

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER- IV • EXAMINATION – SUMMER 2015

Subject Code: X41102**Date: 30/05/ 2015****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.

- Q.1 (a)** Define Control System. Compare Open loop and Closed loop control systems with suitable examples. **07**
- (b)** Explain Thermal System in brief. **07**

- Q.2 (a)** Tabulate the analogous quantities of mechanical and electrical systems using (a) force voltage analogy and (b) force current analogy. **07**
- (b)** Derive the Transfer function for the given Block diagram in figure 1 using block diagram reduction techniques. **07**

OR

- (b)** Obtain the Transfer function $C(S)/R(S)$ using Mason's gain formula for signal flow graph shown in figure 2. **07**
- Q.3 (a)** Explain the rules for construction of root locus. **07**
- (b)** Find (1) Natural frequency (2) Damping factor (3) Rise Time (4) Delay Time (5) Peak time (6) Peak Overshoot (7) Setting time for the given Transfer function. **07**

$$\frac{C(S)}{R(S)} = \frac{1}{S^2 + S + 1}$$

OR

- Q.3 (a)** The forward path of Transfer function of a Unity feedback system is given by **07**
- $$G(S) = \frac{K}{S(S+4)(S+5)}$$
- Construct root locus for the given transfer function.
- (b)** Define steady state error. Derive the steady state error in term of static error co-efficient K_p , K_v & K_a for Type '0' system. **07**

- Q.4 (a)** For the system having the open loop transfer function **07**
- $$G(S)H(S) = \frac{10}{S(S+1)(S+10)}$$
- Determine the GM, PM and comment on stability using Bode plot.

- (b)** Explain Mapping Theorem and Principle of Argument. **07**

OR

Q.4 (a) Explain Nyquist path in brief. Give advantage and disadvantage of Nyquist plot. 07

(b) Draw Polar plot for 07

$$G(S)H(S) = \frac{100}{(S + 2)(S + 4)(S + 8)}$$

Q.5 (a) The system with unity feedback having Transfer function 07

$$G(S) = \frac{128}{s(s^7 + 3s^6 + 10s^5 + 24s^4 + 48s^3 + 96s^2 + 128s + 192)}$$

Find number of poles in LH of s' plane, RH of s' plane on jw axis. Give conclusion about stability.

(b) Write a short note on Observability. 07

OR

Q.5 (a) Derive Transfer function for an Armature Controlled DC motor. 07

(b) Define Gain Margin, Phase Margin, Gain Cross over Frequency and Phase Cross over Frequency. 07


