

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 3 – EXAMINATION – SUMMER 2026

Subject Code: 3131101

Date: 17/06/2026

Subject Name: Control Systems

Time: 02:30 PM TO 05:00 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) Explain standard test signals. **03**
(b) Compare open loop and closed loop system with suitable examples. **04**
(c) Explain any 7 rules of block diagram reduction technique. **07**
- Q.2** (a) Write advantages of state space approach over classical methods. **03**
(b) Write properties of transfer function. **04**
(c) Explain Mason's Gain Formula with suitable example **07**
- OR
- Q.2** (c) Write a short note on state space representation of a control system. **07**
- Q.3** (a) Explain in brief about PID controller. **03**
(b) Explain force voltage analogy. **04**
(c) Explain the steps of root locus **07**
- OR
- Q.3** (a) Explain in brief about PD controller. **03**
(b) Explain force current analogy. **04**
(c) Explain the steps of Bode plot. **07**
- Q.4** (a) Find Laplace transform of $x(t) = \cos 2t$ **03**
(b) Explain Nyquist Stability Criteria. **04**
(c) Explain Phase-Lag compensator in detail. **07**
- OR
- Q.4** (a) Find Laplace transform of $x(t) = \sin 2t$ **03**
(b) Explain polar plot with suitable example. **04**
(c) Explain Phase-Lead compensator in detail **07**
- Q.5** (a) Define i) Marginally stable state ii) Conditional stable state iii) Unstable state. **03**
(b) Define steady state error and obtain its formula **04**
(c) Discuss unit step response of first order system. **07**
- OR
- Q.5** (a) Define i) Gain Margin ii) Frequency response iii) Phase Margin **03**
(b) Obtain equation of peak time for a second order control system when subjected to unit step input. **04**
(c) Discuss impulse response of second order system. **07**