END SEMESTER EXAMINATIONS (DECEMBER 2021/JANUARY 2022) - QUESTION PAPER - PART A

COURSE CODE : ICE-3154
COURSE NAME : Process Instrumentation And Control
SEMESTER : V
DATE OF EXAM : 30/12/2021
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

* This form will record your name, please fill your name.

1

STUDENT NAME: *

2

REGISTRATION NUMBER: *

The value must be a number

3

Feed-Forward control has its application on
(1 Point)

- For slow process with dead time
- Where it does not need the model of the process
- For fast acting process
- Where there is no significant disturbance acting.

4

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

(1 Point)

- False
- True

5

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

- Quarter decay ratio
- ITAE
- ISE
- IAE

6

Which of the following control mechanism cannot be used alone?

(1 Point)

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

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Dynamic feed-forward control gives _____ response and it _____ improve the servo response

(1 Point)

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

8

The hysteresis of a two position controller is set as 5% and the set point of 50%. The upper cut off value will be

(1 Point)

- 45%
- 50%
- 55%
- 52.5%

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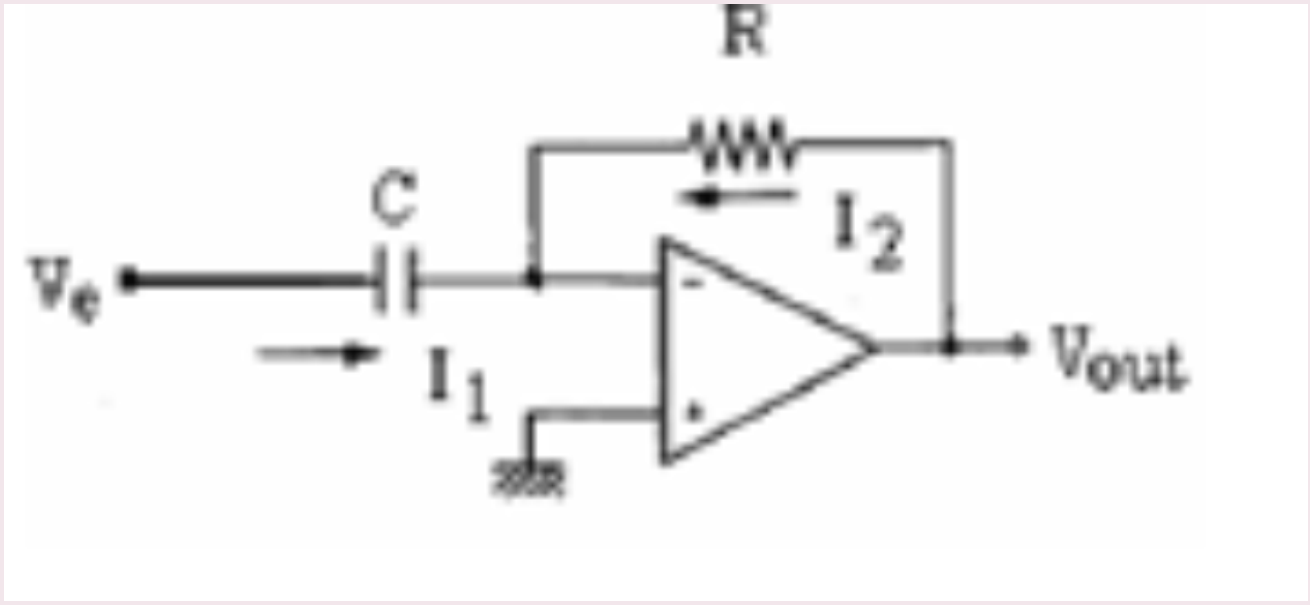
Figure shows the circuit implementation of a D controller which is not practical if there is high frequency variations in variables.
State whether the statement
(1 Point)



- True
- False

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In cross controller design, the diagonal elements of de-coupler is
(1 Point)

- Not necessary to design.
- Need to be derived with dynamics of valve, process and controller.
- Zero
- Unity

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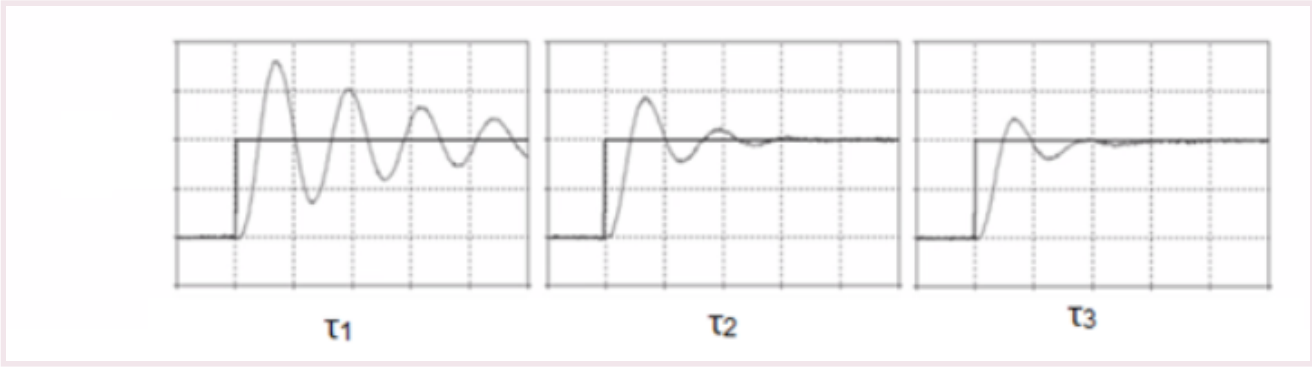
Figure shows the response of a process, controlled by an integral controller with three different values of integral time, τ1, τ2 and τ3. Then chose the correct option:
(1 Point)



