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10ME/PM82

Eighth Semester B.E. Degree Examination, June/July 2016
Control Engineering

Time: 3 hrs. Max. Marks: 100

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

PART – A

1 a. Define control system. Compare open loop and closed loop control systems with an example for each type. **(08 Marks)**

b. With a block diagram, explain proportional, proportional plus integral (PI) and proportional plus integral plus derivative (PID) controllers. Mention its characteristics. **(12 Marks)**

2 a. Derive the differential equation and obtain the transfer function $\frac{\theta(s)}{E_a(s)}$ for armature controlled DC motor coupled to mechanical load having inertia J and friction coefficient f_0. **(12 Marks)**

b. Draw the equivalent mechanical system (nodal basis) and write the set of equilibrium equations and obtain force voltage analogy for the system shown in Fig. Q2 (b). **(08 Marks)**

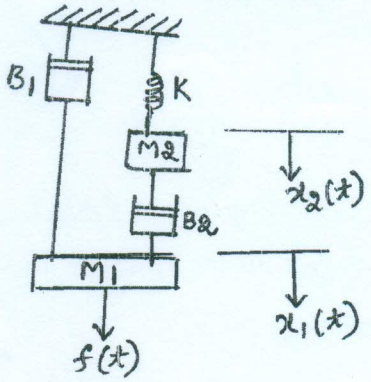

Fig. Q2 (b)

3 a. Reduce the block diagram using reduction technique and obtain $\frac{C(s)}{R(s)}$. **(10 Marks)**

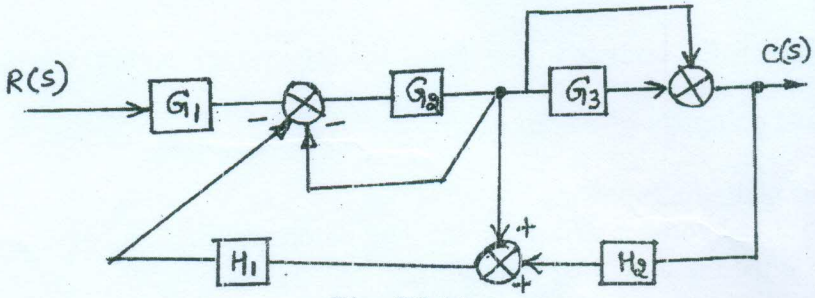

Fig. Q3 (a)

3 b. Find the transfer function by using Mason's Gain formula for the signal flow graph shown in the Fig. Q3 (b). **(10 Marks)**

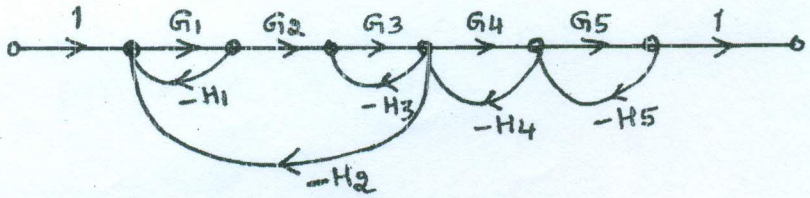

Fig. Q3 (b)

4 a. By applying Routh's criterion discuss the stability of the closed loop system whose characteristic equation is,

$s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$ **(10 Marks)**

b. For a spring mass damper system shown in the Fig. Q4 (b) – (i), a force of 9.6 Newtons is applied to the mass. The response C(t) is as shown in the Fig. Q4 (b) – (ii). Find the value of M, B and K. **(10 Marks)**

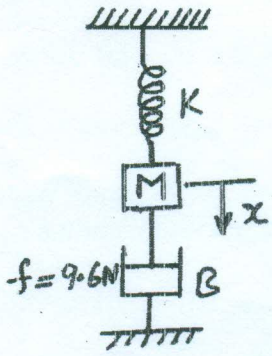

Fig. Q4 (b) – (i)

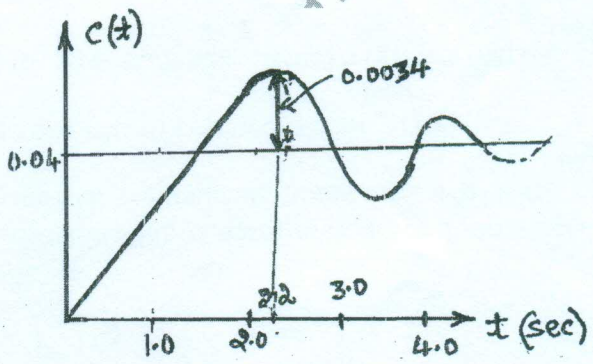

Fig. Q4 (b) – (ii)

PART – B

5 Sketch the Nyquist plot for the system with $G(s)H(s) = \dfrac{(1+0.5s)}{s^2(1+0.1s)(1+0.02s)}$. Find GM and comment on the stability. **(20 Marks)**

6 Plot the Bode magnitude and phase diagrams for the open loop transfer function, $G(s)H(s) = \dfrac{100(s+2)}{s(s+4)(s+5)}$ and

Discuss the stability of the closed loop system and find GM and PM. **(20 Marks)**

7 Sketch the complete root locus for the system having $G(s)H(s) = \dfrac{K}{s(s+3)(s^2+3s+11.25)}$ and comment on stability. **(20 Marks)**

8 a. Explain the following:

i) Lead compensator ii) Lag compensator **(10 Marks)**

b. Define the following terms:

i) State ii) State variables iii) State vector iv) State space

v) State equation. **(10 Marks)**

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