GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII (OLD) - EXAMINATION – SUMMER 2017
Subject Code: 172007   **Date: 29/04/2017**
Subject Name: Modern Control Systems (Department Elective - I)
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.**

Q.1 **(a)** Explain basic P, PI and PID control.   **07**
       (b) List and explain various control objectives of a control system.   **07**

Q.2 **(a)** Explain various rules for construction of root-locus plot from a given open loop transfer function.   **07**
       (b) Describe the steps required to design the cascade lag compensator for the reshaping of root locus.   **07**

OR

       (b) What is effect of adding zero in the reshaping of the root locus?   **07**

Q.3 **(a)** The open loop transfer function of an uncompensated system is   **07**

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

Design suitable compensator using root locus technique to meet the following requirements.
Damping ratio=0.707
Settling time $\leq$ 5 sec
Velocity error constant $\geq$ 4
Also draw the root locus for both compensated and uncompensated systems on the same plot.

       (b) Explain cascade PID compensation using frequency response technique.   **07**

OR

Q.3 **(a)** An open-loop transfer function of a plant is given as   **07**

$$G(s) = \frac{K}{s^2(0.2s+1)}$$

Design a suitable compensator to meet the following requirements.
Acceleration error constant =10
Phase margin $\geq$ 35°

       (b) Explain cascade Lag-lead compensation using frequency response technique.   **07**

Q.4 **(a)** Define the term: state, state variable, state vector and state space, Eigen values, Eigen vector.   **07**
       (b) Explain Jury's stability test technique used to find stability of a sampled data control system.   **07**

OR

Q.4 **(a)** Explain digital control system using suitable block diagram.   **07**
       (b) Explain the stability analysis of sampled-data control system and mapping from s-plane to z-plane.   **07**

Q.5 **(a)** Explain the pole placement method using state feedback control technique.   **07**
       (b) Explain the term controllability. Derive the controllability of a system with the help of controllability test matrix.   **07**

OR

Q.5 **(a)** Explain power series method to find out inverse z-transform. **07**

(b) The transfer function of a system is given by **07**

$$\frac{Y(s)}{U(s)} = \frac{(s+3)}{(s+1)(s+2)}$$

Obtain the state model in canonical form using parallel decomposition method.

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