Reg. No. : | | | | | | | | | | |

Question Paper Code: 34501

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Fourth Semester

Electronics and Instrumentation Engineering

01UEI401 – CONTROL ENGINEERING

(Regulation 2013)

Duration: One hour Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

1. Which of the following system is not an example of closed loop system?
   (a) Traffic light controller

   (b) Action of human being in walking

   (c) Home heating system

   (d) DC motor speed control

2. In force-voltage analogy, spring constant is analogous to

   (a) Voltage (b) Reciprocal of capacitance (c) Capacitance (d) Charge

3. State the order and type number of the system for the given open loop $G(s) = \frac{10}{s(1 + 0.4s)(1 + 0.1s)}$ transfer function

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

4. Which of the following characteristics does it have, the given closed loop transfer function $\frac{C(s)}{R(s)} = \frac{121}{s^2 + 132s + 121}$ of a system

   (a) Over damped system and setting time 1.1s
   (b) Under damped system and setting time 0.6s

   (c) Critically damped system and setting time 0.8s

   (d) Under damped system and setting time 0.707s

5. Phase margin of a system is used to specify which of the following?

(a) Frequency response (b) Absolute stability

(c) Relative stability (d) Time response

6. At the gain cross over frequency, ω=5 rad/s, $\angle G(j\omega)H(j\omega) = -170^\circ$. The phase margin is

(a) -10º (b) 10º (c) -170º (d) 170º

7. If the poles of a system lie on the imaginary axis, the system will be

(a) stable (b) unstable

(c) marginally stable (d) Conditionally stable

8. Normal Routh array indicates

(a) non zero elements in the first column (b) row of all zeros

(c) first column element of the row is zero (d) row of all ones

9. Number of _____ in a state diagram of discrete time system is equal to number of state variables.

(a) integrators (b) state variables

(c) phase variables (d) unit delay

10. The state variable approach is applicable to

(a) Only linear time in-variant systems

(b) Linear time in-variant as well as time varying systems

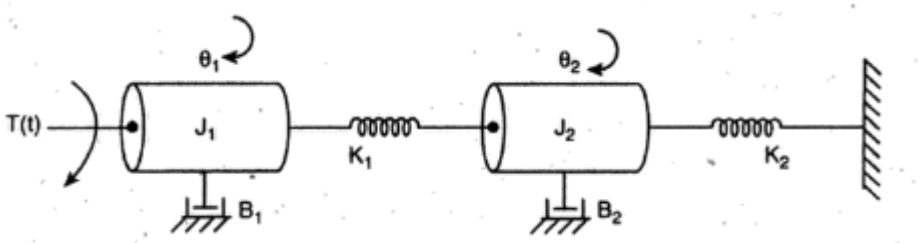
(c) Linear as well as non linear systems

(d) All type of systems

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. For the mechanical system shown in figure write the differential equations and hence find $\frac{\theta_2(s)}{T(s)}$. (8)



12. The open loop transfer of a feedback control system with unity feedback given by

$$G(s) = \frac{40}{s(1+0.5s)}$$

Find the error constants for the system. Also obtain the steady state error when the input is $r(t) = 1 + 5t + 10t^2$. (8)

13. The open loop transfer function of unity feedback system is given by $G(s) = \frac{10(s+2)}{s(s+1)(s+3)}$. Sketch the polar plot and determine the gain margin and phase margin. (8)

14. Sketch the root locus for the unity feedback system whose open loop transfer function is given by $G(s) = \frac{K}{s(s^2+6s+10)}$. Determine the range of 'K' for which the system to be stable. (8)

15. A LTI system is characterized by the state equation

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Where 'u' is a unit step function. Compute the solution of these equation assuming initial condition $x_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ (8)