BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP2023)

CLASS: BTECH **SEMESTER : VI**
BRANCH: EEE **SESSION : SP2023**

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)	Derive the transfer function of the system given in Figure 1. Represent the block diagram of the system.	[2]	1	1,3

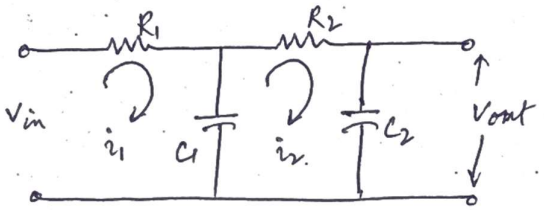

Figure-1

Q.1(b)	Describe the effects of feedback (i) on stability of a system (ii) on sensitivity due to parameter variation in a system.	[3]	1,3	2
Q.2(a)	Define the following for SFG: loop, self loop, path gain, loop gain.	[2]	1	1
Q.2(b)	Apply Mason's gain formula to obtain the overall gain of the system from signal flow graph shown in Figure 2.	[3]	1	3

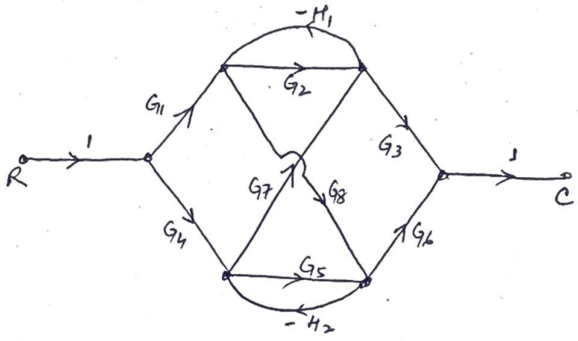

Figure -2

Q.3(a)	Classify a system depending on the value of damping. (i) Draw the nature of response of a 2nd order system with different types of damping. (ii) Sketch the response of a 2nd order underdamped system.	[2]	3	1,2
Q.3(b)	A unity feedback control system has open-loop transfer function $G(s)=\frac{10}{s(s+2)}$ Determine the rise time, % overshoot, peak time and settling time for a step input of 12 volts.	[3]	1,3	3

PTO

Q.4(a)	The characteristic equation of a system is given by $s^4 + 20s^3 + 15s^2 + 2s + k = 0$ (i) Determine the range of k for the system to be stable. (ii) Can the system be marginally stable? If so, determine the required value of k and the frequency of oscillation.	[2]	1,3	3,6
Q.4(b)	Construct the root locus of the system whose open-loop TF is $G(s) = \frac{k}{s(s+2)(s+4)}$ (i) Evaluate the value of k and frequency of oscillation, where the root locus crosses the imaginary axis. (ii) Determine the value of k so that the dominant pair of complex conjugate poles of the system has a damping ratio of 0.5.	[3]	1,2, 3	3,5,6
Q.5(a)	Define frequency response of a system. Derive the expression of resonant frequency.	[2]	3	1,3
Q.5(b)	Construct the Bode plot for the unity feedback system which is given by $G(s) = \frac{1000}{(1+0.1s)(1+0.001s)}$. Determine (i) gain margin (ii) phase margin (iii) assess stability of the system.	[3]	2,3	3,5,6

::::::22/02/2023::::::M