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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Sixth Semester, B.E. - Electronics and Communication Engineering

Make-up Examination; July - 2016

Control System

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Assume missing data suitably.

UNIT - I

1 a. List the merits and demerits of open loop and closed loop control systems. Give at least one example. 8

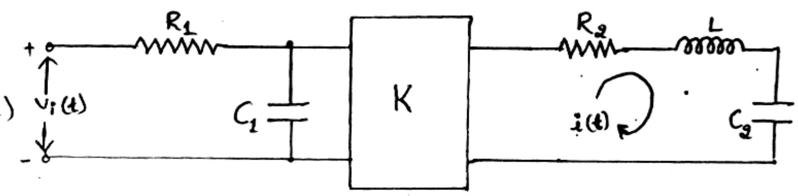
b. Define the following : 4

i) Control system ii) Command input

iii) Reference input iv) Disturbance.

c. Determine the transfer function $\frac{I(S)}{V_i(S)}$ for the circuit shown in Fig. Q 1(c). K is gain of an ideal amplifier. 8

Fig. Q1(c)



2 a. Explain significance of transfer function stating its advantages. 4

b. For the electromechanical system shown in Fig. Q 2(b). Determine the transfer function. $\frac{X(S)}{E(S)}$ 8

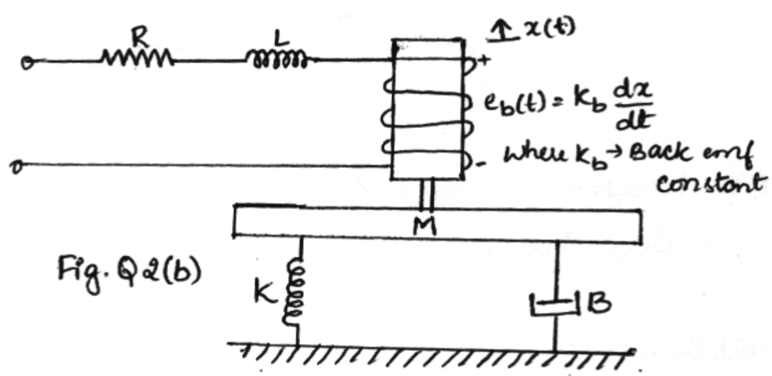


Fig. Q2(b)

c. Draw an electrical network based on Torque-Voltage analogy for the rotational mechanical system shown in Fig. Q 2(c). 8

Contd….2

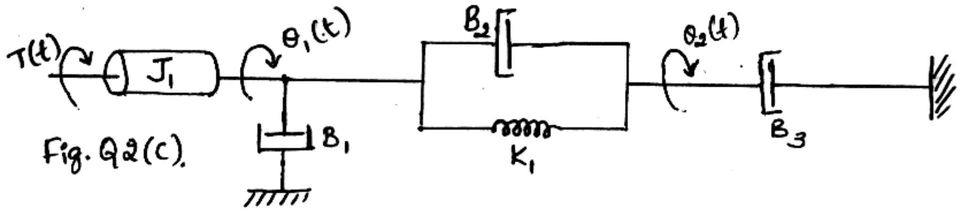


Fig. Q2(c)

UNIT - II

3 a. Explain the block diagram ruler to perform the following,

i) Shifting a summing point behind the block

ii) Shifting a take-off point beyond the block 6

iii) Converting Non-unity feedback to unity feedback.

b. Reduce the block diagram shown in Fig. Q3(b) to its simplest form and hence obtain closed loop transfer function. 8

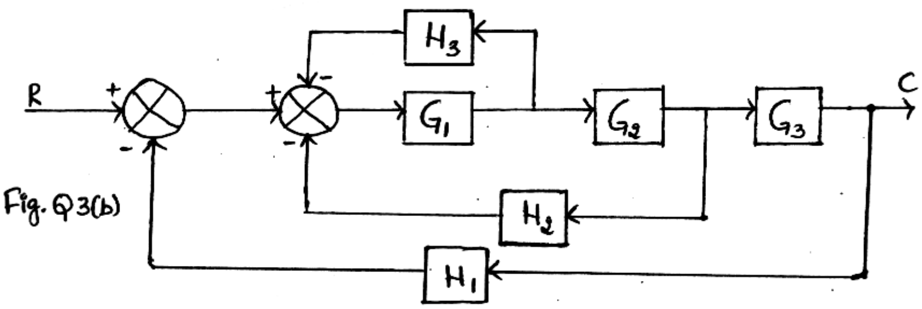


Fig. Q3(b)

c. Obtain the closed loop transfer function $\frac{C(S)}{R(S)}$ by using Marson's gain formula for the signal flow graph shown in Fig. Q3(c). 6

