| O.P.Code: 23EE0215 | R23 | H.T.No. | | | | | | | | | |
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**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**
(AUTONOMOUS)
**B.Tech. II Year II Semester Supplementary Examinations December-2025**
**CONTROL SYSTEMS**
(Electrical and Electronics Engineering)

**Time: 3 Hours** **Max. Marks: 70**

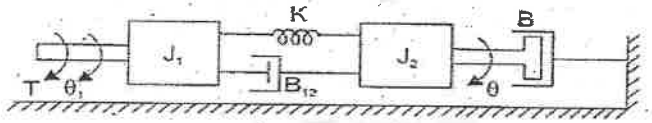
**PART-A**
(Answer all the Questions **10 x 2 = 20** Marks)

| | | | | | |
|---|---|---|---|---|---|
| 1 | a | What is Synchros? | CO1 | L1 | 2M |
| | b | Write the analogous electrical elements in force-voltage for the elements of mechanical translational systems. | CO1 | L2 | 2M |
| | c | How the system was classified depending on the value of the damping? | CO2 | L2 | 2M |
| | d | What are the different types of controllers? | CO2 | L1 | 2M |
| | e | What is centroid? How the centroid is calculated? | CO3 | L1 | 2M |
| | f | Define asymptotes. How will you find the angle of asymptotes | CO3 | L1 | 2M |
| | g | Define gain margin. | CO4 | L1 | 2M |
| | h | List the frequency domain specifications. | CO4 | L1 | 2M |
| | i | What is state diagram? | CO5 | L1 | 2M |
| | j | Define observability and Controllability. | CO5 | L1 | 2M |

**PART-B**
(Answer all Five Units **5 x 10 = 50** Marks)

**UNIT-I**

| | | | | | |
|---|---|---|---|---|---|
| 2 | | Write the differential equations governing the mechanical rotational system shown in the figure and find transfer function. | CO1 | L3 | 10M |




**OR**

| | | | | | |
|---|---|---|---|---|---|
| 3 | a | Give the block diagram reduction rules to find the transfer function of the system. | CO1 | L3 | 5M |
| | b | List the properties of signal flow graph. | CO1 | L2 | 5M |

**UNIT-II**

| | | | | | |
|---|---|---|---|---|---|
| 4 | | List out the time domain specifications and derive the expressions for Rise time, Peak time and Peak overshoot. | CO2 | L3 | 10M |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| 5 | | Define steady state error. Derive the static error components for Type 0, Type 1 & Type 2 systems. | CO2 | L2 | 10M |

**UNIT-III**

| | | | | | |
|---|---|---|---|---|---|
| 6 | | With the help of Routh's stability criterion determine the stability of the following systems represented by the characteristic equations:<br>i) $S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5 = 0$<br>ii) $9S^5 - 20S^4 + 10S^3 - S^2 - 9S - 10 = 0$ | CO3 | L3 | 10M |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| 7 | | Develop the root locus of the system whose open loop transfer function is $G(S) = \frac{K(S+9)}{S(S^2+4S+11)}$ | CO3 | L4 | 10M |

**UNIT-IV**

| | | | | | |
|---|---|---|---|---|---|
| 8 | a | Determine the transfer function of Lag Compensator and draw pole-zero plot. | CO4 | L3 | 5M |
| | b | Define and derive the expression for resonant frequency. | CO4 | L2 | 5M |



**OR**

| | | | | | |
|---|---|---|---|---|---|
| 9 | | Develop the Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5 rad/sec. $G(S) = \frac{KS^2}{(1+0.2S)(1+0.02S)}$ | CO4 | L4 | 10M |

**UNIT-V**

| | | | | | |
|---|---|---|---|---|---|
| 10 | a | Explain the properties of STM. | CO5 | L3 | 5M |
| | b | Define state, state variable, state equation. | CO5 | L2 | 5M |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| 11 | | State whether the system is controllable and observable for the linear time invariant system characterized by the state model $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ 2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u, Y(t) = \begin{bmatrix}1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$. | CO5 | L3 | 10M |

*** END ***