END SEMESTER MAKE UP EXAMINATIONS (FEBRUARY 2022) - QUESTION PAPER - PART A

COURSE CODE : ICE-3154
COURSE NAME : Process Instrumentation And Control
SEMESTER : V
DATE OF EXAM : 26/02/2022
DURATION : 45 + 5 minutes

Instructions for Students:
(1) ANSWER ALL THE QUESTIONS.
(2) EACH QUESTION CARRIES 1 MARK.
(3) YOU ARE INSTRUCTED TO INFORM THE INVIGILATOR AFTER SUBMISSION OF THIS FORM IN THE CHAT SECTION.

* Required

1

STUDENT NAME: *

2

REGISTRATION NUMBER: *

3

During the modeling of nonlinear single tank system, the following approximation is used (1 Point)

- Range Kutta
- Taylor Series
- Mc-lauren series
- a & b

4

The simulation result of the mathematical model of interacting two tank system response for unit step input is_____ (1 Point)

- Fast response
- Sluggish response
- Moderate response
- Can't define it.

5

For the mixing process, during the modeling process the following assumption is made (1 Point)

- Temperature of feed is uniform
- Flow is uniform
- Density is uniform
- Pressure is uniform

6

Ratio control can be used for controlling flow only (1 Point)

- true
- false

7

Feed-forward control can be used alone without feedback control. (1 Point)

- True
- False

8

The procedure followed in identifying the model of the interacting and non-interacting is tanks is called as (1 Point)

- Gray box modeling.
- First principle modeling.
- Data driven modeling.
- Hybrid modeling.

9

In the MIMO process, designing of cross controllers is to avoid majorly with (1 Point)

- Internal disturbances.
- External disturbances.
- Inter-loop interactions.
- Zero offset.

10

Under RGA analysis for MIMO process, the sum of row and column should be equal to (1 Point)

- 0.75
- 0.5
- 0
- 1

11

Dynamic feed-forward control gives _____ response and it _____ improve the servo response
(1 Point)

- Worse & can't
- Improved and can't
- Improves and can
- Poor and can't

12

In MIMO process interactions are reduced by de-coupler design along with controller design, state whether the statement is true or false
(1 Point)

- True
- False

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If the RGA element value is 0.5 for a 2 x 2 system, it means (1 Point)

- Worse case
- Moderate case
- Fine operation case
- None of the above

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For controlling the CSTR, which control configuration is more preferred (1 Point)

- Conventional PI
- Feed-forward control
- Cascade control
- PID control

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When a dynamic feed-forward control is designed for a critical process, its overall response will (1 Point)

- Get poor compared to Static Feed-Forward.
- Get improved compared to Static Feed-Forward
- Similar response
- None of the above

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Ratio control application can be used on distillation column for (1 Point)

- Reflux and distillate
- Feed and distillate
- Distillate and bottom product
- Reflux and top product

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In an on-off controller, the dead band is set to be 12% of the span. If the Set point is 75, then: (1 Point)

- The upper edge of the dead band is 81 and lower edge of dead band is 69.
- The upper edge of the dead band is 6 and lower edge of dead band is -6.
- The upper edge of the dead band is 87 and lower edge of dead band is 63.
- The upper edge of the dead band is 12 and lower edge of dead band is -12.

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For suppression of small errors, the best performance evaluation criteria that can be used is (1 Point)

- ISE
- IAE
- ITAE
- Quarter decay ratio

19

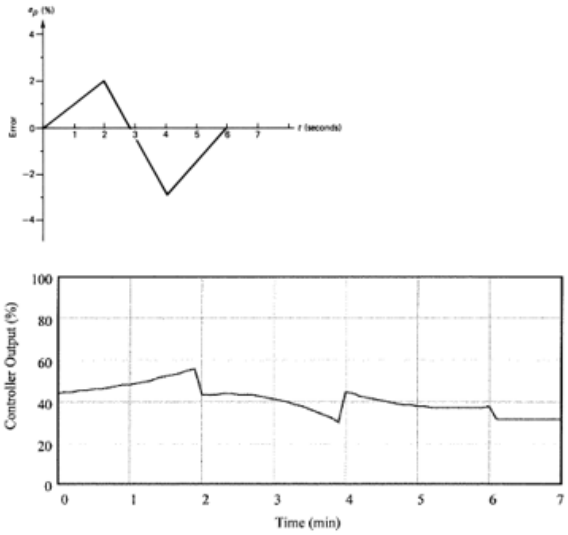
In a PID controller, the overshoots has increased.

