CBCS SCHEME

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15ME73

Seventh Semester B.E. Degree Examination, July/August 2021
Control Engineering

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions.***

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

b. What are the requirements of an Ideal Control System? **(08 Marks)**

2 Explain with Block diagrams:
(i) Proportional controller. (ii) Integral controller.
(iii) Derivative controller. (iv) P.I.D controller. **(16 Marks)**

3 a. Draw F-V and F-C circuits using analogue quantities. **(08 Marks)**

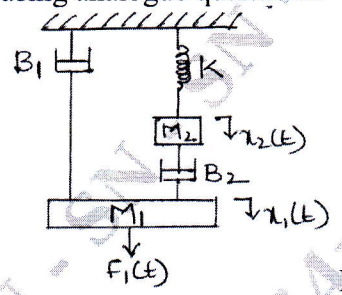

Fig. Q3 (a)

b. Determine the overall transfer function of a block diagram shown in Fig. Q3 (b). **(08 Marks)**

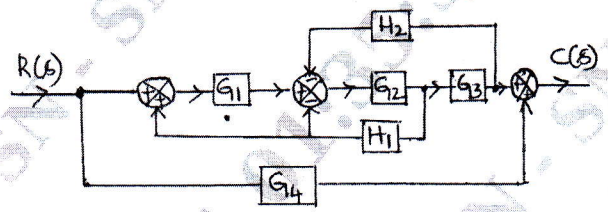

Fig. Q3 (b)

4 a. Determine the transfer function of field controlled DC motor which relates output angular displacement (θ) with input voltage (e_f). **(08 Marks)**

b. Obtain the overall TF of SFG given:

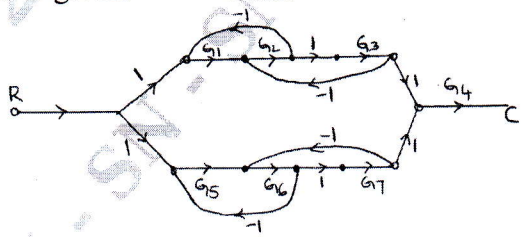

Fig. Q4 (b) **(08 Marks)**

5 a. Discuss the various standard inputs used in control system analysis. **(04 Marks)**

b. Derive the response equation of 1st order system for unit step input. **(06 Marks)**

c. Applying RH criterion, discuss the stability of closed loop system as a function of K for the following OLTF,

$$G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+4s+16)}.$$ **(06 Marks)**

6 Sketch the Root locus plot for $G(s)H(s) = \frac{K}{s(s+2)(s+4)(s+6)}$. For what values of K, the system becomes UNSTABLE. **(16 Marks)**

7 a. Sketch the Polar plot for the transfer function, $G(s) = \frac{1}{(1+s)(1+2s)}$. **(06 Marks)**

b. Apply Nyquist stability interior to the system with loop transfer function, $G(s)H(s) = \frac{4s+1}{s^2(1+s)(1+2s)}$. Ascertain its stability. **(10 Marks)**

8 For a unity feedback system with OLTF, $G(s) = \frac{40(s+5)}{s(s+10)(s+2)}$

Draw the Bode plot and determine : GM, PM, ω_{gc}, ω_{PC}. Comment on the stability of the system. **(16 Marks)**

9 a. Write down the characteristics of,
(i) Lag compensator
(ii) Lead compensator.
(iii) Lag-lead compensator. **(09 Marks)**

b. Define : (i) State (ii) State vector (iii) Controllability (iv) Observability **(07 Marks)**

10 a. Find the controllability and observability of the system described by the state equation:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u;$$

$y[1 \quad 0]x$. **(08 Marks)**

b. Explain the design of lead compensator using Root locus (procedure only). **(08 Marks)**

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