

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2024

Subject Code:3142003

Date:20-07-2024

Subject Name: Control Theory

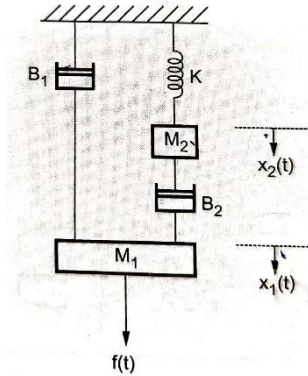
Time:10:30 AM TO 01:00 PM

Total Marks:70

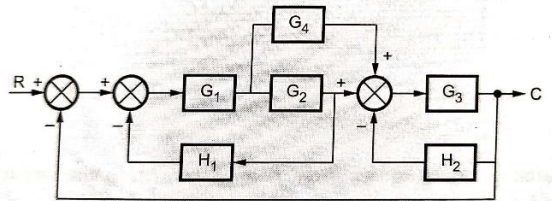
Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Explain the use of Laplace transform in control system.	03
	(b) Distinguish between: (1) Time varying and time invariant Systems, (2) deterministic and Stochastic control systems.	04
	(c) Explain what open loop control system with an example is.	07
Q.2	(a) The transfer function of a system is given by $T(S) = \frac{2(s+2)}{(s+4)^2(s+1)(s^2+2s+2)}$ Determine: (1) Poles, (2) Zeros & (3) Characteristic Equation.	03
	(b) State and explain the basic elements used for modelling of mechanical translational system?	04
	(c) What is force-current analogous system? Which are the analogous quantities according to this method?	07
	OR	
	(c) Determine the transfer function $X_2(t)/f(t)$ of the system shown in fig.	07

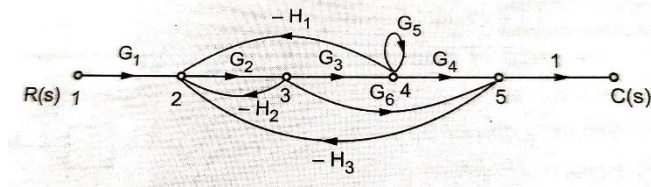


Q.3	(a) Define : Transfer Function, Source Node, Sink Node, Summing Point, Take-off Point.	03
	(b) State the properties of signal flow graph.	04
	(c) Using BLOCK diagram reduction rules, find C/R.	07



OR

- Q.3** (a) Explain the critical rules form the block diagram reduction rules. **03**
 (b) State and explain the meson's Gain Formula to determine the overall transfer function of the closed-loop system. **04**
 (c) Find the overall gain for the signal flow graph shown. **07**



- Q.4** (a) Discuss the various standard inputs used in control system analysis. **03**
 (b) Define steady state response and steady state error. **04**
 (c) Evaluate the static error constants for a unity feedback system having a forward path function $G(s) = \frac{50}{s(s+10)}$. **07**
 Estimate the steady state errors of the system for the input $r(t) = 3 + t + t^2$.

OR

- Q.4** (a) Derive the expressions for static error coefficient when reference input is parabolic of magnitude 'A'. **03**
 (b) Explain about the time constant of first order system. **04**
 (c) With a neat sketch explain all the time domain specification. **07**
- Q.5** (a) What do you understand by absolute stability and relative stability? Which method indicates what type of stability? **03**
 (b) With suitable example explain how relative stability can determine from Nyquist Plot? **04**
 (c) Sketch the root locus of the system whose open transfer function is $G(s) = \frac{K}{s(s+1)(s+3)}$. Determine the value of K for damping ratio equal to 0.5. **07**

OR

- Q.5** (a) Define Routh's stability criterion. **03**
 (b) For a system with characteristic equation $F(s): S^6 + 3S^5 + 4S^4 + 6S^3 + 5S^2 + 3S + 2 = 0$, Examine stability. **04**
 (c) Determine the root locus of the system with $G(s)H(s) = \frac{K(s+5)}{(s^2 + 4s + 20)}$. **07**
