KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Marks Scored:

Level : B.E.
Year : III

Course : COEG 304
Semester: I

Exam Roll No.:

Time: 30 mins.

F.M. : 20

Registration No.:

Date 04 JUN 2019

SECTION "A"
[20 Q. × 1 = 20 marks]

Choose and encircle the most appropriate answer.

1. The transfer function is defined only for
   a. Linear time varying systems
   b. Linear time invariant systems
   c. Linear and nonlinear systems
   d. Nonlinear systems

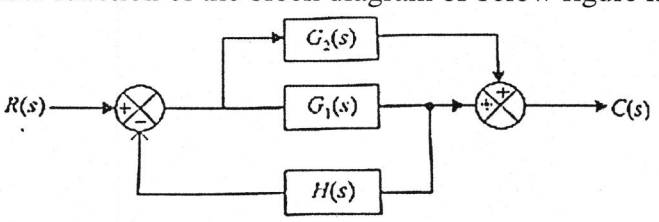
2. The steady state error of a first order system to a ramp input is equal to
   a. time constant of the system
   b. zero
   c. infinite
   d. unity

3. Control systems are normally designed with damping factor
   a. $\xi=0$ b. $\xi=1$ c. $\xi>1$ d. $\xi<1$

4. For a second order over damped system the poles are
   a. Purely imaginary
   b. Complex conjugate of each other
   c. Real and equal
   d. Real and unequal

5. If the characteristic equation of the system is $s^2+4s+10=0$, the system is
   a. Undamped b. overdamped c. critically damped d. underdamped

6. The close loop transfer function of the block diagram of below figure is




   a. $\frac{G_1(s)+G_2(s)}{1+G_1(s)H(s)}$
   b. $\frac{G_1(s)+G_2(s)}{1+G_2(s)H(s)}$
   c. $\frac{G_1(s)}{1+G_2(s)H(s)}$
   d. $\frac{G_1(s)+G_2(s)}{1+[G_1(s)+G_2(s)]H(s)}$

7. A unity feedback control system has an open loop transfer function of $G(s)=\frac{K}{(s-1)(s+3)}$ The closed loop system is
   a. Unstable for all values of **K**
   b. Stable for all values of **K**
   c. Stable for **K** ≥3 and unstable for **K**< 3
   d. Unstable for **K** ≥ and stable for **K**< 3

8. The characteristic equation of a system is $2s^3+4s^2+4s+8=0$. How many roots are there in the left half s-plane or on jw-axis?
   a. One b. Two c. Three d. four

9. Due to the use of a derivative controller the rise time of a system is
a. Increased b. decreased c. not affected d. made zero

10. If the system has non repeated poles on the *jw* axis, the system is
a. Stable b. Unstable c. Marginally stable d. Conditionally stable

11. For high speed application, DACs use
a. parallel form of conversion
b. serial form of conversion
c. successive approximation form of conversion
d. feed forward form of conversion

12. Transfer function of PID controller has
a. 2 poles and one zero b. 2 zeroes
c. 1 pole and 2 zeros d. 2 poles

13. $G(s)=\frac{e^{-2s}}{s(s+4)}$, the system with this transfer function is operated in closed loop with unity feedback. The closed loop system is
a. Stable b. Unstable c. Marginally stable d. Conditionally stable

14. Unit impulse response of a linear system is obtained from its unit step response by
a. Taking its derivative
b. Taking its integral
c. Multiplying it with a suitable constant
d. Cannot be obtained from the step response

15. A LVDT is a ..... transducer.
a. velocity b. pressure c. acceleration d. displacement

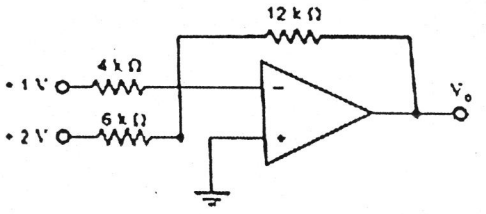
16. RTD have
a. Positive temperature coefficient b. Negative temperature coefficient
c. Either type of temperature coefficient d. High tolerance

17. If the highest frequency content in the input signal is fhHz, a special problem called Aliasing occurs if it is sampled at the rate of
a. f s< 2fh b. f s>2fh c. f s = 2 f h d. $f_s) \geq 2\ f_h$

18. An 8-bit A/D converter has a resolution of
a. $1/2^4$ b. $1/2^8$ c. $1/2^{12}$ d. $1/2^{16}$

19. In an integral controller
a. the output is proportional to input
b. the rate of change of output is proportional to input
c. the output is proportional to rate of change to input
d. the output is increased

20. For the circuit as shown in figure below, the value of output Vo is
a. +3V b. −3V
c. −7V d. +7V



KATHMANDU UNIVERSITY
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04 JUN 2019

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Time : 2hrs. 30 mins.

Course : COEG 304
Semester : I
F.M. : 55

SECTION "B"
[5 Q × 11 = 55 marks]

Attempt *ANY FIVE* questions. Assume any suitable data if necessary.

