R18 Regulation *Subject code:* 2P4BD

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech IV Semester Regular/Supplementary Examinations, July 2021

CONTROL SYSTEMS

(ELECTRICAL AND ELECTRONICS ENGINEERING)

Maximum Marks: 70 Date: 04.08.2021 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10x2M=20 Marks)

1 What are the different types of control system?
2 Write the expression for Mason's gain formula?
3 What are the standard test signals used in control systems?
4 What is the need of PID controller?
5 Define a stable system.
6 What are the merits of frequency domain analysis?
7 What is polar plot?
8 What is a Phase Lead compensator and why is it used?
9 Write any four advantages of state variable representation?
10 Write classical form equations of the state space model?

Part-B

Answer All the following questions. (5X10M=50Marks)

11 A. Contrast differences between open loop and closed loop control systems with suitable example?

B. Write the differential equations governing the mechanical system as shown in below figure.1. And determine the transfer function. [5+5]

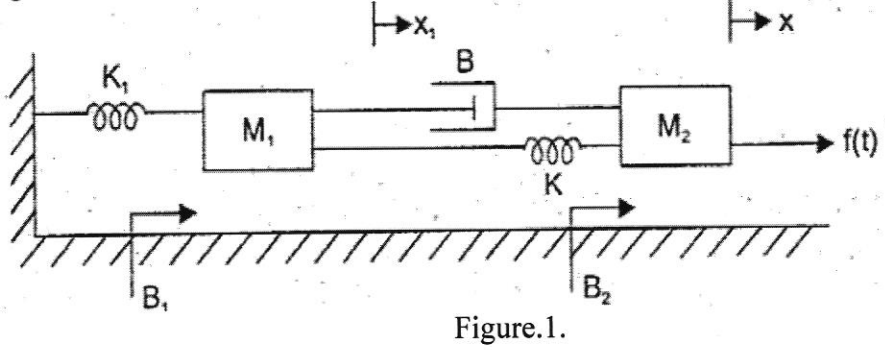

Figure.1.

OR

12 A. Describe the construction and operating principle of synchro transmitter with neat diagrams.

B. Find the overall transfer function of the system whose signal flow graph is shown in figure.2 [5+5]

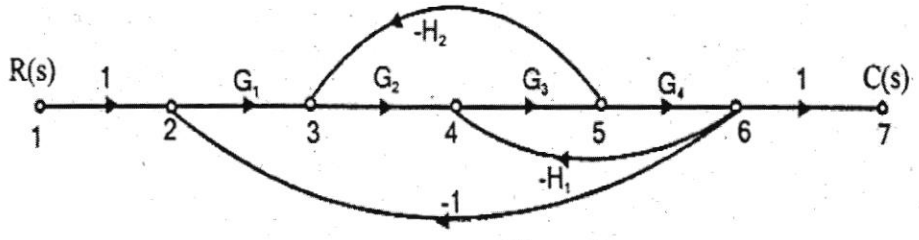

Figure.2.

13 A. Derive the time domain specifications of second order system with unit step input.

B. A unity feedback system has a forward path transfer function $G(S) = \frac{10}{S(S+2)}$. Find the rise time, percentage overshoot, peak time, settling time for a step input of 12 units. [5+5]

OR

14 A. Derive the time response of second order system under undamped for unit step input.

B. A unity feedback system has a forward function $G(S) = \frac{K_1(2S+1)}{S(5S+1)(1+S)^2}$ when the input r(t)=1-6t, determine the minimum value of K1 so that steady state error is less than 0.1. [5+5]

15 A. How RH stability criterion can be used to study the relative stability?

B. Sketch the root locus of the system, whose open loop transfer function is $G(S) = \frac{K}{S(S+2)(S+4)}$. Find the value of K so that the damping ratio of the closed loop system is 0.5. [3+7]

OR

16 Sketch the Bode plot and determine the Gain margin and phase margin. For the open transfer function is given $G(S) = \frac{75(1+0.2s)}{S(S^2+16s+100)}$. [10]

17 Draw the Nyquist plot for the system whose open loop transfer function is $G(S)H(S) = \frac{(1+4s)}{S^2(1+S)(1+2S)}$. Determine the stability of a closed loop system. If the closed loop system is not stable then find the number of closed loop poles lying on the right half of S-plane. [10]

OR

18 A. Explain in detail about the lag compensation technique.

B. Sketch the polar plot for open loop transfer function $G(S) = \frac{1}{S(1+S^2)}$. [4+6]

19 A. Obtain the state space representation of an n^{th} order differential equation.

B. Diagonalize the given system matrix $A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -5 & -4 \end{pmatrix}$. [5+5]

OR

20 Check the controllability and observability of the given system $A = \begin{pmatrix} 0 & 1 \\ -1 & -3 \end{pmatrix}$, $B = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, $C = (1 \quad 1)$ [10]