TEE-502

Roll No. | | | | | | | | | | |

Odd Semester Examination, 2019-20
B. Tech: EEE (Semester: 5th)
System Engineering

Time: 3:00 hrs. **Max .Marks :100**

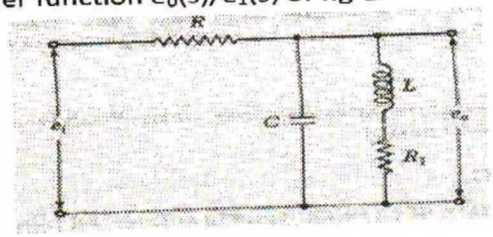
Total no. of printed pages: 2

Note : (i) All questions are compulsory.
(ii) In case of numerical problems assume data whenever not provided.

4X5=20

Q1. Attempt **any four** of the following

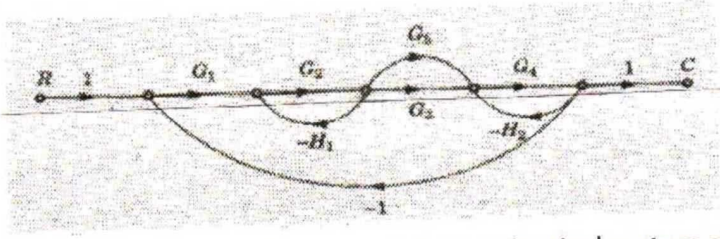
(a) Determine the transfer function $e_0(s)/e_1(s)$ of fig-1.



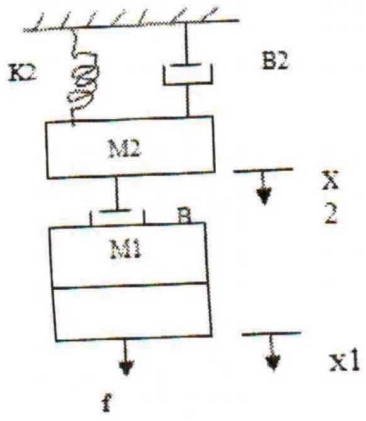
(b) Define terms transmittance and non-touching loop with respect to a signal flow graph.

(c) Explain open and closed loop systems. Write a comparative study of both..

(d) Draw the block Diagram from the signal flow graph shown in fig-2.



(e) Draw the electrical equivalent circuit diagram of the mechanical system shown below using force-voltage analogy



(f) Explain any four rules of Block Diagram Reduction.

4X5=20

Q2. Attempt **any four** of the following

(a) A second order system is subjected to a unit step input. Given, $\xi = 0.5$ and $\omega_n = 6$ rad/sec. Determine the rise time, peak time, settling time and peak overshoot.

ɔ) Obtain the unit step response of unity feedback system whose open loop transfer function is

$$G(S) = \frac{4}{s(5+s)}$$

(c) Discuss the PI and PID controller with their application and their error constants.

(d) Calculate the value of K_p, K_v, K_a for

$$G(s)H(s) = \frac{s^2(s+4)}{s(s^3+144s+256)}$$

Write clearly what are the input used for calculating each of these error constant.calculate steady stste error for each of these inputs.

(e) With respect to transient response of second order system for step input, define the following:
(i) Rise Time (ii) Time Constant(iii) Percentage Overshoot(iv) Settling Time.

(f) Explain the transient response of a first order system with a suitable example.

2x10=20

ɫ3. Attempt **any two** of the following

(a) Explain sampler and zero order hold circuit used in sampled data control system.

(b) Find the Z-transform of (i) sinωt (ii) e^{at}.

(c) Find the time response for given system if unit step input is applied.

$$G(s) = \frac{S(s^2+9s+19)}{(s^3+7s^2+14s+8)}$$

2x10=20

Q4. Attempt **any two** of the following

(a) Define and explain the controllability and observability .
Apply Kalman's test for controllability and observability on following system

$x1=x_2$ $\qquad \dot{x}2 = -2x1 - 3x2 + u$

$y= x_1 + x_2$

(b) Consider a single input–single output control system having an overall transfer

$$G(s) = \frac{s^2+4s+4}{s^3+5s^2+4s}$$

Represent the state model and obtain the matric es A, B, C.

(c) A system is represented by the folowing dynamic equation:

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = [1 \quad 0]\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Determine the transfer function

2x10=20

Q5. Attempt **any two** of the following

(a) If

$$x(t) = \begin{matrix} 0 & 1 \\ -2 & 3 \end{matrix} x(t)$$ find Eigen values and Eigen Vectors

(b) Obtain eigen values, eigen vectors and state model in canonical form.

$$A = \begin{matrix} 0 & 0 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{matrix}$$

function with respect to stability concept? Write down