# GURU NANAK INSTITUTE OF TECHNOLOGY
## An Autonomous Institute under MAKAUT
## 2022
## PROCESS CONTROL SYSTEM
## FT704B

**TIME ALLOTTED: 3Hours** **FULL MARKS:70**

***The figures in the margin indicate full marks.***

***Candidates are required to give their answers in their own words as far as practicable***

**GROUP – A**

**(Multiple Choice Type Questions)**

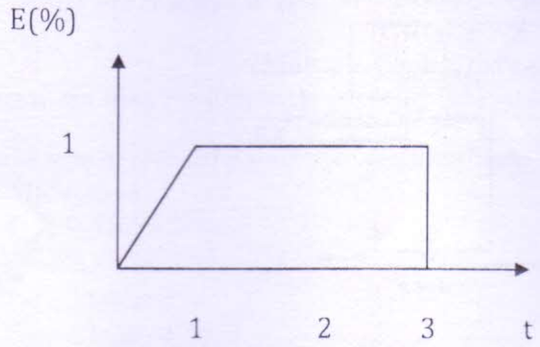
Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

| | | Marks | CO No |
|---|---|---|---|
| 1. i) | What is the type & order of a system whose transfer function is: $G(S)= 5/S(S^2+ 5S+6)$<br>a) Type 0 ,Order 2<br>b) Type 1, Order 3<br>c) Type 2,Order 4<br>d) Type 1,Order 4 | 1 | CO1 |
| ii) | The overall transfer function of two blocks in parallel are :<br>a) Sum of individual gain<br>b) Product of individual gain<br>c) Difference of individual gain<br>d) Division of individual gain | 1 | CO1 |
| iii) | Flapper –Nozzle system is used in<br>a) electronic controller<br>b) pneumatic controller<br>c) hydraulic controller<br>d) none of these | 1 | CO2 |
| iv) | Ratio control is a type of<br>a) Feedforward control<br>b) Cascade control<br>c) Feedback control<br>d) None of these | 1 | CO3 |
| v) | Tight shut off is not present in<br>a) single seated valve<br>b) double seated valve<br>c) butterfly valve<br>d) gate valve | 1 | CO4 |

| | | | |
|---|---|---|---|
| vi) | Which controller is also known as anticipatory controller?<br>a) P Controller<br>b) I Controller<br>c) D controller<br>d) None of these | 1 | CO2 |
| vii) | In Cascade Control there are<br>a) one Measurement variable & one manipulated variable<br>b) one Measurement variable & more than one manipulated variable<br>c) more than one Measurement variable & one manipulated variable<br>d) any one of these | 1 | CO3 |
| viii) | Solenoid is a type of<br>a) Hydraulic Actuator<br>b) Electrical Actuator<br>c) Pneumatic Actuator<br>d) None of these | 1 | CO4 |
| ix) | Offset error presents in<br>a) P Controller<br>b) I Controller<br>c) D controller<br>d) None of these | 1 | CO2 |
| x) | Solenoid is a type of<br>a) Hydraulic Actuator<br>b) Electrical Actuator<br>c) Pneumatic Actuator<br>d) None of these | 1 | CO2 |
| xi) | For a 50 % error to the P controller, its output is 50 %. The proportional band PB is<br>a) 200%<br>b) 150 %<br>c) 50 %<br>d) 100% | 1 | CO2 |
| xii) | The feed forward system is unsatisfactory for<br>a) fast process<br>b) sluggish process<br>c) any one of the process<br>d) none of these | 1 | CO3 |

## GROUP – B
**(Short Answer Type Questions)**
(Answer any *three* of the following) **3 x 5 = 15**

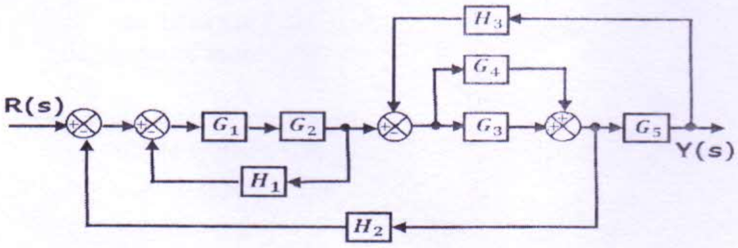
| | | Marks | CO No |
|---|---|---|---|
| 2. | Explain the application of Feed forward control in Heat exchanger. | 5 | CO3 |
| 3. | Design an electronic integral controller of input range 6V.an output of 5V and $K_I$ of 3.0%/%-min | 5 | CO2 |
| 4. | Plot the graph of a PI controller output as a function time. The error to the controller is shown in fig. Kp=5, $K_I$=1.0 s-1, $P_I(0)$=20%. | 5 | CO2 |




| | | Marks | CO No |
|---|---|---|---|
| 5. | What is time proportional control? Why offset error presents in proportional controller? | 5 | CO2 |
| 6. | Explain working principle of spring actuator with positioned. | 5 | CO4 |

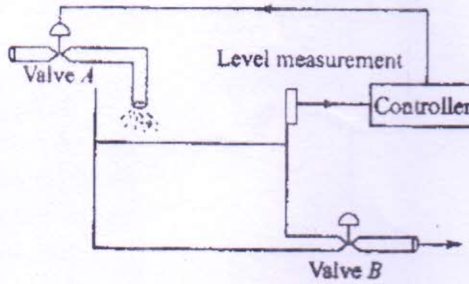
## GROUP – C
**(Long Answer Type Questions)**
(Answer any *three* of the following) **3 x 15 = 45**

| | | Marks | CO No |
|---|---|---|---|
| 7. a) | Explain the working principle of air to close control valve. | 5 | CO4 |
| b) | What is rangeability? Explain the cavitation and flashing phenomena with the help of a diagram | 5 | CO4 |
| c) | Write basic principle of I to P converter. | 5 | CO4 |
| 8. a) | What is Transfer Function.Derive the transfer function of a closed loop system. | 5 | CO1 |
| b) | Find out the overall transfer function of the system using block diagram reduction algebra | 7 | CO1 |




| | | Marks | CO No |
|---|---|---|---|
| c) | For the transfer function given below find out<br>i) poles & zeros of the system<br>ii) order & type of the system<br>$G(S)=(S^2+1)/S^3(S+6)$ | 3 | CO1 |

| | | | |
|---|---|---|---|
| 9. a) | Draw & explain the basic block diagram of process control. | 5 | CO2 |
| b) | Define self regulation. What is 'Neutral zone'? In which controller it occurs? | 5 | CO2 |
| c) | Valve A is linear with a flow scale factor of 10 $m^3$/hr per percent controller output. The controller output is nominally 50% with KP= 1% / %.A load change occurs when the flow through valve B changes from 500 $m^3$/hr to 600 $m^3$/hr. Set point is at 6 m and the liquid level can vary from 1-13 m. Calculate the new level upon load change. | 5 | CO2 |




| | | | |
|---|---|---|---|
| 10. | Write short notes on any three: | 3x5=15 | |
| a) | Valve Positioner | 5 | CO4 |
| b) | Three element Boiler drum Level Control | 5 | CO3 |
| c) | Pneumatic Proportional controller | 5 | CO2 |
| d) | Solenoid as actuator | 5 | CO4 |
| e) | Safety valve | 5 | CO4 |

| | | | |
|---|---|---|---|
| 11.a) | What is a Feed forward control, explain briefly. What are the advantages and disadvantages of the system? | 5 | CO3 |
| b) | What is Cascade Control? Explain with example. | 5 | CO3 |
| c) | Explain one Scheme of Ratio Control& its application. | 5 | CO3 |