**Code No.PC406EC**

**METHODIST COLLEGE OF ENGINEERING & TECHNOLOGY**

**(An Autonomous Institution)**

**B.E. (ECE) IV-Semester (AICTE) Regular Examination, AUGUST-2023**

**Subject: AUTOMATIC CONTROL SYSTEMS**

**Time: 3 hours Max.Marks:60**

**Note: Missing data, if any, maybe suitably assumed.**

**PART-A**

**Answer All the questions.(10X2M=20M)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q.No.** | **Questions** | **Marks** | **CO** | **BTL** |
| **1. a** | Define Transfer Function for a system.  | **2M** | **1** | **1** |
| **b** | Write the Mason’s Gain formula.  | **2M** | **1** | **1** |
| **c** | Explain RH criterion of stability. | **2M** | **2** | **2** |
| **d** | Given r(t)=(1-t2)u(t) and G(s) = $\frac{2}{s^{2}(s+3)}$. find steady state error. | **2M** | **2** | **3** |
| **e** | State the Principle of Argument.  | **2M** | **3** | **1** |
| **f** | What isNyquist Criterion for stability? | **2M** | **3** | **1** |
| **g** | List any two properties of state transition matrix. | **2M** | **4** | **1** |
| **h** | Define Controllability and Observability of a system | **2M** | **4** | **1** |
| **i****j** | What is the transfer function of Zero order hold circuit?Identify the advantages of Digital Control Systems. | **2M****2M** | **5****5** | **1****2** |

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**PART-B**

**Answer Any Five questions**.**(5X8M=40M)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q.No.** |  | **Questions** | **Marks** | **CO** | **BTL** |
| **2.** | **a** | What is the open loop DC gain of a unity negative feedback sys having closedloop transfer function as $\frac{(s+4)}{(s^{2}+7s+13)}$. | **3M** | **1** | **3** |
| **b** | Derive the Transfer Function for the Mechanical System shown below. Also draw the Force-Voltage analogous circuit. | **5M** | **1** | **4** |
| **3.** | **a** | Construct Root Locus for the following Open Loop Transfer Function: G(s) =$\frac{k}{[s\left(s+4\right)\left(s^{2}+s+20\right)]}$. | **8M** | **2** | **4** |
|  |  |  |  |  |
| **4.** | **a** | What are the merits of Bode Plots over Nyquist Plot? | **3M** | **3** | **1** |
| **b** | Illustrate the need for a compensator.For a Lead-compensator network, draw pole-zero plot, Bode plot and list the Transfer Function expression. | **5M** | **3** | **3** |
| **5.** | **a** | Obtain the state space representation of the following systems described by the differential equation $$\frac{d^{3}x}{dt^{3}}+3\frac{d^{2}x}{dt^{2}}+4\frac{dx}{dt}+4x=u\_{1}\left(t\right)+3u\_{2}\left(t\right)+4u\_{3}(t)$$Output equations:$y\_{1}=4\frac{dx}{dt}+3u\_{1}(t)$ ;$$y\_{2}=\frac{d^{2}x}{dt^{2}}+ 4u\_{2}(t)+ u\_{3}(t)$$ | **5M** | **4** | **4** |
| **b** | Specify the need for state variables. | **3M** | **4** | **2** |
| **6.** | **a** | Illustrate the block diagram of digital control systems. | **5M** | **5** | **4** |
| **b** | Draw the circuit of Sample and Hold circuit and obtain its Transfer Function. | **3M** | **5** | **4** |
| **7.** | **a** | Discuss about the Block Diagram representation and its components of a control system. | **3M** | **1** | **3** |
| **b** | Write the standard form of a second order system whose closed loop poles are located at s= (-3$)\pm $j4. Then calculate the rise time. | **5M** | **2** | **4** |
| **8.** | **a** | Given the characteristic Equation is 2s3 + 3s2 + 2s + k =0, find the condition for k for the system to be stable. | **4M** | **3** | **4** |
| **b** | Compute the observability matrix of the system matrix: A=$\left[\begin{matrix}1&2\\3&4\end{matrix}\right]$ ,B = $\left[\frac{2}{5}\right]$, C= $\left[3 4\right]$ | **4M** | **4** | **4** |
| **9.** | **a** | For the system, find response at sampling instants to unit step input for T = 1 sec, k=1. | **5M** | **5** | **4** |
| **b** | Write short notes on frequency domain specifications. | **3M** | **3** | **3** |

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