BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.TECH. **SEMESTER : VI**
BRANCH: EEE **SESSION : SP/2023**

SUBJECT: EE351 CONTROL THEORY

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	State the Mason's gain formula. Obtain the overall gain of the system shown in Fig-1 using Mason's gain formula.	[5]	1	2,3

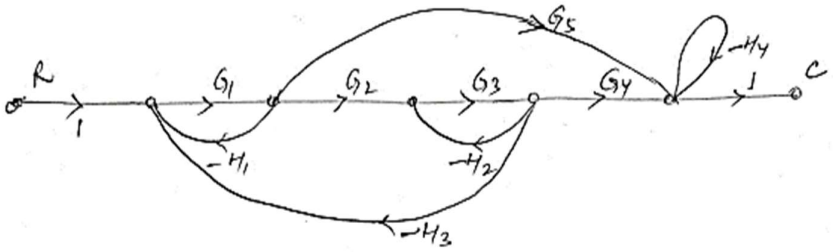

Fig-1.

Q.1(b)	Draw the signal flow graph of the system shown in Fig-2. Determine C/R for the system using block diagram reduction technique.	[5]	1	2,3

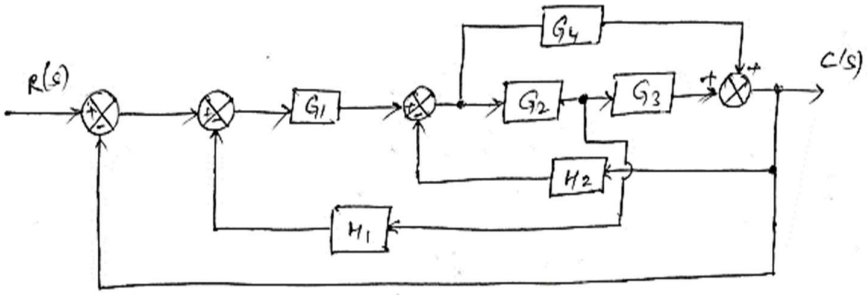

Fig-2

Q.2(a)	A second order system is represented by a transfer function given by $\frac{Q_0(s)}{T(s)} = \frac{1}{Js^2 + fs + K}$, where $Q_0(s)$ is the proportional output and T is the input torque. A step input of 10Nm is given to the system and test results are given below: M_p=6%, t_p=1 Sec , e_{ss}=0.5 rad. Determine the values of K, J and f.	[5]	1,3	4,5
Q.2(b)	A unity feedback control system has an open-loop TF $G(s) = \frac{K}{s(s^2 + 4s + 13)}$ Sketch the root locus. Also examine the stability of the system.	[5]	1,2	2,3,4

PTO

Q.3(a)	Establish the correlation between time domain and frequency domain specifications.	[5]	1.3	4
Q.3(b)	Sketch the polar plot for the system whose open loop transfer function is given by $G(s)H(s)=\frac{20}{s(s+1)(s+2)}$.	[5]	2	2,3
Q.4(a)	Explain (i) tachometers (ii) synchros.	[4]	1	1
Q.4(b)	A closed loop control system with unity feedback is shown in Fig-3. By using derivative control the damping ratio is to be made 0.7. Determine the value of derivative rate feedback K_t. The input to the system is step input.	[3]	1,4	5

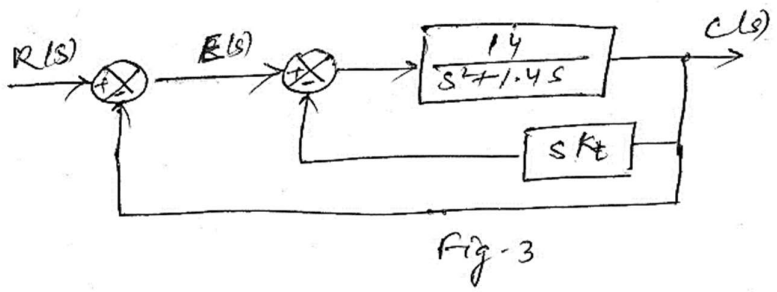

Fig-3

Q.4(c)	What is compensation? Explain. Discuss various types of compensations.	[3]	5	1,6
Q.5(a)	Mention the advantages of state space technique over classical method. Define: state, state variable and state vector.	[5]	1	1,2
Q.5(b)	Outline the usefulness of state transition matrix. The state equation of a linear time invariant system is given by $\dot{X}=\begin{bmatrix}0 & 1\\ -1 & -2\end{bmatrix}X+\begin{bmatrix}0\\ 1\end{bmatrix}u$ $y=\begin{bmatrix}1 & 0\end{bmatrix}X$ Determine the state transition matrix.	[5]	1,3	2,5

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