1. a. What do you mean by a control system? Distinguish between linear and nonlinear control system. [3]
   b. What is Seebeck effect? Describe with a schematic diagram how Seebeck effect is used in a thermocouple for the temperature measurement in an industry. [4]
   c. Show that with integral control the steady state error is zero for a ramp input. [4]

2. a. Derive the transfer function $\frac{E_0(s)}{E_i(s)}$ of the electrical circuit shown in Figure-1 [5]

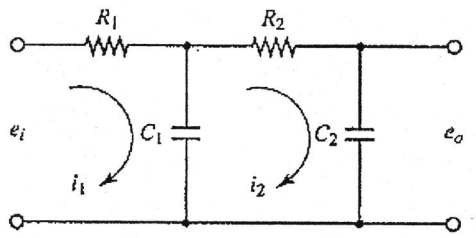


Figure-1

   b. Determine the transfer function $\frac{Y(s)}{R(s)}$ of Figure-2 using block reduction method. [6]

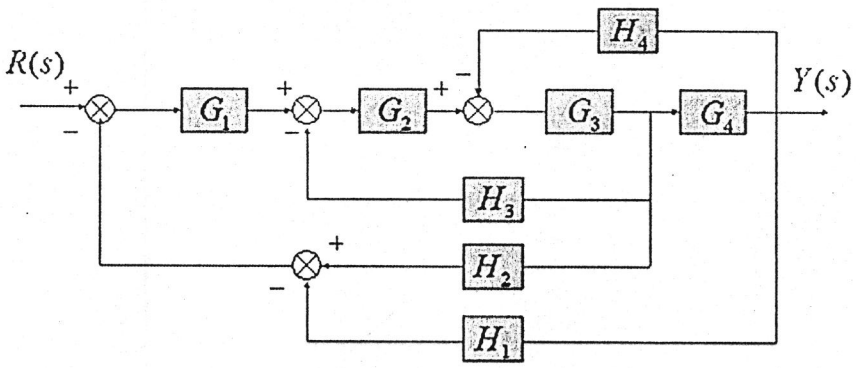


Figure-2

3. a. Derive the unit step response of a second order system for $0 < \xi < 1$ and deduce the expression
   for unit step response y(t).
   Locate on the complex plane the roots of the characteristics equation of a second order system for $\xi<1$, $\xi=1$, $\xi>1$. [6]

   b. By means of the Routh criterion, determine the stability of the systems and number of roots represented by given characteristics equation. [5]

$$s^4 + 2s^3 + 10s^2 + 20s + 5 = 0$$

4. a. A closed loop control system with a unity feedback is shown in Figure-3. By using derivative control the damping ratio is to be made 0.75. Determine the value of $T_d$. [5]

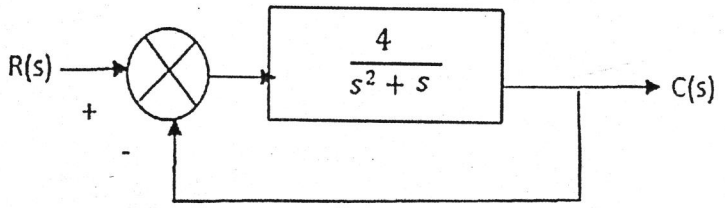


Figure-3

b. Derive the balance condition of a Schering bridge circuits. [6]

5. a. Consider a 6 bit D/A converter with a resistance of 320 kΩ in LSB position. The converter is designed with weighted resistive network. The reference voltage is 10V. The output of the resistive network is connected to an OPAMP with a feedback resistance of 5 kΩ. What is the output voltage for a binary input of 111010? [5]

b. Describe the following terms used in conjunction with digital to analog (D/A) conversion: [3]

i. Discrete levels ii. Resolution iii. Quantization error iv. Decision Levels

c. What is a flow sensor? Describe the working of Coriolis mass flow rate sensor. [3]

6. a. Draw the ladder diagram for the process shown in Figure-4: [6]

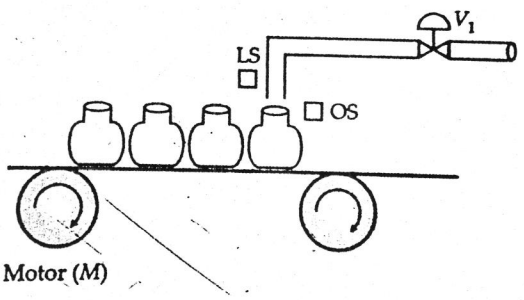


Figure-4

**Step 1** The Motor M rotates and the conveyor belt moves
**Step 2** As soon as the first bottle crosses the limit switch (LS), the motor stops and bottle is under the pipe
**Step 3** As the bottle is under the pipe, valve V opens
**Step 4** The bottle is filled up and when full, opticalswitch (OS) is closed and valve V is closed
**Step 5** The motor again rotates and the steps 1 to step 4 are repeated.

b. Describe the use of the following sensors used for control: [5]

i. Pneumatic sensor
ii. Hall Effect sensor
iii. Inductive Proximity Sensor