

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BACHELOR OF ENGINEERING – SEMESTER 6 – EXAMINATION – SUMMER 2026**

**Subject Code: 3160104**

**Date: 22/05/2026**

**Subject Name: Basic 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.**

- Q.1** (a) Define the terms: Rise time, Settling time and Peak time **03**  
(b) Explain the function of proportional controller **04**  
(c) Explain steady-state error in detail. **07**
- Q.2** (a) Define control system. Classify control systems on different bases. **03**  
(b) A unity feedback control system has open-loop transfer function  $G(s)=10/(s(s+2))$ . Find the closed-loop transfer function of the system. **04**  
(c) Explain open-loop and closed-loop control systems with examples. **07**
- OR
- Q.2** (c) Develop the mathematical model of a mechanical system (translational or rotational) with a suitable example. **07**
- Q.3** (a) Explain the Nyquist stability criterion. **03**  
(b) Explain linear time-invariant (LTI) systems. **04**  
(c) Explain the desired features of feedback control algorithms. **07**
- OR
- Q.3** (a) Explain the Hurwitz stability criterion. **03**  
(b) Explain the difference between SISO and MIMO systems. **04**  
(c) Explain the state-space representation in detail and its importance in control theory. **07**
- Q.4** (a) Define: State, State variable and State vector. **03**  
(b) Define the terms: Gain crossover frequency, Phase crossover frequency, Gain margin and Phase margin **04**  
(c) Explain the steps to plot a Bode plot. **07**
- OR
- Q.4** (a) Explain ON-OFF controller. **03**  
(b) Discuss standard Excitation functions. **04**  
(c) Explain phase lag compensator in detail. **07**
- Q.5** (a) Define: proportional band and rate gain. **03**  
(b) Explain the SFG with one example in detail. **04**

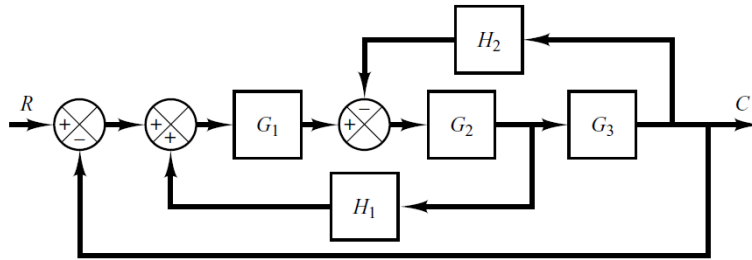
(c) Explain rules for construction of root locus. 07

OR

Q.5 (a) Discuss Natural & Man made control systems. 03

(b) Guided missile control is an example of the closed loop control system. Justify the statement. 04

(c) Consider the system shown in figure below. Simplify this diagram. 07



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