

Birla Institute of Technology and Science, Pilani

Department of chemical engineering

II-Semester 2017-2018

Chemical Engineering Laboratory II (CHE F341)

End Semester Quiz Marks: 45 Date: 27/04/2018 Time: 50 minutes



Name: _____ ID No. _____ Sec No. _____

Instructions: For MCQs: Each incorrect answer will be awarded -0.25

PART- I

Multi choice questions

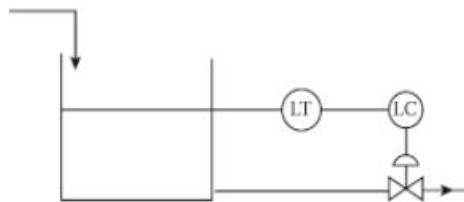
25 x 1 = 25 M

Write your answers in the table below.

1	2	3	4	5	6	7	8	9	10
c	c	d	b	d	b	a	c	d	b
11	12	13	14	15	16	17	18	19	20
a	d	c	a	d	b	c	d	c	b
21	22	23	24	25	No of correct answers				
c	d	a	a	c	No of incorrect answers				

Marks Obtained

- For proportional controller:
 - Output = Error /Gain + Bias
 - Output = Error × Gain - Bias
 - Output = Error × Gain + Bias
 - None of the above
- Valve Coefficient is a measure of
 - Pressure drop across the valve
 - Flow through the valve
 - Capacity of a valve
 - None of these
- A liquid level control system is configured as shown in the figure below. If the Level Transmitter (LT) is direct acting and the pneumatic control valve is air to open, what kind of control action should the controller (LC) have and why?



- Reverse acting since the control valve is direct acting
 - Reverse acting since the control valve is reverse acting
 - Direct acting since the control valve is reverse acting
 - Direct acting since the control valve is direct acting
- A proportional controller with a gain of K_c is used to control a first order process. The offset will increase, if
 - K_c is increased
 - K_c is reduced

- (c) integral control action is introduced (d) derivative control action is introduced.
5. With a damping coefficient more than 1, the second order will be
 (a) Under damped (b) Critically damped
 (c) Oscillatory (d) Over damped
6. Crushing efficiency is defined as
 (a) The ratio of surface energy created by crushing to the energy fed to the machine
 (b) The ratio of surface energy created by crushing to the energy absorbed by the solid
 (c) The ratio of energy absorbed by the solid to the energy fed to the machine
 (d) The ratio of energy absorbed by the solid to the surface energy created by crushing
7. The type of pump used in rotary vacuum filter for feeding the trough is
 (a) gear (b) centrifugal (c) reciprocating (d) peristaltic
8. If the radius of a basket centrifuge is halved and the rpm is doubled, then
 (a) linear speed of the basket is doubled (b) linear speed of the basket is halved
 (c) centrifugal force is doubled (d) capacity of centrifuge is increased
9. Cascade control comes under the control configuration which uses
 (a) one measurement and one manipulated variable
 (b) more than one measurements and more than one manipulated variables
 (c) one measurement and more than one manipulated variables
 (d) more than one measurements and one manipulated variable
10. The unit step response of the transfer function $\frac{1}{s^2+2s+3}$
 (a) has a non-zero slope at the origin
 (b) has a damped oscillatory characteristic
 (c) is overdamped
 (d) is unstable
11. The use of pine oil as the promoter in the froth floatation experiment is to
 (a) Increase the hydrophobic characteristic of the particles.
 (b) Collect the desired hydrophobic particles
 (c) Increase the hydrophilic characteristic of the particles.
 (d) Make the homogeneous mixture of coal and sand particles.
12. Froth floatation processes may be used for particles in the range of
 (a) 400-700 μm (b) 500-900 μm (c) 10-40 μm (d) 5-250 μm
13. To control the cake thickness in a rotary drum filter, which of the following is varied?
 (a) trough agitator speed (b) feed tank agitator speed
 (c) speed of rotating drum (d) none
14. The angle between the roll faces at the level where they will just take hold of a particle and draw it into the crushing zone, is known as?
 (a) Angle of nip (b) Contact angle (c) Angle of repose (d) Critical angle
15. A closed loop system is distinguished from the open loop system by which of the following?
 (a) Servo mechanism (b) Regulator mechanism (c) Input pattern (d) Feedback
16. What is the unit of work index in Bond's Law for crushing of solids
 (a) Dimensionless (b) kWh/ton (c) kW/ton (d) kWm^{1/2}/ton
17. For crushing of solids, the Rittinger's law states that the work required for crushing is proportional to:
 (a) Change in volume due to crushing (b) The size reduction ratio
 (c) The new surface created (d) None of these
18. Match the List I with List II and select the correct answer using the codes given below the lists.

