

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023****Subject Code:2141004****Date:17-07-2023****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.

MARKS

- Q.1**
- | | | |
|-----|---|-----------|
| (a) | Define: (1) System (2) Control system (3) Controller | 03 |
| (b) | Explain Feedback and feed forward system | 04 |
| (c) | Explain & Compare Open loop system & Closed loop system with suitable example | 07 |
- Q.2**
- | | | |
|-----|---|-----------|
| (a) | Define: (1) Laplace Transform (2) Inverse Laplace Transform (3) Transfer Function | 03 |
| (b) | List properties of Laplace transform. Prove any one of them. | 04 |
| (c) | Explain block diagram reduction rules with example | 07 |
- OR**
- | | | |
|-----|---|-----------|
| (c) | Discuss method to obtain signal flow graph with example | 07 |
|-----|---|-----------|
- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Define: (1) State (2) State space (3) State trajectory | 03 |
| (b) | How transfer function is obtained from state model? | 04 |
| (c) | Explain the mathematical modelling of fundamentals components of mechanical translation system. | 07 |
- OR**
- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Obtain the state transition matrix for the state model whose system matrix A is | 03 |
|-----|---|-----------|
- $$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$
- given by
- | | | |
|-----|--|-----------|
| (b) | Discuss the sensitivity of control system. | 04 |
| (c) | What is force current analogous system? Which are analogous quantities according to this method? | 07 |
- Q.4**
- | | | |
|-----|--|-----------|
| (a) | Define: (1) Overdamped (2) Critically damped (3) Underdamped system | 03 |
| (b) | Determine the stability of the given characteristic equation by Hurwitz's method.
$F(s) = s^3 + s^2 + s + 4 = 0$ is a characteristic equation | 04 |
| (c) | Explain rules for construction of root locus. | 07 |
- OR**
- Q.4**
- | | | |
|-----|---|-----------|
| (a) | Define: (1) Delay time (2) Rise time (3) Peak time | 03 |
| (b) | By means of Routh criterion, determine the stability of the system described by characteristic equations.
$s^4 + 2s^3 + 8s^2 + 4s + 3 = 0$ | 04 |
| (c) | Sketch the root locus for the system having
$G(s)H(s) = K / s (s^2 + 2s + 2)$. | 07 |

- Q.5** (a) Define: (1) Gain crossover frequency (2) Phase crossover frequency (3) Resonant peak **03**
- (b) Write short note on: (1) PD controller (2) PI controller **04**
- (c) Sketch the bode plot for the transfer function **07**
 $G(s) = ks^2 / (1 + 0.2s) (1 + 0.02s)$.
- OR**
- Q.5** (a) Explain Nyquist Stability Criterion. **03**
- (b) Determine Gain margin and Phase margin from Polar and Nyquist plot. **04**
- (c) Draw and explain the Bode plot of lag-lead network. **07**
