GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-VII(NEW) • EXAMINATION - WINTER 2016

Subject Code:2172007 Date:29/11/2016 Subject Name: Modern Control Systems (Departmental Elective - II) Time:10.30 AM to 1.00 PM **Total Marks: 70**

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- 0.1 (a) What is the meaning of disturbance signal in control system? Explain the 07 effects of the disturbance in the forward path of closed loop control system using suitable block diagram.
 - (b) Explain the aspects that must be taken into account while designing the control 07 system.
- 0.2 (a) What is phase lead compensation? Explain phase lead compensation using bode 07 plot technique.
 - (b) When the feedback control system is having unsatisfactory transient response, 07 which type of compensation can provide a limited improvement in steady-state performance? Explain the method in detail using root-locus technique.

OR

- (b) Define the terms: state, state variable, state vector and state space, Eigen values, 07 Eigen vector.
- Q.3 (a) The open loop transfer function of an uncompensated system is

$$G(s) = \frac{K}{s^2}$$

Design suitable compensator using root locus technique to meet the following requirements.

Mp $\leq 20\%$, Settling time ≤ 4 sec, Ka ≥ 2

(b) For the given electrical network in the figure below, find a state-space 07 representation if the output is the current through the resistor.



OR

(a) An open-loop transfer function of a plant is given as $G(s) = \frac{K}{s(s+1)}$ 0.3

07

(b) Find the state-space representation in phase-variable form for the transfer 07 function given below.

$$\frac{C(s)}{R(s)} = \frac{24}{(s^3 + 9s^2 + 26s + 24)}$$

- Q.4 (a) Explain determination of state transition matrix using infinite series method. 07
 - (b) Determine the stability of a sampled data control system having following 07 characteristic polynomial.

$$2z^4 + 8z^3 + 12z^2 + 5z + 1$$

OR

- Q.4 (a) Explain digital control system using suitable block diagram. 07
 - (b) The state equations of a control system are given below. Examine for complete 07 state controllability.

$$\dot{x1} = -\frac{1}{\tau_1}x1 + \frac{1}{\tau_1}u$$
 and $\ddot{x2} = -\frac{1}{\tau_2}x2 + \frac{1}{\tau_2}u$

Q.5(a) Explain state feedback with integral control.07(b) Determine the unit step time response for the pulse transfer function07

$$\frac{C(z)}{R(z)} = \frac{z}{z^2 - z + 0.5}$$

- Q.5 (a) Discuss the advantages of state space analysis over the classical control system. 07
 - (b) List various methods to find out inverse z-transform and explain any one of 07 them.
