

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:2141004

Date:01-07-2024

Subject Name:Control System Engineering

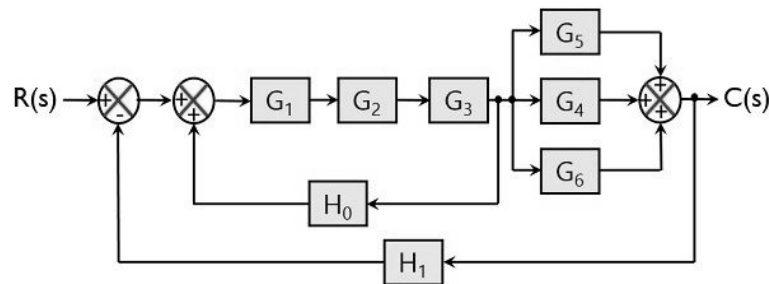
Time:10:30 AM TO 01:00 PM

Total Marks:70

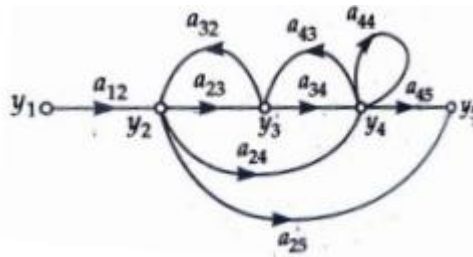
Instructions:

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.

- Q.1** (a) Compare block-diagram and signal flow graph method. 07
 (b) Explain rules of block diagram reduction techniques. 07
- Q.2** (a) Reduce the given block-diagram of figure.1 to its simple form and hence obtain the equivalent transfer function $C(s) / R(s)$. 07



- (b) Write short notes on open loop control systems and closed loop control systems. Discuss their advantages and disadvantages. 07
- OR**
- (b) Obtain transfer function using Signal Flow Graph method. 07



- Q.3** (a) Derive expression for rise time, peak time and max. peak overshoot for second order control system when unit step input is applied. 07
 (b) Derive equation for Force-Voltage analogous electrical network for any Mechanical system. 07

OR

- Q.3** (a) Define Steady State Error and derive the expressions for Error Constants K_p , K_v and K_a corresponding to step, ramp and parabolic input respectively. 07
 (b) Using Routh's criterion check the stability of a system whose characteristic equation is given by $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$ 07

- Q.4** (a) Draw the polar plot for the given transfer function $G(s)H(s) = \frac{10}{s(s+2)(s+5)}$ 07
 (b) Write a short note on phase lead compensator. 07

OR

- Q.4 (a)** Discuss the rules for construction of polar plot. **07**
(b) What is Nyquist stability criterion? Explain, How the gain and phase margin are obtained from Nyquist plots? **07**

- Q.5 (a)** Discuss rules for construction of root locus. **07**
(b) By means of Routh criterion, determine the range of K for stability of the system described by characteristic equation, $s^3 + 8s^2 + 2s + 4K = 0$. **07**

OR

- Q.5 (a)** Sketch the bode plot for the transfer function $G(s) = \frac{10}{s(1+0.5s)(1+0.1s)}$ **07**
(b) Discuss general procedure for construction of Bode plot. **07**
