KATHMANDUUNIVERSITY
End Semester Examination [C]
April/May 2023

Marks Scored:

Level : B.E.
Year : III

Course : COEG 304
Semester: I

Exam Roll No.:

Time: 30 mins.

F.M. : 10

26 APR 2023

Registration No.:

Date :

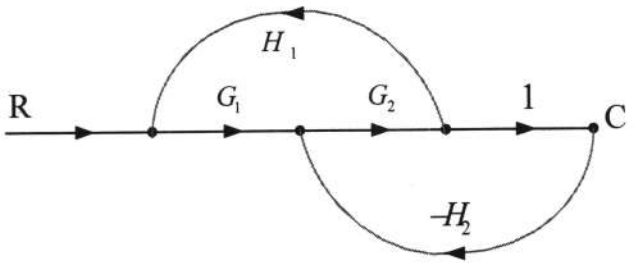
SECTION "A"
[20Q × 0.5 = 10 marks]

Encircle the most appropriate alternative from each set of choices.

1. The transfer function is defined as .....
   a. The ratio of the Laplace transform of output to Laplace transform of input considering initial condition as zero.
   b. The ratio of Laplace transform of input to Laplace transform of output considering initial conditions as zero.
   c. The ratio of input to output
   d. The ratio of output to input

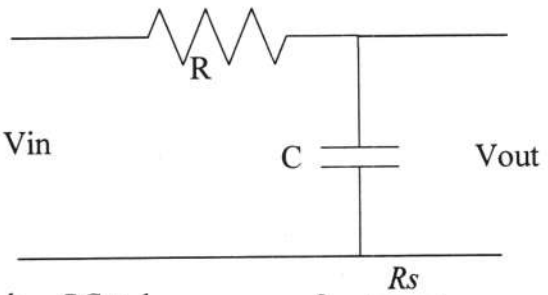
2. The Laplace transform of $e^{-2t}\sin 2t$ is .....
   a. $\frac{4}{(s+2)^2+4}$ b. $\frac{4}{s^2+4}$ c. $\frac{2}{s^2+4s+8}$ d. $\frac{2}{s^2+4}$

3. The overall transfer function for the signal flow graph given below is.....



   a. $\frac{G_1G_2}{1-G_1G_2H_1+G_2H_2}$
   b. $\frac{G_1G_2}{1+G_1G_2H_1+G_2H_2}$
   c. $\frac{G_1G_2}{1-G_1G_2H_1-G_2H_2}$
   d. $\frac{G_1G_2}{1+G_1G_2H_1+G_2H_1}$

4. The transfer function for the network given below is.....



   a. $\frac{1}{RCs+1}$ b. $RCs+1$ c. $\frac{Rs}{Cs-1}$ d. $\frac{R}{C}s+1$

5. If maximum overshoot (Mp) = 100%, the damping ratio is.....
   a. 1 b. 0 c. 0.5 d. Infinity

6. The settling time of a second order system is.....when the steady state output is within 2% tolerance band.
   a. $t_s = \frac{4}{\xi\omega_n}$ b. $t_s = \frac{\xi\omega_n}{4}$ c. $t_s = \frac{4\xi}{\omega_n}$ d. $t_s = 4\xi\omega_n$

7. The time needed for the response to reach from 10% to 90% of the final value is termed as.....
   a. Rise time b. Peak time c. Settling time d. Delay time

8. The position error coefficient of a system $G(s) = \frac{1}{(s+2)(s+7)}$ with unity feedback is.....
   a. 0 b. Infinity c. 14 d. 1/14

9. The type of the transfer function, $G(s)H(s) = \frac{K}{s^3 + 2s^2 + 3s}$ is.....
   a. 1 b. 2 c. 3 d. 4

10. For the Routh array given below: the system is stable if.....

s^3	1	3
s^2	4	K
s^1	$\frac{(12-K)}{4}$	0
s^0	K	0

    a. K>12 b. K=12 c. K>39 d. K<3

11. The location of the closed loop conjugate pair of pole on jw axis indicates that the system is.....
    a. Stable c. marginally stable
    b. Unstable d. critically stable

