator
ii) Lag compensator **(08 Marks)**

c. A system is governed by the differential equation $\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 10y = 8u(t)$ where y is the output and u is the input of the system. Obtain a state space representation of the system. **(06 Marks)**

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