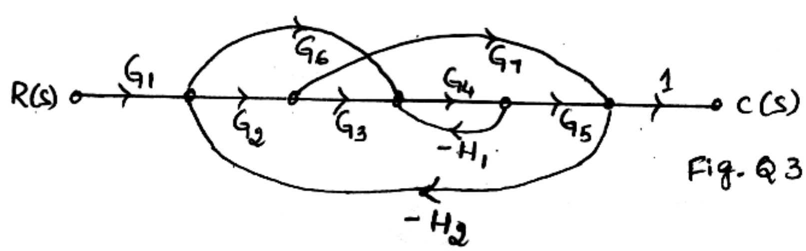


Fig. Q3(c)

4 a. What are step signals? How are they defined mathematically? 4

b. Find all error-coefficients and steady states errors for a system with open loop transfer function as $G(S)H(S) = \frac{10(S+2)(S+3)}{S(S+1)(S+5)(S+4)}$ where input is $r(t) = 3 + t + t^2$. 8

c. Starting from fundamentals, derive an expression for step response of a typical under-damped second order closed loop control system. 8

UNIT - III

5 a. Write a note on Routh-Hurwitz criterion along with its limitations. 6

b. State and prove the theorem on BIBO stability. 6

c. Check the stability of the given characteristic equation using Routh's array. 8

$$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$$

6 a. Explain briefly the following terms with repeat to Root-Locus technique : 6

i) Centroid ii) Asymptote iii) Breakaway point.

b. For a negative feedback system having $G(S) = \frac{K(S+1)}{(S+2)(S+3)(S+4)}$

i) Sketch the Root-Locus with necessary calculations. Show at least one test point on the complete plane on the Root-locus, where criterion is satisfied. 14

ii) If K = 10, where are the roots?

UNIT - IV

7 a. State and explain Nyquist criterion. 6

b. Find the range of K for closed loop stability using Nyquist stability, 14

$$G(S)H(S) = \frac{K(4S+1)}{S(S-1)}, K > 0$$

8 a. For the polar plot shown in Fig. 8(a).

i) Determine the G.M in dB and p.m. if OA = – 0.5, OB = – 1, OC = – 2, OD = – 2.5, OE = 0.8666 +j0.5 and OF = – 0.643 – j0.766.

ii) Complete the Nyquist plot and determine whether system is stable, if all the poles are in left half of S-plane. 10

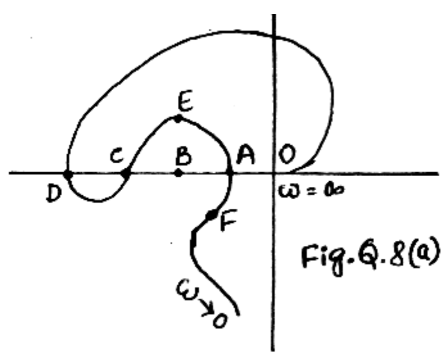


Fig.Q.8(a)

b. For a unity feedback system : 10

$G(S) = \frac{K(1+S^2)}{S^3}$, determine the range of K for the system using Nyquist criterion.

UNIT - V

9 a. Define : 6

i) State ii) State variables iii) State vectors.

b. List the advantages of state variable analysis. 4

c. Obtain an appropriate state model for a system represented by an electric circuit as shown in Fig. Q 9(c) 10

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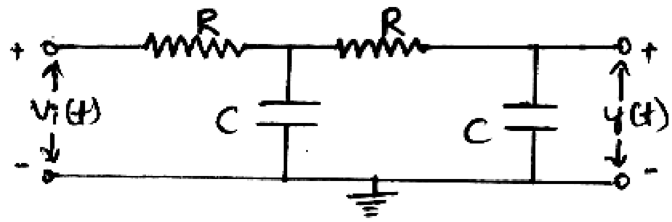
Fig. Q9(c)



10 a. Derive an expression for peak resonant and resonance frequency. 6

b. Find the transfer function of the system whose asymptotic approximation in given in Fig. Q 10(b). 4

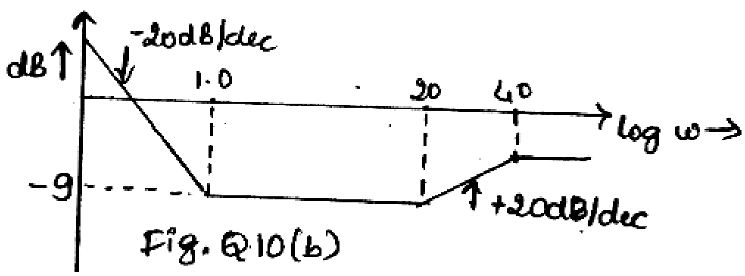


Fig. Q10(b)

c. Construct the Bode plot for unity feedback control system having :

$$G(S)=\frac{10(S+10)}{S(S+2)(S+5)}$$ 10

From plot obtain GM and PM. Comment on the stability of the system.

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