2023

M.Sc.

4th Semester Examination

ELECTRONICS

PAPER : ELC-403

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks.
Candidates are required to give their answers in their own words as far as practicable.
Illustrate the answers wherever necessary.

Answer **all** questions.

(CONTROL SYSTEM AND INSTRUMENTATION)

1. Answer *any* **four** questions from the following : 2×4=8

(a) Open-loop transfer function of a control system is given by $G(S) = \frac{5}{(S+3)}$ and $H(S) = \frac{3}{(S+5)}$. Determine the characteristic equation. 2

(b) Depending upon the ξ, mention the different damping systems. 2

(c) Open-loop transfer function of a control system is given by $G(S) = \frac{k}{(1+ST_1)(1+ST_2)}$.

Draw the polar plot of the system. 2

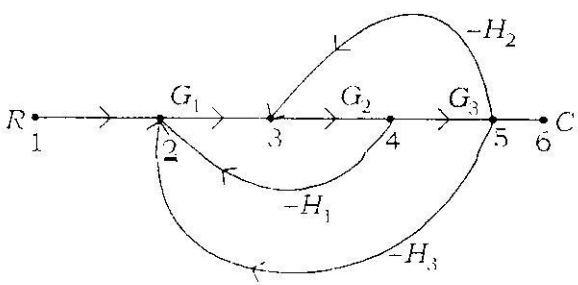
(d) Differentiate between Mason's gain formulas and block diagram reduction method. 2

(e) Mention two applications of spectrum analyzer. 2

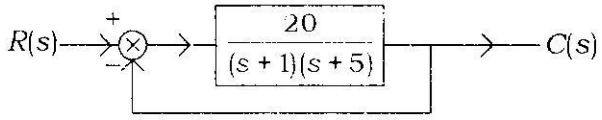
(f) Define phase margin and gain margin of a control system. 2

2. Answer *any* **four** questions from the following : 4×4=16

(a) Find e/R of the following SFG using Mason's gain formula : 4



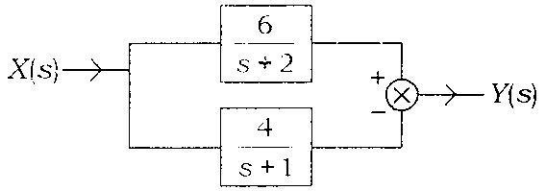
(b) The block diagram of a unity feedback control system is shown below :



Determine the characteristic equation of the system t_p and M_p. 2+2=4

(c) The open-loop transfer function of a unity feedback system is given by $G(S) = \frac{50}{(1+0{\cdot}1S)(S+10)}$. Determine static error coefficients K_p and K_v. 2+2=4

(d) Show that the transfer function Y(s)/X(s) has a zero in the right half s plane. Obtain Y(t) when $X(t)$ is a unit step for the system shown below : 4



(e) Sketch the Bode plot of the system 4

$$G(S) = \frac{1}{(S+3)^3}$$

(f) Differentiate between active and passive transducers. What are the advantages of semiconductor strain guage? 2+2=4

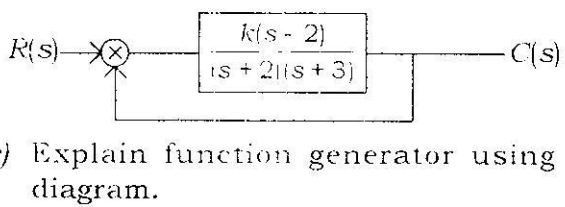
3. Answer *any* **two** questions from the following : 8×2=16

(a) The characteristic equation of a feedback control system is given below :

$$S^4 + 25S^3 + 15S^2 + 20S + K = 0$$

Determine the range of K for stability. Determine the value of K so that the system is marginally stable and find the frequency of sustained oscillations. 4+2+2=8

(b) For the system shown below, sketch the Nyquist plot for $K = 2$ and use the Nyquist criteria to determine whether the closed loop system is stable for this gain. Find the range of K for the system to be stable. 6+2=8



(c) Explain function generator using block diagram. 8

(d) Sketch the root locus plot for the system having open-loop transfer function given by

$$G(S)H(S) = \frac{k}{S(S+4)(S^2+4S+13)}$$ 8

[Internal Assessment : 10 Marks]

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