The derivative time constant has to be _____so as to reduce the overshoots. (1 Point)

- Increased
- Reduced
- Reduced to zero
- None of these

20

The error graph and the corresponding controller response are given below. Then the controller used is: (1 Point)



- P
- PI
- PID
- PD

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If the integral controller has a TI=3min what is the controller output for a constant error of 2.2% (1 Point)

- 0.012
- 0.012t
- 396
- 396t

22

A process equation is given by

Pi= f (Qi, Qo, Ti, To, Po) where

Pi= Pressure inside a tank

Q i =Liquid flow into the tank

Qo =Liquid flow into the tank

Ti=Temperature inside the tank

To, = Temperature inside the tank

Po=Atmospheric Pressure

Then: (1 Point)

- Pi Is the manipulating variable and Qi is the controlled variable
- Pi Is the manipulating variable and Ti is the controlled variable
- Pi Is the manipulating variable and any of the variables Qi, Qo, Ti, To, Po the controlled variable
- Any of the variables Qi, Qo, Ti, To, Po can be the manipulating variable and Pi is the controlled variable

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Chose the correct statement: (1 Point)

- A positive error indicates a measurement above the setpoint, and a negative error indicates a measurement below the setpoint.
- A positive error indicates a measurement below the setpoint, and a negative error indicates a measurement above the setpoint.
- A positive error indicates a measurement equal to the setpoint, and a negative error indicates a measurement not equal to the setpoint.
- A positive error indicates a measurement below the setpoint, and a negative error indicates a measurement above the setpoint or the other way depending on wether its direct action or reverse action.

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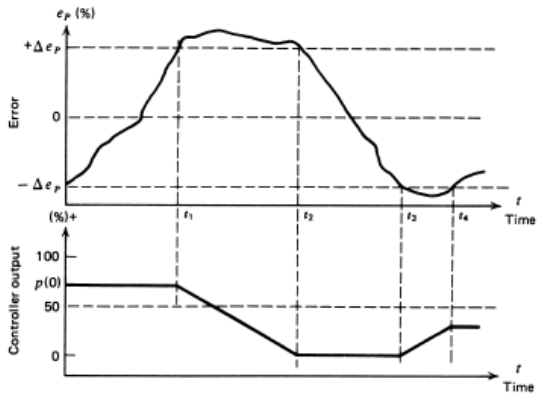
Identify the controller from the controller response shown in figure below: (1 Point)



- Two position controller
- Three position controller
- Floating mode controller
- Continuous mode controllers.

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For an integral controller, if Kc increases:

a. The response moves from sluggish overdamped to faster but oscillatory underdamped behavior

b. The overshoot and decay ratio of the closed loop response both increases

Chose the correct option: (1 Point)

- Statements a and b are true
- Statements a is true and b is false
- Statements b is true and a is false
- Both statements a and b are false.

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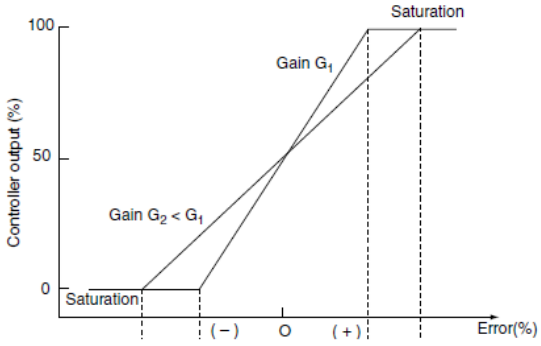
Graph shows the response of two P controllers P1 with a gain of G1 and P2 with a gain of G2.

