Total No. of Pages: 4

510703

Roll No.

510703

B. Tech. V - Sem. (Main/Back) Exam., (Academic Session 2021- 2022)
Electronics & Communication Engineering
5EC4 – 03 Control System

Time: 3 Hours

Maximum Marks: 120
Min. Passing Marks:

Instructions to Candidates:

Part – A: *Short answer questions (up to 25 words) 10 × 2 marks = 20 marks. All ten questions are compulsory.*

Part – B: *Analytical/Problem solving questions 5 × 8 marks = 40 marks. Candidates have to answer five questions out of seven.*

Part – C: *Descriptive/Analytical/Problem Solving questions 4 ×15 marks = 60 marks. Candidates have to answer four questions out of five.*

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. Graph paper

2. Semi Logarithmic paper

PART – A

Q.1 Compare the difference between the open loop and closed loop system. [2]

Q.2 Outline the force current analogy for the elements of mechanical translational system. [2]

Q.3 What do you mean by characteristic equation? [2]

Q.4 What is lead compensator? What are its applications? [2]

Q.5 Why frequency domain compensation is normally carried out using bode plots? [2]

Q.6 What is use of M and N circles? [2]

Q.7 Why the frequency compensation is normally carried out using Bode plots? [2]

Q.8 State the Routh-Hurwitz stability criterion. [2]

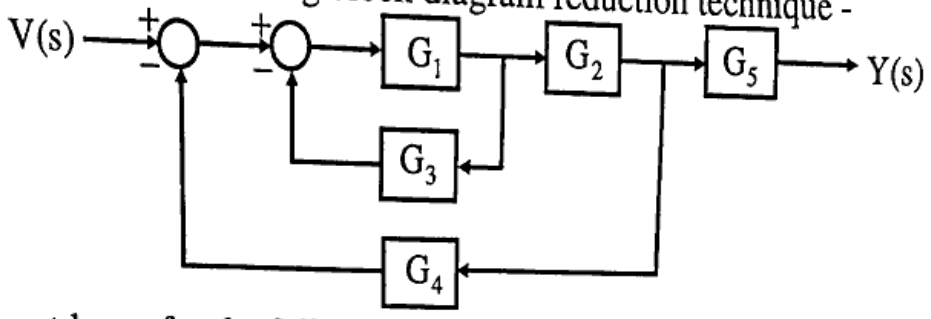
Q.9 Define Controllability and Observability. [2]

Q.10 Define Optimal control and Nonlinear control system. [2]

PART – B

Q.1 The impulse response of a closed loop control system having unity feedback is $c(t) = -te^{-t} + 2e^{-t}$ $(t > 0)$. Calculate the open loop transfer function. [8]

Q.2 Find the transfer function using block diagram reduction technique - [8]



Q.3 Draw the root locus for the following open loop transfer function and determine the range of K for stability - [8]

$$G(s)H(s) = \frac{K}{s(s^2 + 2s + 4)}$$

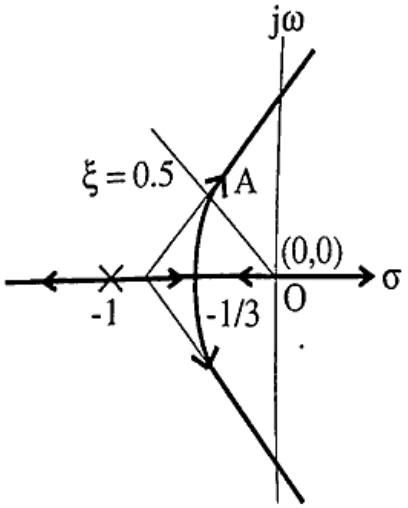
Q.4 Find the phase margin for the open loop transfer function given below - [8]

$$G(s)H(s) = \frac{2\sqrt{3}}{s(s + 1)}$$

Q.5 Write the procedure for the design of lag compensator and lag-lead compensator using Bode plot. [8]

Q.6 Define controllability and observability in state space model and write down the formulas to establish controllability and observability for a given state space model. [8]

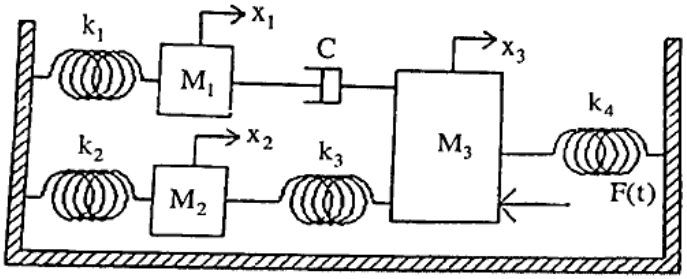
Q.7 The characteristic equation of a unity feedback system is $1 + KG(s) = 0$. The open loop transfer function G (s) has one pole at zero and two poles at -1. The root locus of the system is shown in figure given below. The constant damping ratio line for get a = 0.5, intersects the root locus at point A. The distance from the origin to point A is given as 0.5. Find the value of K at point A. [8]



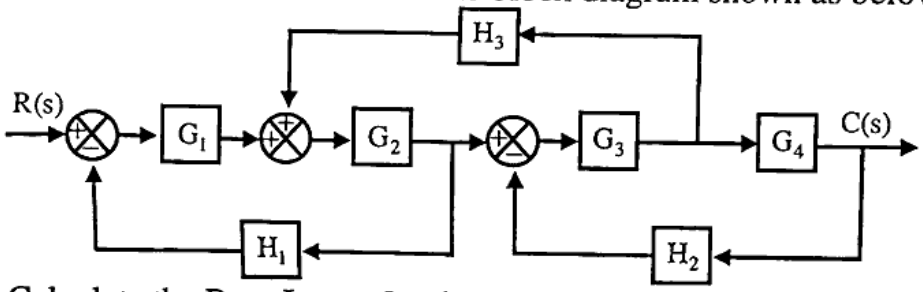
PART – C

Q.1 (a) A certain system is described by the differential equation, $\frac{d^2y}{dt^2} + 14\frac{dy}{dt} + 40y = 5$. Find the expression for y(t), assuming initial conditions to be zero. [8]

(b) Write the differential equations of motion for the following system - [7]



Q.2 (a) Find the transfer function for the block diagram shown as below - [8]



(b) Calculate the Root Locus for the closed loop system shown in the below figure. [7]