	List I		List II
P	Ziegler-Nicholas	1	Process reaction curve
Q	Underdamped response	2	Decay ratio
R	Feed-forward control	3	Tuning technique
		4	Disturbance measurement

- (a) P-1, Q-4, R-2 (b) P-1, Q-2, R-3
(c) P-3, Q-4, R-1 (d) P-3, Q-2, R-4
19. Impact is the principle mechanism of:
(a) Jaw crusher (b) Roll crusher
(c) Ball mill (d) Attrition mill
20. In a PID controller, the overshoot has increased. The derivative time constant has to be ___ so as to reduce the overshoots:
(a) Reduced (b) Increased (c) Reduced to zero (d) None of the above
21. Point out which is not true for filter press:
(a) Maintenance cost is low
(b) It is equally suitable whether the cake or filtrate is the main product
(c) It is continuous in operation
(d) It can be used for a wide range of material with varying conditions of cake thickness and pressure
22. Which of the following is measured in feed forward control system
(a) Controlled variable (b) Process Variable
(c) Manipulated variable (d) Load variable
23. Use of Integral controller along with P-control facilitates:
(a) Elimination of offset (b) Reduction of offset
(c) Reduction of stability time (d) reduction in oscillation
24. The value of ultimate period of oscillation P_u is 3 min, and that of the ultimate controller gain K_{cu} is 2. Select the correct set of tuning parameters (controller gain K_c , the derivative time constant τ_D in minute, and the integral time constant τ_I in minute) for a PID controller using Ziegler-Nichols controller settings.
(a) $K_c = 1.2$; $\tau_I = 1.5$, $\tau_D = 0.38$ (b) $K_c = 1.5$; $\tau_I = 1.5$, $\tau_D = 0.51$
(c) $K_c = 1.5$; $\tau_I = 2.1$, $\tau_D = 0.51$ (d) $K_c = 1.1$; $\tau_I = 2.1$, $\tau_D = 1.31$
25. Derivative control action is typically used when controlling____, but rarely used when controlling____
(a) Level, temperature (b) Flow, level
(c) Temperature, flow (d) Pressure, flow

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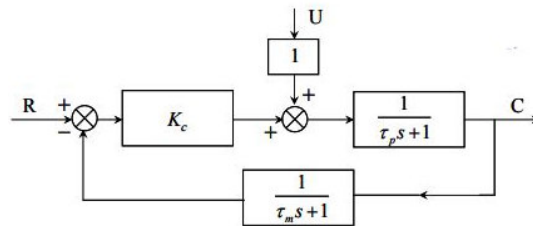
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Part-II (20 M)

1. The block diagram of a system with a proportional controller is shown below



- A unit step input is introduced in the set point. The value of K_c to provide a critically damped response for $U=0$, $\tau_p=8$ and $\tau_m=1$ is _____ (3)
2. A step change of magnitude 4 is introduced into a system having transfer function $\frac{Y(s)}{X(s)} = \frac{10}{s^2+1.6s+4}$. Determine (a) % overshoot, (b) ultimate value of $Y(t)$, (c) Period of oscillation and (d) Maximum value of $Y(t)$. (3)
3. What is the power required (KW) to crush 100 ton/h of limestone, if 80 percent of the feed passes a 2- in screen and 80 percent of the product a 1/8 in. screen? The work index of lime stone is 12.74. (2)
4. In a ball mill of diameter 2000 mm, 100 mm dia steel balls are being used for grinding. Presently, for the material being ground, the mill is run at 15 rpm. At what speed will the mill have to be run if the 100 mm balls are replaced by 50 mm balls, all the other conditions remaining the same? (2)
5. The energy required per unit mass to grind limestone particles of very large size to 100 μm is 12.7 kWh/ton. An estimate (using Bond's Law) of the energy to grind the particles from a very large size to 50 μm is _____ (2)
6. A filtration is conducted at constant pressure to recover solids from dilute slurry. To reduce the time of filtration, the solids concentration in the feed slurry is increased by evaporating half the solvent. If the resistance of the filter medium is negligible, if filtration time will be reduced by a factor of _____ (2)
7. A unit step is applied at $t=0$ to a first order system without time delay. The response has a value of 1.264 units at $t= 10$ min and 2 units at steady state. The transfer function of the system is _____ (2)
8. Characteristic equation of a feedback system is $s^3+Ks^2+5s+10=0$. For the system to be critically stable, the value of K should be _____ (2)
9. The unit impulse response of a first order process is given by $2e^{-0.5t}$. The gain and time constant of the process are _____ (2)