



Note: Answer all questions

First exam  
2023-2024

Max. Mark: 100 %

**Q1/ Multiple Choice Questions (Marks are evenly distributed)**

**(25 Marks)**

1)- Which of the following is the input of a controller in typical closed loop system?

- a) Feedback signal      b) Disturbance signal  
c) Sensed signal      **d) Actuating Error signal**      e) Reference input

2) The poles for the following system:  $\frac{Y(s)}{X(s)} = \frac{(s+2)}{(s+1)(s+7)}$  are:

- a) 1, 2      b) 2, 7      c) -2, 0      **d) -1, -7**      e) 1, 7

3)- An output of a control block is given by  $3e^{-t}$ . What is the transfer function of the block?

- a)  $1/3(s+1)$       **b)  $3/(s+1)$**       c)  $1/(s+3)$       d)  $(s+3)$       e)  $(s+1)$

4)- An open loop control system with two blocks in series. The first block transfer function is given by  $G_1(s) = 0.5(s+2)/(s+1)$  and the second block is given by  $G_2(s) = 2/[s(s+2)]$ . What is the overall transfer function?

- a)  $1/[s(s+2)]$       b)  $2.5/[(s+1)(s+2)]$       c)  $1/[(s+2)(s+1)]$       **d)  $1/s(s+1)$**       e)  $1/s$

5)- Effect of feedback on sensitivity is minimum in:

- a) Closed loop control system**      c) Open loop control system  
b) Open and closed loop control systems      d) None of the mentioned      e) Electrical systems

6)- Which of the following is an example of an open loop system?

- a) Household Refrigerator      b) Respiratory system of an animal      c) Robotic systems  
d) Air conditioner unit.      **e) Mercury blood pressure measuring device**

7) Standard test signals in control system are:

- a) Impulse signal      b) Ramp signal      c) Unit step signal      d) Cosine signal      **e) All of the mentioned**

8) Unit step signal is the signal whose values is :

- a) one for all values of time greater than or equal to zero**

- b) Deterministic signal and changing between 0 and 1  
c) It is zero for time less than one 1 second.      d) All of the mentioned      e) one for  $t=1$

9) Ramp input

- a) Denotes constant velocity      b) Value increases linearly with time      c) It varies exponentially with time  
**d) It denotes constant velocity and varies linearly with time**      e) All of the mentioned

10) The Laplace of unit impulse function  $\delta(t)$  is

- a)  $e^{-s}$       b)  $1/s$       c)  $1/s^2$       **d) 1**      e)  $1/s + 1$

11) The error signal in a closed loop system is the difference between the reference input and the

- a) Disturbance signal      b) Command input      c) Controlled signal      **d) Feedback signal**      e) step signal

12) The voltage ( $V_L$ ) across an inductance ( $L$ ), with current passing through it ( $i_L$ ) is equal to

- a)  $V_L = L \cdot i_L$       **b)  $V_L = L \cdot di_L/dt$**       c)  $V_L = i_L \cdot (dL/dt)$       d)  $V_L = i_L \cdot (d^2i/dt^2)$       e)  $V_L = L \cdot (i_L)^2$



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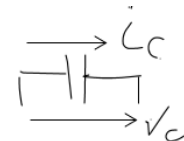
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- 13) The order and type of the transfer function given by  $G(s) = (s + 1) / (s^3 + 3s^2 + 12s)$  is of :
- a) order 1 and type 0      b) order 1 and type 1      c) order 3 and type 2      **d) order 3 type 1**  
e) order 2 type 0

- 14) The inverse Laplace transform of any transfer function is
- a) required for evaluating the output in time domain**  
b) required for evaluating the input in time domain  
c) required for evaluating the output in s domain  
d) required for evaluating the output at initial condition.  
e) required for evaluating the roots of the characteristic equation

- 15) The current  $i_c$  passing through a capacitor ( C ) is given by
- a)  $i_c = (V_c) ( C )$       b)  $i_c = (V_c) ( dC / dt )$ .      **c)  $i_c = ( C ) ( dv_c / dt )$**       d)  $C \int V_c dt$   
e)  $1/C \int V_c dt$



- 16) Transfer function is defined as the:
- a) output to input in s domain with initial conditions.  
**b) output to input in s domain with zero initial conditions.**  
c) input to output in s domain with initial conditions.  
d) input to output in s domain with zero initial conditions.  
e) output to input in time domain

- 17) A block diagram consists of two blocks connected in parallel. The first block is  $G_1(s) = \frac{2}{s+1}$  and the second block is  $G_2(s) = -\frac{1}{s+2}$ . Find the overall transfer function?
- a)  $G(s) = \frac{1}{2s+3}$       b)  $G(s) = \frac{2s+1}{(s+1)(s+2)}$       c)  $G(s) = \frac{1}{(s+1)(s+2)}$   
**d)  $G(s) = \frac{s+3}{(s+1)(s+2)}$**       e)  $G(s) = \frac{3}{(s+1)(s+2)}$

- 18) A block diagram consists of two blocks connected in series. The first block is  $G_1(s) = \frac{2}{s+1}$  and the second block is  $G_2(s) = \frac{s+1}{s+4}$ . Find the overall transfer function?
- a)  $G(s) = \frac{2}{s+4}$**       b)  $G(s) = \frac{2(s+1)}{(2s+5)}$       c)  $G(s) = \frac{2(s+1)}{(s+4)}$   
d)  $G(s) = \frac{(s+3)}{(s+1)(s+4)}$       e)  $G(s) = \frac{s+3}{(s+5)}$



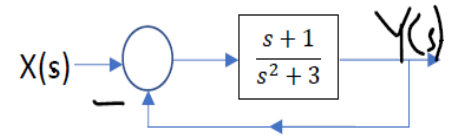
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19) A unity negative feedback system with feedforward transfer function  $G(s)$  as shown in Fig.2. Find  $\frac{Y(s)}{X(s)}$  ?