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

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Reset control action is often expressed in units of
(1 Point)

- Rate per second
- Unit less
- Minutes
- Repeats per minute

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For the given characteristic equation , the ultimate gain and frequency is _____
(1 Point)

- 30.5 & 1.5 rad/sec
- 32 & 1.2 rad/sec
- 33 & 1.4 rad/sec.
- 31.52 & 1.93 rad/sec

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In an integral only controller, if process variable is moved below set point, the controller output will:
(1 Point)

- will rampup in the opposite direction
- will ramp up in the same direction
- May rampup in same or opposite direction depending on the integral time

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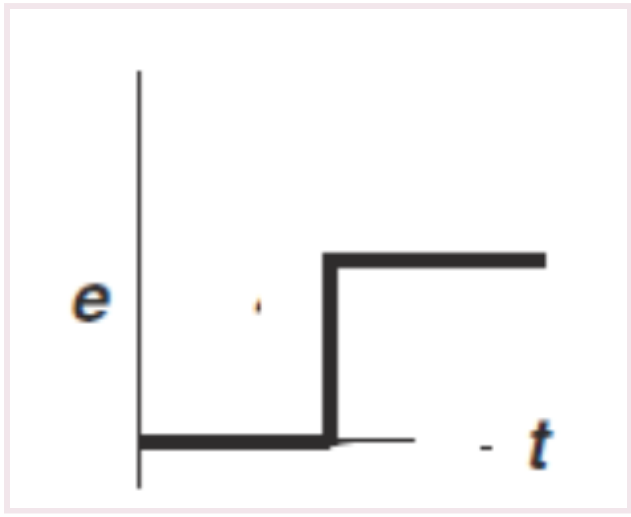

For the error graph shown in the figure, the output of a derivative controller will be:
(1 Point)

- 0
- ∞
- ramp with a slope =2
- ramp with unity slope

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In RGA analysis, the value of Lamda=0.5 implicates
(1 Point)

- M1 does not have any effect on Y2
- M2 does not have any effect on Y1
- Off-diagonal elements are negative.
- Two MV affects the two output to same degree.

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Using a Proportional Controller, ideally the error can be made to zero if:
(1 Point)

- Kc=∞
- Kc=0
- Kc=1%
- Kc=63.2%

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In a PI controller, the Integral action is minimized if:
(1 Point)

- kp=∞
- Ti=0
- Kp=0
- Ti=∞

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In which of the following case, a PID control will be preferred?
(1 Point)

- The plant has multiple input and multiple output
- The plant with single loop feedback system
- The plant has higher dead time
- The plant behaviour is non linear

20

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

21

A control valve connected at outlet of a tank follows the relationship Qo=6H(1/2) where Qo is the outflow from the valve and H is the height of water in the tank.Then the linearised form of the relationship around a steady state height of 2m is _____ ?
(1 Point)

- q0=8.48+21.2(h-2)
- q0=84.8+2.12(h-2)
- q0=8.48+2.12(h-2)
- q0=8.48+4.24(h-2)

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

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The inference of interacting system results with _____
(1 Point)

- Sluggish response
- Both a & d
- Speed response
- Medium acting response

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In a PID controller, the overshoots has increased.

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

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

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The nonlinear modeling of a single tank system is given by_____ before approximation
(1 Point)

- Differential equations
- All the above
- State Space
- Transfer function

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If the gain of a proportional controller is too high, the control action is likely to be

(1 Point)

- Two position
- PID control
- PI Control
- PD control

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Identify which is the wrong statement w.r.t cascade control
(1 Point)

- Insensitive to modelling errors.
- Only one measurement and more than one manipulated variable
- Inner loop effect of reducing time lag in outer loop, so the cascade control responds very quickly.
- Both b & c

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The response of the closed loop system using a Proportional controller when a step input of amplitude 1 is given is expressed by the equation . What is the offset error after 2 sec?
(1 Point)

$$y(t) = 0.83(1 - e^{-t/0.35sec}).$$

- 0.172
- 0.344
- 3.44
- 1.72

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In a single tank system, the transfer function of level to inlet flow rate is

(1 Point)

- 1/(RCs + 1)
- R/(RCs + 1)
- R/RCs
- 1/RCs

30

In a process with higher disturbances, which of the following control method can be preferred?

(1 Point)

- On Off control
- P Mode
- PID Mode
- PI Mode

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The application of ratio control can be applied to
(1 Point)

- All the above.
- Distillation column
- Reactors
- Optimal combustion

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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)

- ◯ 36%
- ◯ 0.036%
- ◯ 3.6%
- ◯ 0.36%