12. What is the main objective of process control ?
    a. to control physical parameters c. to control optical parameters
    b. to control mechanical parameters d. to control electrical parameters

13. A 5 bit digital to analog converter has a current output. When the digital input is 10000, the current output is 8mA. If the digital input is 11111, the output current is.....
    a. 25.25 mA b. 16.5 mA c. 0.5 mA d. 15.5 mA

14. The number of comparators required in a 3-bit flash type ADC is.....
    a. 2 b. 3 c. 7 d. 8

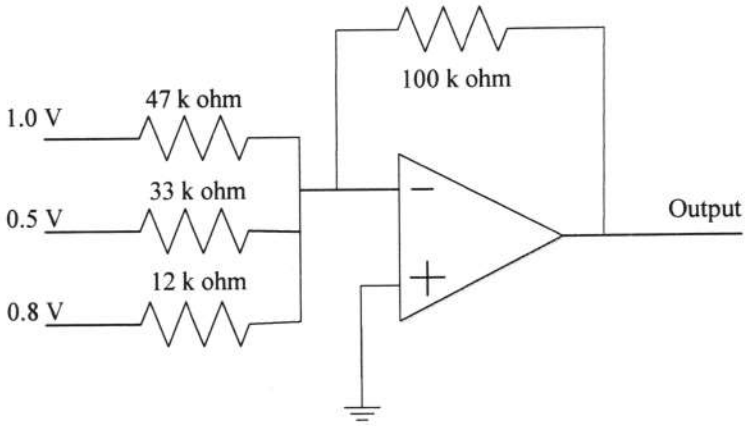
15. A 4-bit R/2R ladder DAC uses.....
    a. One resistor value c. Three resistor values
    b. Two resistor values d. Four resistor values

16. A low pass filter is formed using.....
    a. RLC circuit
    b. Resistor
    c. Resistor and Capacitor
    d. Inductor and capacitor

17. In a certain low-pass filter, fc=4.5 kHz. Its pass band is.....
    a. 0 Hz to 4.5 Khz
    b. 0 Hz
    c. 4.5 kHz
    d. 9 kHz

18. The op-Amp as a voltage follower has a voltage gain of.....
    a. Infinity
    b. Zero
    c. Unity
    d. Less than unity

19. Determine the output voltage for the given network.



    a. -12.35 V
    b. -10.31 V
    c. -9.26
    d. 10.31

20. Which transducer measure change in acceleration, pressure, strain and temperature?
    a. Photoelectric transducer
    b. Capacitive transducer
    c. Piezoelectric transducer
    d. Inductive transducer

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SECTION "B"
[5Q × 8 = 40 marks]

Attempt *ANY FIVE* questions. Draw neat and clean diagram wherever necessary. Assume suitable data if necessary.

1. a. Classify the following as open or closed loop system with valid reasons and block diagram (i) An electrical On-Off Switch and (ii) Room air-conditioner. [4]

   b. Explain what is meant by open-loop transfer function in relation to a closed-loop control system mathematically. [4]

2. a. In the liquid level system as shown in Figure 1, two tanks interact. Find the transfer function Q2(s)/Q(s). [5]

