Enrolment N	No
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Date:29/05/2017

Total Marks: 70

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC- SEMESTER-IV - EXAMINATION – SUMMER 2017 Subject Code: X41102 Date

Subject Name: Control Theory

Time: 10:30 AM TO 01:00 PM

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- **Q.1** (a) Define the following terms.
 - 1. Peak Overshoot
 - 2. Settling time
 - 3. Rise time
 - 4. Steady state error
 - 5. Self loop
 - 6. Forward path
 - 7. Characteristics equation
 - (b) Classify the control system and explain close loop control system with suitable 07 example also give the advantages of close loop system over open loop system.
- Q.2 (a) What is transfer function? List and explain the different steps for deriving the 07 transfer function using Mason's gain formula.
 - (b) Explain the different steps for block diagram reduction technique using 07 appropriate example.

OR

- (b) Explain the analogous quantities of mechanical and electrical systems using
 (1) force voltage analogy and
 (2) force current analogy
- Q.3 (a) Explain the modeling of thermal system with appropriate example. 07
 - (b) What is state space? Derive the relationship between state space and transfer 07 function.

OR

- **Q.3** (a) What do you mean by Stability? Determine the stability of the system described **07** by characteristic equation: $S^5 + 7S^4 + 6S^3 + 42S^2 + 8S + 56 = 0$ using Routh's criterion.
 - (b) Derive the steady state error in terms of static error coefficients Kp, Kv and Ka 07 and discuss for type 0 system.
- Q.4 (a) What is the significance of root locus in system stability? Draw the root locus 07 for unity feedback control systems has open loop transfer function G(s) = k(s+3) / [s(s+1)(s+2)(s+4)]
 - (b) Derive the relationship between transient response and frequency response of the control system.

OR

- **Q.4** (a) Define the following terms.
 - 1. Asymptote
 - 2. Angel of aperture
 - 3. Angel of departure
 - 4. Real axis loci
 - 5. Break away point
 - 6. Centroid
 - 7. Angel of asymptote

07

1

	(b)	A unity feedback system is characterized by the open loop transfer function $G(s) = 361 / (s^2+16s+361)$. Determine rise time, peak time, peak overshoot and settling time.	07
Q.5	(a)	 Draw the response of system having following location of roots. 1. Roots on negative real axis 2. Roots on positive real axis 3. Complex conjugate roots on left-half of the s-plane 4. Complex conjugate roots on right-half of the s-plane 5. Single pair of roots on imaginary axis 6. Double pair of roots on imaginary axis 7. Single root at origin 	07
	(b)	Explain the Nyquist Stability Criterion with suitable example. OR	07
Q.5	(a)	List the general steps for constructing the Bode Plot and draw the bode plot using appropriate example.	07
	(b)	Explain the transfer function of simple liquid level pressure difference system with appropriate example.	07
