BRAINWARE UNIVERSITY

Term End Examination 2023
Programme – B.Tech.(ECE)-2019/B.Tech.(ECE)-2020
Course Name – Control Systems
Course Code - PCC-EC601
(Semester VI)

Full Marks : 60   **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)   1 x 15=15

1.   *Choose the correct alternative from the following :*

(i)   Judge the damping ratio, if overshoot is excessive

   a) > 0.4   b) = 0.4
   c) < 0.4   d) Infinity

(ii) Transient response in the system is basically due to

   a) Forces   b) Friction
   c) Stored energy   d) Coupling

(iii) Stability of a system implies that

   a) Small changes in the system input does   b) Small changes in the system parameters
      not result in large change in system output   does not result in large change in system
                                                        output

   c) Small changes in the initial conditions does d) All of the above mentioned
      not result in large change in system output

(iv) The relationship between an input and output variable of a signal flow graph is given by
      the net gain between the input and output node is known as the_____

   a) Overall gain of the system   b) Stability
   c) Bandwidth   d) Speed

(v)   Signal flow graphs

   a) apply to linear systems   b) The equation obtained may or may not be
                                                        in the form of cause or effect

   c) Arrows are not important in the graph   d) They cannot be converted back to block
                                                        diagram

(vi) By equating the denominator of transfer function to zero, choose among the following
      will be obtained

   a) Poles   b) Zeros
   c) Both a and b   d) None of the above

(vii) Transfer function of the system is defined as the ratio of Laplace output to Laplace
      input considering initial conditions_____

a) 1
b) 2
c) 0
d) infinite

(viii) Identify the overall transfer function of two blocks in parallel are

    a) Sum of individual gain
    b) Product of individual gain
    c) Difference of individual gain
    d) Division of individual gain

(ix) The forward path transfer function is given by G(s) = 2/s(s+3). Determine the type and order of the system:

    a) 1, 2
    b) 2, 2
    c) 0, 2
    d) 1, 1

(x) The gain margin of a second-order system is:

    a) Zero
    b) Infinite
    c) One
    d) Two

(xi) The number of roots in the left half of the s-plane of the given equation $s^3 + 3s^2 + 4s + 1 = 0$ is

    a) 1
    b) 3
    c) 2
    d) 0

(xii) Control System is described as

    a) Control system is a system in which the output is controlled by varying the input
    b) Control system is a device that will not manage or regulate the behaviour of other devices using control loops
    c) Control system is a feedback system that can be both positive and negative
    d) Control System is a system in which the input is controlled by varying the output

(xiii) The impulse response of an RL circuit is

    a) Parabolic function
    b) Step function
    c) Rising exponential function
    d) Decaying exponential function

(xiv) Feedback control system is basically _____

    a) Band pass filter
    b) Band stop filter
    c) High pass filter
    d) Low pass filter

(xv) Select the following is the input of a controller

    a) Signal of fixed amplitude not dependent on desired variable value
    b) Desired variable value
    c) Desired variable value
    d) Error signal

Group-B
(Short Answer Type Questions)   3 x 5=15

2. Explain the properties of state transition matrix.   (3)
3. Define Transfer function of a closed loop system. Explain Pole and Zero of a transfer function.   (3)
4. Distinguish Absolute stability and Relative stability.   (3)
5. Explain underdamped, overdamped and critically damped system with graph.   (3)
6. Explain the advantages of bode plots.   (3)

OR

Explain the advantages of frequency response analysis   (3)

Group-C
(Long Answer Type Questions)   5 x 6=30

7. A unity feedback system has a forward path transfer function G(s)=8/(s+2).Identify the value of damping ratio, undamped natural frequency of the system, percentage over shoot, peak time and settling time.   (5)

8. Evaluate the stability of the system whose characteristic equation is given by (5)
$$2s^4 + 2s^3 + s^2 + 3s + 2 = 0$$

9. Identify the stability of the system whose characteristic equation is given by (5)
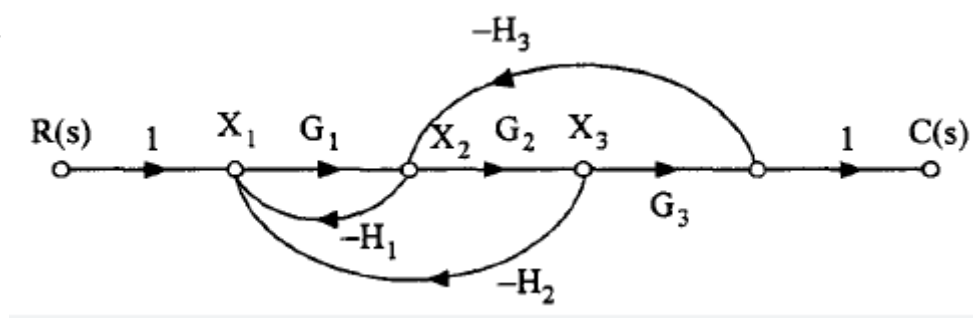2s^4+2s^3+s^2+3s+2=0

10. (5)

Obtain the rise time, peak time, maximum peak overshoot and settling time of unit step response of a closed loop system given by

$$\frac{C(s)}{R(s)} = \frac{16}{(s^2 + 2s + 16)}$$

11. (5)

Sketch the polar plot for $G(s) = \frac{1}{s(s+1)}$.

12. (5)

Evaluate the transfer function of C(s)/R(s) of the system whose signal flow graph is shown in the Fig.

OR

(5)

A system characterised by the transfer function

$$\frac{Y(s)}{u(s)} = \frac{2}{s^3 + 6s^2 + 11s + 6}.$$

Evaluate the state and output equation in matrix form

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