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B.Tech V- Semester (Main) Examination Nov. - 2019

PCC/PEC Electronics & Comm. Engg.

5EC4-03 Control System

Time : 3 Hours **Maximum Marks : 120**

Min. Passing Marks : 42

Instructions to Candidates:

*Attempt **all** ten questions from **Part A**, **five** questions out of **seven** questions from **Part B** and **four** questions out of **five** from **Part C**.*

(Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly).

Part - A

(Answer should be given up to 25 words only)

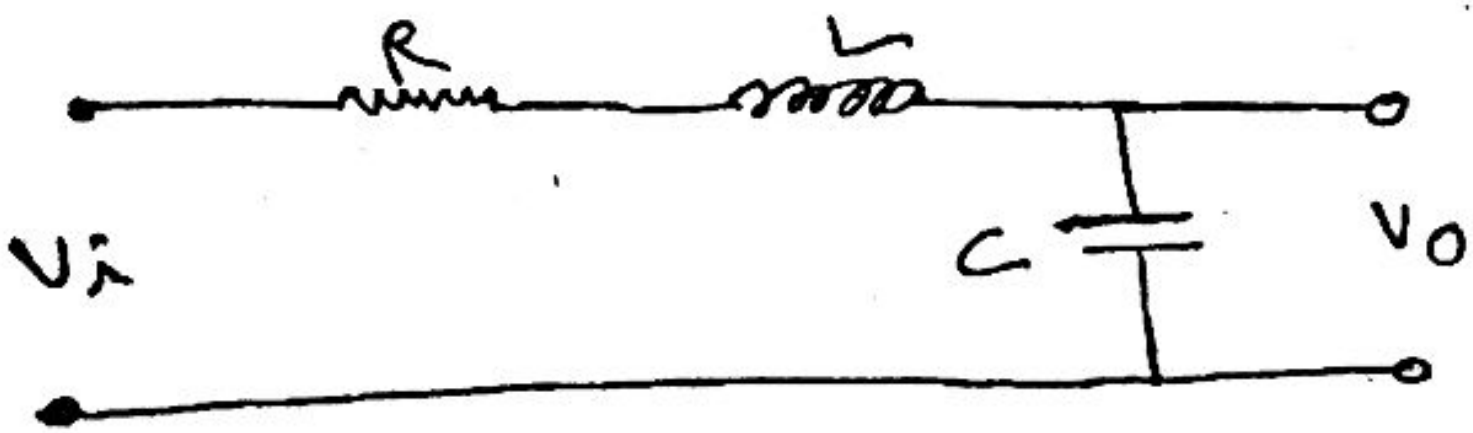
All questions are compulsory **(10×2=20)**

1. What is LVDT?
2. What is unity feedback closed loop control system?
3. Explain rise time and settling time.
4. Explain observability.
5. What is meant by optimal control?
6. What is lag compensation?
7. Explain relative stability.
8. What are type-I and type-II systems?
9. What is meant by feed forward control?
10. What is steady state error?

(Analytical/Problem Solving questions)

Attempt any **five** questions (5×8=40)

1. Draw the block diagram of series RLC circuit, where v_i and v_0 are the input and output voltages.



2. Draw the signal flow graph of following set of equations:

$$x_2 = x_1 + ax_5$$
$$x_3 = bx_2 + cx_4$$
$$x_4 = dx_2 + ex_3$$
$$x_5 = fx_4 + gx_3$$
$$x_6 = x_5$$

3. When a second order control system is subjected to a unit step input, the values of $s = 0.5$ *and* $w_n = 6$ *rad* / sec. Determine the rise time, peak time, settling time and peak overshoot.

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

5. Consider the unity feedback control system, whose open loop transfer function is $G(s) = \frac{1+as}{s^2}$. Determine the value of a , so that the phase margin is 45.

6. Consider the following system and check its controllability and observability:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -0.5 & 0 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

7. For the given transfer function, obtain the state model:

$$G(s) = \frac{k}{s^3 + a_2 s^2 + a_1 s + a_0}$$

Part - C

(Descriptive/Analytical/Problem Solving/Design Question)

Attempt any **four** questions **(4×15=60)**

1. The open loop transfer function of a unity feedback system is given by

$$G(s) = \frac{K}{s(1+sT)}$$

Where, K and T are constants. By what factor the amplifier gain be reduced so that the peak overshoot, of unit step response of the system is reduced from 75% to 25%.

2. The characteristic equation of feedback control system is

$$s^4 + 20s^3 + 15s^2 + 2s + K = 0$$

a) Determine the range of K for the system to be stable.

b) Can the system be marginally stable? If so find the required value of K and frequency of sustained oscillation.

3. For the following system, find its state, output equation and express it in matrix form

$$\frac{y(s)}{u(s)} = \frac{20(4s+2)}{s^3 + 5s^2 + 8s + 2}$$

4. Investigate the stability by the Routh stability criterion for the following characteristic equation

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

5. The open loop transfer function of a unity feedback system is given by:

$$G(s) = \frac{K}{s(1+sT)}$$

By what factor, the amplifier gain K should be multiplied so that the damping ratio is increased from 0.3 to 0.9