Then chose the correct option about Proportional Band of the controllers.: (1 Point)



- PB of P1 is greater than that of P2
- PB of P2 is greater than that of P1

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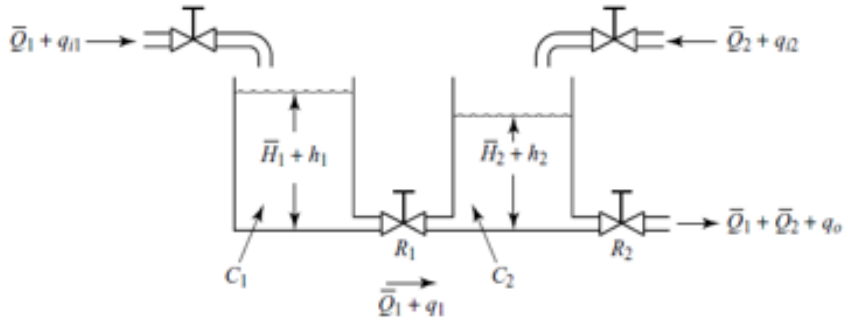
For the liquid level system shown in figure which of the following equation describes tank 1. (1 Point)



a. $\frac{dh_1}{dt} = (q_1 - q_{i2})$

b. $\frac{dh_1}{dt} = (q_{i1} -$

c. $\frac{dh_1}{dt} = (q_{i1} - q_{i2})$

d. $\frac{dh_1}{dt} = (q_{i2} -$

- a
- b
- c
- d

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Which of the following control mechanism cannot be used alone? (1 Point)

- Proportional mode
- Derivative mode
- Integral mode
- None of the above

29

During the implementation of cascade control system, the secondary loop should be
(1 Point)

- Slower than the primary loop
- Faster than the primary loop
- Same as that of primary loop
- It doesn't matter

30

Read the following statements and chose the correct option/options:
(i)In a servo problem the disturbance does not change while in a regulatory problem set point does not
change.
(ii)In direct controller action as the controller output increases the error value increases and in reverse
control action as the controller output increases the error value reduces.
(iii)The proportional band of a P controller can be reduced as Kp value is increased due to which after a limit of Kp the P controller start acting like an On-Off controller.
(1 Point)

- i and ii are correct
- i,ii,iii are correct
- ii and iii are correct
- i and iii are correct.

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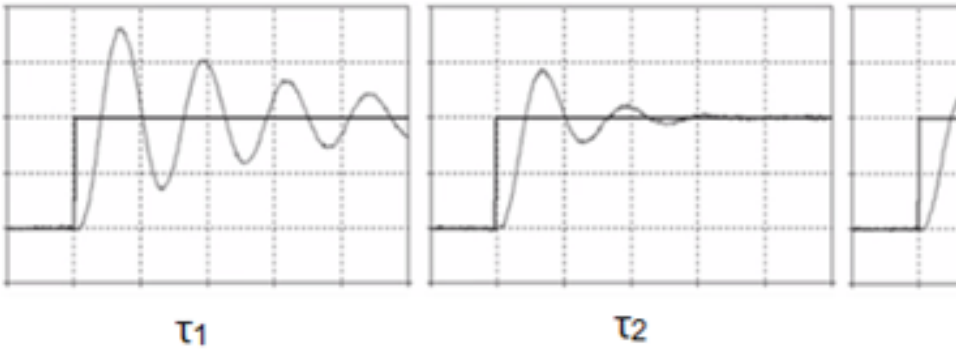
Figure shows the response of a process, controlled by an integral controller with three different values of integral time, τ1, τ2 and τ3. Then chose the correct option: (1 Point)



- τ1>τ2>τ3
- τ2> τ1>τ3
- τ3> τ2>τ1
- τ1> τ3>τ2

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The temperature has a range of 300 to 440 K and a setpoint of 384 K. The percent of span error when the temperature is 379 K is,
(1 Point)

- 0.36%
- 3.6%
- 36%
- 0.036%