Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–VII • EXAMINATION – SUMMER • 2015

Subject Code: X71904 **Date: 18/05/2015**

Subject Name: Control Engineering

Time: 02:30 pm - 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)** 1) Identify a possible input and output for the automatic electric iron. Is it an open loop or closed loop control system? Justify your answer. **04**

2) List out the advantages and disadvantages of open loop system. **03**

(b) What is Transfer Function? Explain the properties, advantages and disadvantages of Transfer Function. **07**

Q.2 **(a)** What do you mean by 'poles' and 'zeros' of the Transfer Function? Determine the 'poles' and 'zeros' of the Transfer Function $G(s) = \frac{2(s+1)(s+2)^2}{(s+3)(s+4)(s+5)^3}$. Also plot the same on *s*-plane. **07**

(b) Draw the schematic diagram of single spring-mass-damper system subjected to an external force. Derive the transfer function of the system in usual notations explaining the steps involved. **07**

OR

(b) What is block diagram? Draw the block diagram of shaft-rotor-damper system subjected to an external torque. Derive the transfer function of the system by reducing the block diagram in usual notations. **07**

Q.3 **(a)** With suitable neat sketch/s, explain the rules to reduce the block diagram for the following cases:

1) when three blocks are in series **01**

2) when two blocks are in parallel **02**

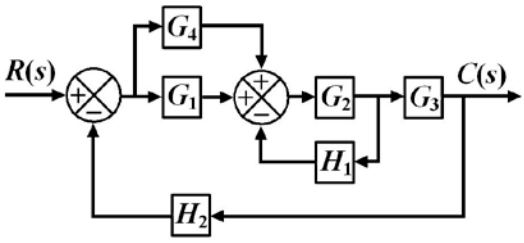
3) when there is a negative feed-back loop **02**

4) shifting of a summing point before a block **02**

(b) What is a signal flow graph? How it is drawn? State and explain Mason's gain formula to derive the Transfer Function with suitable example. **07**

OR

Q.3 **(a)** Draw the signal flow graph from the block diagram shown in figure. Using Masson's gain formula, obtain the Transfer Function. **07**



(b) What is Time Response Analysis of a system? Also discuss about the various types of input test signals. **07**

Q.4 **(a)** The overall transfer function of a second order control system is given as $G(s) = \frac{1}{s^2 + s + 1}$. Determine natural frequency, damping factor, rise time, delay time, peak time, pick overshoot and settling time for 2% band width. **07**

(b) What are the different control actions? Explain any two of them. **07**

OR

Q.4 **(a)** What is the stability of the system? List out the different stability criteria and explain one of them with suitable example. **07**

(b) Investigate the stability condition of a system whose characteristic equation is given as $3s^7 + 9s^6 + 6s^5 + 4s^4 + 7s^3 + 8s^2 + 2s + 6 = 0$. **07**

Q.5 **(a)** What are the basic components of a hydraulic system? Explain any three of them. **07**

(b) What is the main function of a pressure relief valve? Explain the constructional details of a pressure relief valve with neat sketch. **07**

OR

Q.5 **(a)** Write a short note on 'Digital to Analog Converter'. **07**

(b) What is a programmable logic controller (PLC)? Explain the working of PLC showing the block diagram. **07**

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