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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

Make UP EXAMINATION - JULY 2024

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| **Semester : V** | **Date :03-JULY-2024** |
| **Course Code :EEE205** | **Time :9:30AM-12:30PM** |
| **Course Name :** **Control Systems** | **Max Marks :100** |
| **Program :B.Tech** | **Weightage :50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 4 QUESTIONS 4Q X 5M=20M** | | | |
| 1 | List and define the time domain specifications. | (CO 2) | [Knowledge] |
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| 2 | List the differences between open loop control systems and closed loop control systems. | (CO 1) | [Knowledge] |
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| 3 | Write the necessary and sufficient condition for stability in Routh’s stability criterion | (CO 3) | [Knowledge] |
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| 4 | Define: Underdamped, undamped, critically damped and over damped systems. | (CO 2) | [Knowledge] |
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| 5 | Define observability and controllability of a system. | (CO 4) | [Knowledge] |
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| 6 | What is a compensator? State the difference between lead and lag compensator. | (CO 4) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 7 | A signal flow graph is the graphical representation of the relationships between the variables of set linear algebraic equations. Obtain the transfer function of the the following SGF. | (CO 1) | [Comprehension] |
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| 8 | Steady-state error is a property of the input/output response for a linear system and defined as the difference between the desired value and the actual value of a system output in the limit as time goes to infinity. The magnitudes of the steady-state errors due to these individual inputs are indicative of the goodness of the system. For the feedback control systems given in figure 1, identify the type of input signal which gives rise to a constant steady state error and evaluate the expected steady state error values | (CO 2) | [Comprehension] |
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| 9 | The root locus shows the changes in the transient response as the gain, K, varies. We can clearly see ranges of stability, ranges of instability, and the conditions that cause a system to break into oscillation. A control system has open loop transfer function G(s) = k/s(s + 2). Find the breakaway point, centroid and Root locus branch for the above transfer function | (CO 3) | [Comprehension] |
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| 10 | The characteristic equation, also known as the determinant equation, is the equation obtained by equating to zero the characteristic polynomial. The characteristics equation of a system is given as s^5+3s^4+s^3+3s^2+s+3=0. State the stability of the system. | (CO 3) | [Comprehension] |
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| 11 | When a system is subjected to Step input r(t)=Au(t). The steady state error is given by eSS=A/(1+Kp). Where kp is known as static position error constant. Find the steady state error for the unit ramp input for the given negative non-feedback system is G(s)=100(S+5)/((S^2+5S+10)), H(s)=1/((S) ). | (CO 2) | [Comprehension] |
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| 12 | The state model of a system consists of the state equation and output equation. The state equation of a system is function of state variables and inputs.  i. Obtain the state model of the electrical network shown in Fig. by choosing minimal number of state variables.  Control Systems - State Space Model - Tutorialspoint | (CO 4) | [Comprehension] |
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| 13 | The two systems are said to be analogous to each other if the following two conditions are satisfied.  (i). The two systems are physically different & (ii). Differential equation modelling of these two systems are same. Electrical systems and mechanical systems are two physically different systems. Represent any electrical and mechanical systems with its differential equations. | (CO 1) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 15M=30M** | | | |
| 14 | The log-magnitude and phase frequency response curves as functions of log ω are called Bode plots or Bode diagrams. Sketching Bode plots can be simplified because they can be approximated as a sequence of straight lines. Straight-line approximations simplify the evaluation of the magnitude and phase frequency response. The open loop transfer function of unity feedback control system is . Sketch the Bode plot with the indication of all the parameters which are required to assess the stability of the system. Also state whether the system is stable or not | (CO 4) | [Application] |
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| 15 | The state model of a system consists of the state equation and output equation. The state equation of a system is function of state variables and inputs.  a. Find the transfer function of the system described by state space model as  ] X + ; Y = [0 1] X | (CO 4) | [Application] |
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| 16 | The open loop transfer function of a system is given by:  G(s) = 40/ (S+4)(S +1) . Sketch the Nyquist plot and comment on the stability of the system. | (CO 3) | [Application] |
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