BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2023)

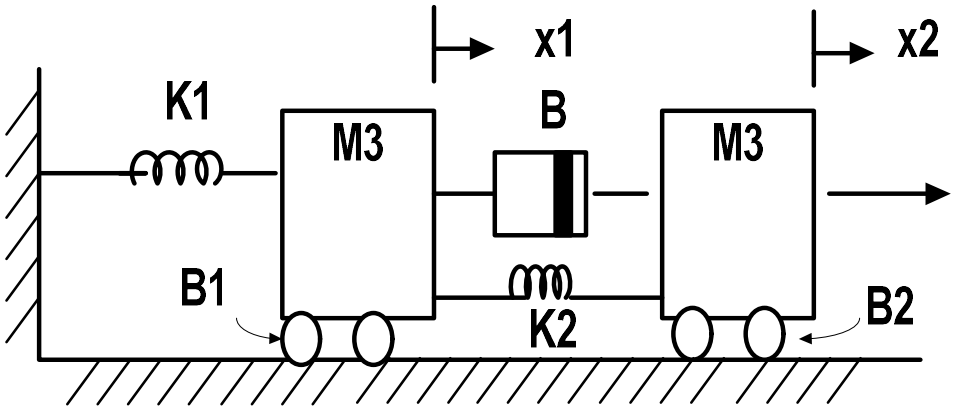
CLASS: BTECH — **SEMESTER : V**
BRANCH: EEE — **SESSION : MO/2023**

SUBJECT: EE351 CONTROL THEORY

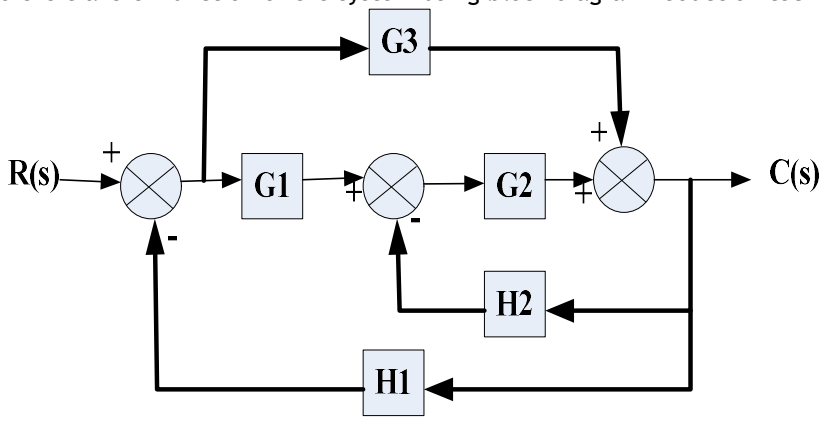
TIME: 02 Hours — **FULL MARKS: 25**

INSTRUCTIONS:
1. **The question paper contains 5 questions each of 5 marks and total 25 marks.**
2. **Attempt all questions.**
3. **The missing data, if any, may be assumed suitably.**
4. **Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Define causal system, close loop system, Time Variant system, non-minimum phase system	[2]	CO1, CO2, CO3,	2
Q.1(b)	Write down the differential equations describing the dynamics of the mechanical system shown in figure. Draw the electrical f-v analogous system K1 and K2 are the stiffness of the springs. B1, B2 and B are damping coefficients.	[3]	CO1, CO2, CO3,	3

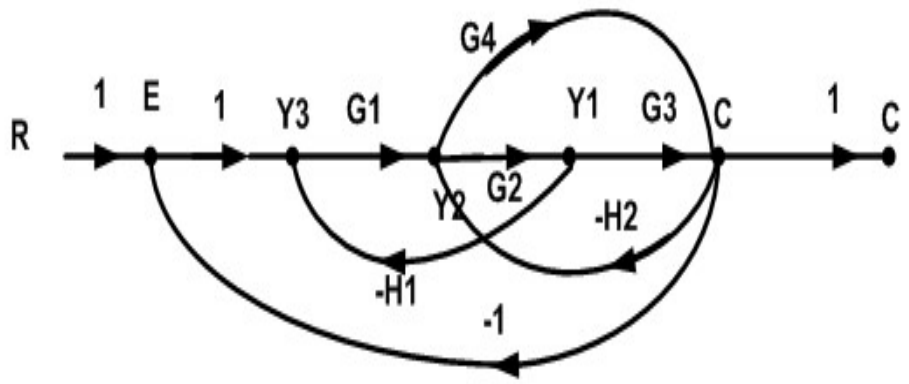


Q.2(a)	How to linearize the non linear system, Obtain the linearized model for non- linear system at operating point x=1, $y = 2x^3 + x^2 + 1$	[2]	CO1, CO2, CO3,	2
Q.2(b)	Find the transfer function of the system using block diagram reduction technique.	[3]	CO1, CO2, CO3,	2



Q.3(a) Determine the sensitivity of negative feedback closed loop system transfer function for w=1 rad/sec with respect to forward path and feedback path When open loop gain $G(s)=\frac{20}{s(s+5)}$ and feedback gain H(s)=0.8 [2] CO1, CO2, CO3, 2

Q.3(b) [3] CO1, CO2, CO3, 2



Find C(s)/R(s) of given line diagram using mason`s gain formula

Q.4(a) The system with unity negative feedback having open loop gain $G(s)=\frac{25}{s(s+5)}$, Determine the damping frequency, rise time percentage overshoot, and settling time with 5% tolerance of closed loop system subjected to unit step input. [2] CO1, CO2, 3

Q.4(b) Consider a negative feedback system with $G(s)=\frac{1}{s^2(s+1)}$ and $H(s)=\frac{20}{s+20}$ Find the error constant. [3] CO1, CO2, 2

Q.5(a) Find the system gain at point $s=-4+j4$, for the given $G(s)=\frac{K}{s(s+8)}$ [2] CO1, CO2, 2

Q.5(b) Sketch the root locus of the unity feedback system where K is varying from 0 to infinity. $G(s)=\frac{K(S+5)(S+2)}{(S+7)(S+10)}$ [3] CO1, CO2, 3

:::::21/09/2023 M:::::