

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2019****Subject Code: 2151705****Date: 31/05/2019****Subject Name: Process Control Systems****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.

MARKS

- Q.1**
- | | | |
|-----|---|-----------|
| (a) | Define dead time in process control. Explain its effect on system stability. | 03 |
| (b) | What causes inverse response? Explain with mathematical arguments. | 04 |
| (c) | Derive the transfer function of non interacting two tank system with linear resistance element. | 07 |
- Q.2**
- | | | |
|-----|---|-----------|
| (a) | With the help of suitable example, explain servo and regulatory control system. | 03 |
| (b) | Explain any one method for obtaining First Order Plus Time Delay (FOPTD) approximate model for processes. | 04 |
| (c) | Derive the mathematical model of continuous stirred tank heater with its process loop. | 07 |
- OR**
- | | | |
|-----|--|-----------|
| (c) | Discuss two position control with and without neutral zone. What is the effect of neutral zone on controller output? | 07 |
|-----|--|-----------|
- Q.3**
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|-----|---|-----------|
| (a) | Explain direct and reverse mode of control action with the help of example. | 03 |
| (b) | Explain multi position control in brief. | 04 |
| (c) | Analyze the closed loop response of first order system with proportional control to unit step change in set point and unit step change in process load. | 07 |
- OR**
- Q.3**
- | | | |
|-----|--|-----------|
| (a) | An integral controller is used for speed control with a set point of 12 rpm within a range of 10-15 rpm. Initially, at zero error the controller output is 22%. The constant $K_I = -0.15\%$ controller output per second per percentage error. If the speed jumps to 13.5 rpm, calculate the controller output after 2 seconds for a constant e_p . | 03 |
| (b) | What is offset in case of proportional control action? How offset can be eliminated? Explain. | 04 |
| (c) | Explain the composite PI controller with equation, transfer function and draw the response of PI controller to step input of error. | 07 |
- Q.4**
- | | | |
|-----|--|-----------|
| (a) | What is self regulation? Give an example of self regulating process. | 03 |
| (b) | Briefly discuss velocity form of discrete PID controller. Also state its advantages over position form of the algorithm. | 04 |
| (c) | Explain Integral wind up and anti-wind up scheme to prevent it. | 07 |

- Q.4** (a) Draw and explain unit step response of an integrating process. **03**
(b) Briefly discuss position form of discrete PID controller. Also discuss its limitations. **04**
(c) What do you mean by tuning of controller? Explain Z-N method of tuning. **07**
- Q.5** (a) Show any one configuration of ratio control scheme. **03**
(b) Briefly discuss override control scheme. **04**
(c) Draw the basic block diagram of feed forward control. Write the difference between feedback and feed forward control scheme. **07**

OR

- Q.5** (a) Briefly explain air-fuel ratio control for drum boiler. **03**
(b) Briefly explain the split range control scheme. **04**
(c) Draw the basic block diagram of cascade control scheme and discuss in detail with suitable process example. **07**

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