PAPER ID-310477

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM V) THEORY EXAMINATION 2024-25
CONTROL SYSTEM

TIME: 3 HRS **M.MARKS: 70**

Note: Attempt all Sections. In case of any missing data; choose suitably. If required, use **graph paper, and Semi-log paper.**

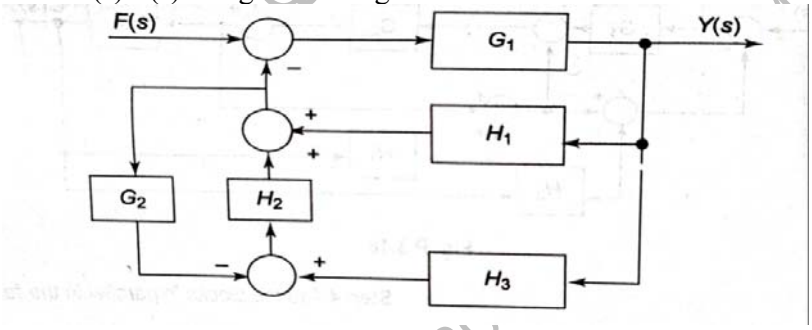
SECTION A

1. Attempt *all* questions in brief. **2 x 07 = 14**

Q no.		CO	Level
a.	Explain, how the control systems are classified?	CO1	K3
b.	Draw Torque –Speed characteristic of an AC servo motor and mention the effect of X/R ratio.	CO1	K3
c.	The transfer function of a system is given by $T(s)= K(s+6) / s(s+2)(s+5)(s^2+7s+12)$ Determine (i) Poles (ii) Zeros (iii) Characteristic equation and (iv) Pole-Zero plot	CO2	K4
d.	Explain the term absolute and conditional stability.	CO3	K4
e.	Define Phase margin, Gain margin Gain cross-over frequency and phase cross-over frequency.	CO4	K4
f.	Draw Lag and Lead network with passive elements.	CO5	K4
g.	Discuss Kalman's test for determining state controllability.	CO5	K4

SECTION B

2. Attempt any *three* of the following: **07 x 3 = 21**

a.	Reduce the block-diagram shown in Fig (a). .Obtain overall transfer function Y(s)/F(s) using block-diagram reduction rules.  Fig (a)	CO1	K3
b.	Draw the time response curve and define the time response specification of second order control system for unit step input.	CO2	K4
c.	For unity feedback system, open-loop transfer function is $G(s)=K / s(s^2+10s+36)$ Find the range of K for which the system is stable. Also, determine the value of K for which the system response is oscillatory and the value of frequency of oscillation at this value of K.	CO3	K4

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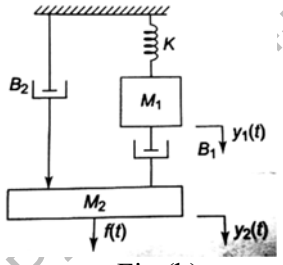
d.	For the function , $G(s)=10 / (s+4)(s^2+4s+8)$ Draw a sketch of the polar plot and find the intersection with the real and imaginary axis.	CO4	K4
e.	The system matrix of a linear time-invariant system is $A=\begin{bmatrix}-1 & 1\\ 0 & -1\end{bmatrix}$ Determine the state transition matrix by power series method. Also, verify the result by Laplace transform method.	CO5	K4

SECTION C

3. Attempt any *one* part of the following: **07 x 1 = 07**

a.	Explain the effect of feedback of control system on the followings: (i) Overall gain (ii) Bandwidth	CO1	K3
b.	Obtain the transfer function $Y_{1(s)/F(s)}$ of mechanical system shown in Fig-(b)  Fig.(b)	CO1	K3

4. Attempt any *one* part of the following: **07 x 1 = 07**

a.	(i) Derive the expression for the rise time of the response to unit step input for the system whose closed loop transfer function is $\frac{C(s)}{R(s)}=\frac{a}{s+a}$ (ii) How steady state error of a control system is determined? How it can be reduced.? Discuss it	CO2	K4
b.	Discuss Proportional Derivative controller and obtain its overall effect on specifications of the second order system.	CO2	K4

5. Attempt any *one* part of the following: **07 x 1 = 07**

a.	State and explain Hurwitz criterion. Also write a note on special cases of Routh's criterion.	CO3	K4
b.	Discuss any three rules for construction of root locus. Also determine angle of departure for the open loop transfer function of feedback control system $G(s)H(s)=\frac{K}{s(s^2+6s+12)}$	CO3	K4

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6.	**Attempt any *one* part of the following:**	**07 x 1 = 07**	
a.	Using standard transfer function of a second order system, derive the expression of resonant peak and resonant frequency.	CO4	K4
b.	Sketch the Nyquist plot for G(S)H(s)=$\frac{(s-z_1)}{s(s+p_1)}$; z_1, p_1>0	CO4	K4

7.	**Attempt any *one* part of the following:**	**07 x 1 = 07**	
a.	Explain the effects and limitations of three types of electrical compensators.	CO5	K4
b.	Discuss the derivation of the state model using following method (i) Bush or companion form(ii) Jordan's form	CO5	K4