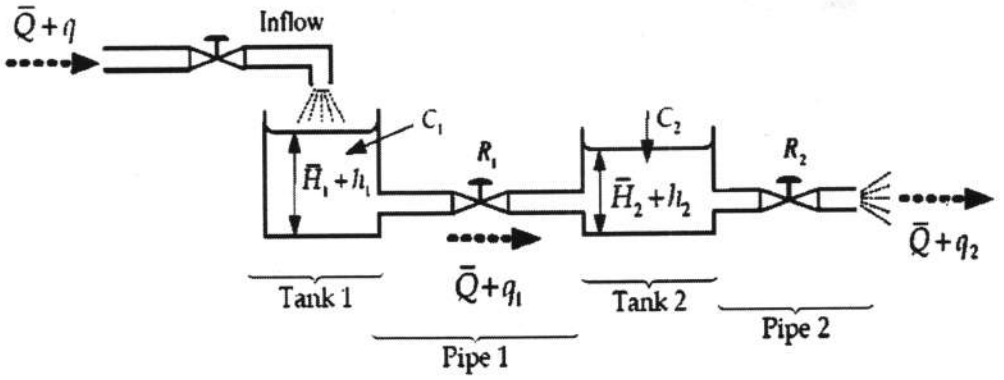

Figure 1

   b. How the location of system poles in pole-zero map would affects the system stability? Explain your understanding. [3]

3. a. Obtain the overall transfer function for a control system having the block diagram shown in Figure 2 using block diagram reduction method. [5]

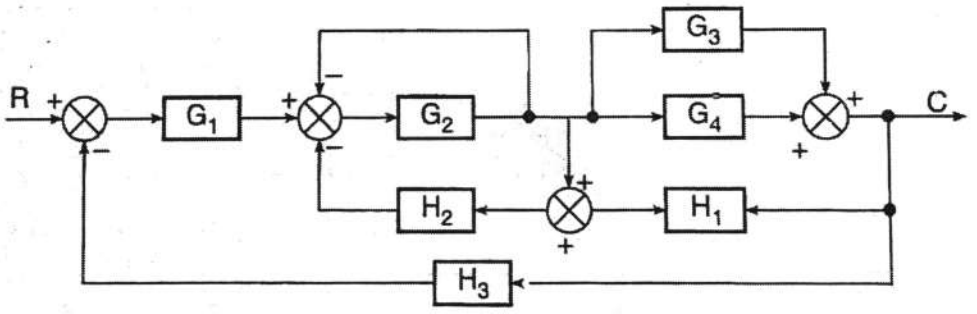

Figure 2

b. Check the stability of the system, having following characteristic equation. $s^5 + 6s^4 + 3s^3 + 2s^2 + s + 1 = 0$ [3]

4. a. The unity feedback system is characterized by an open loop transfer function $G(s) = \frac{K}{s(s+10)}$. Determine the gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine peak overshoot and time at peak overshoot for a unit step input. [5]

b. Differentiate between human aided control and automatic control with proper illustration and block diagram. [3]

5. a. The open-loop transfer function of a control system is given below: [4]

$$G(s)H(s) = \frac{2(s^2 + 3s + 20)}{s(s+2)(s^2 + 4s + 10)}$$

Determine the static error coefficients and steady state error for the input given as

(*i*).5

(*ii*).4*t*

(*iii*).$4t^2 / 2$

b. Figure 3 is a D/A converter with op-amp. Find the output of op-amp if the input digital signal is 1011. Assume that binary 1 represents 5V. [4]

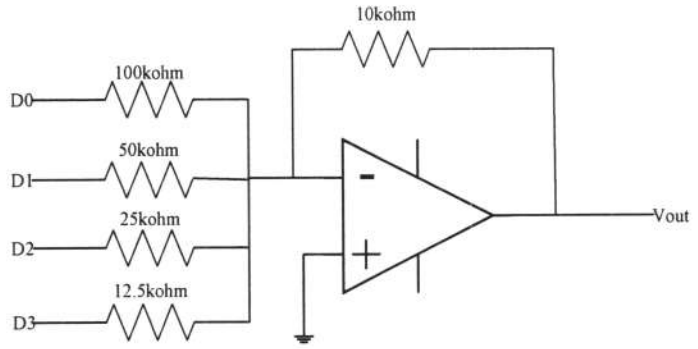

Figure 3

6. a. Design a 4-bit flash type A/D converter. What will be the encoder binary output for Vin=6.5 V if the Vref = 8 V. Also, explain its working. [5]

b. Define actuator and explain various types of actuator with illustrations. [3]