- a)  $\frac{s+1}{s^2+4}$       **b)  $\frac{s+1}{s^2+s+4}$**       c)  $\frac{1}{s^2+2s+3}$       d)  $\frac{s+2}{s^2+3}$       e)  $\frac{s+2}{s^2+4}$



20) The Laplace of  $\frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 8y = 2$  is

- a)  $Y(s) = \frac{2}{(s+2)(s+4)}$       b)  $Y(s) = \frac{2s}{(s+2)(s+4)}$       **c)  $Y(s) = \frac{2}{s(s+2)(s+4)}$**   
d)  $Y(s) = \frac{2}{(s+6)(s+8)}$       e)  $Y(s) = \frac{2}{s(s+6)(s+8)}$

21) The Laplace of  $[ u(t) = 3e(t) + 7\frac{de(t)}{d(t)} + 2 \int e(t)dt ]$  is

- a)  $U(s) = (3 + 7s + \frac{2}{s}) E(s)$**       b)  $U(s) = (3 + \frac{7}{s} + 2s) E(s)$       c)  $U(s) = (7 + 3s + 2/s) E(s)$   
d)  $U(s) = (3s + \frac{7}{s} + 2) E(s)$       e)  $U(s) = (3 + 7s) E(s)$

Fig. 2

22) Find the initial condition  $y(t=0)$  for the following system.

$$\frac{Y(s)}{X(s)} = \frac{(s+3)}{(s+1)(s+4)}$$

using initial value theorem where the input  $x(t)$  is a unit step function  $x(t)=1$ .

- a) 1      b) 3/4      c) 3/5      d) infinity      **e) Zero**

23) Find the initial condition  $y(t=0)$  for the same system in Q20 but with input of unit impulse  $x(t)=\delta(t)$

- a) 1**      b) infinity      c) 3/4      d) 1/4      e) none of above

24) Find the output at steady state  $y(t=\infty)$  for the same system given in Q(20) where  $x(t)=1$

- a) 1      b) 3      **c) 3/4**      d) infinity      e) 3/5

25) Find the output at steady state  $y(t=\infty)$  for the same system given in Q(20) where  $x(t)=\delta(t)$

- a) 1      b) 4      c) 3/5      **d) zero**      e) infinity



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**Q2) Answer the following questions with True or False**

**(25 Marks)**

- 1) Open loop system is more efficient than closed loop systems. A) True B) False
- 2) The Laplace equation is an equation in time domain. A) True B) False
- 3) A water tank system with float is considered as a feedback closed loop system. A) True B) False
- 4) If angular velocity is  $\omega(s)$  and angular position is  $\theta(s)$  then  $\omega(s) = \theta(s) / s$  A) True B) False
- 5) A system with pole located at the left hand side of s-Plane is considered Unstable. A) True B) False
- 6) The Pole of a first order system can not be a complex value  $(\sigma + j\omega)$  A) True B) False
- 7) The system is stable if the output is bounded for a bounded input. A) True B) False
- 8) The Laplace transform of  $(\frac{dy}{dt})$  is  $Y(s)/s$  A) True B) False
- 9) The Laplace of  $\{ e^{-2t} \cos(t) \}$  is  $s / [(s + 1)^2 + 4]$  A) True B) False
- 10) In a Process control system, the output is a variable such as speed or position A) True B) False
- 11) In Servomechanism system the output is a variable such as Temperature or pressure A) True B) False
- 12) For  $Y(s)/X(s) = G(s)$  ; If the input is unit step function then  $Y(s) = s G(s)$  A) True B) False
- 13) For  $Y(s)/X(s) = G(s)$  ; If the input is Impulse function then  $Y(s) = G(s)$  . A) True B) False
- 14) The ratio of the output  $Y(s)$  to the actuating error signal  $E(s)$  is called the *feedforward transfer function* A) True B) False
- 15) The ratio of the feedback signal  $B(s)$  to the actuating error signal  $E(s)$  is called the *open-loop transfer function*. A) True B) False
- 16) If the feedback transfer function  $H(s)$  is unity, then the open-loop transfer function and the feedforward transfer function are the same. A) True B) False
- 17) The output of closed-loop system depends on both the closed-loop transfer function and the nature of the input signal A) True B) False
- 18) Reference input is almost the desired output A) True B) False
- 19) A control system in which the output signal has no effect upon the control action is a closed loop system A) True B) False
- 20) The required power in open loop system is lower than in a closed loop system. A) True B) False
- 21) If the parameters of a system is changing with time it called nonlinear system. A) True B) False
- 22) The balance equation for a mechanical system is:  $\sum Forces = Mass \times velocity$  A) True B) False
- 23) The Laplace of any function is evaluated by  $L[f(t)] = F(s) = \int_0^{\infty} f(t)e^{-st} dt$  A) True B) False
- 24) The symbol (s) in Laplace equations refers to a complex variable. A) True B) False
- 25) Laplace of  $3 \frac{d^2y}{dt^2}$  is  $3s Y(s)$  A) True B) False

رئيس القسم

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استاذ المادة

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"good luck"