

Reg No.: _____

03000IC302052002 Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree Regular and Supplementary Examination July 2021



Course Code: IC302

Course Name: CONTROL ENGINEERING- II

Max. Marks: 100

Duration: 3 Hours

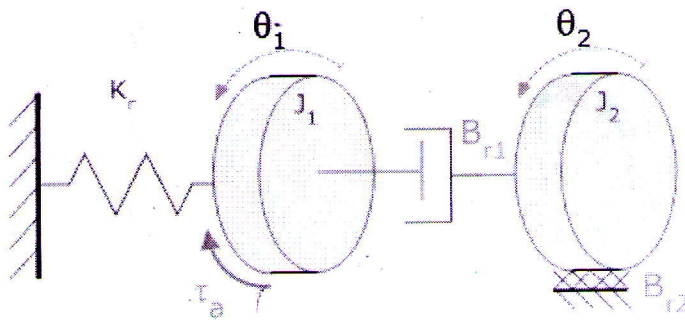
(Issue minimum two normal graph sheets)

PART A

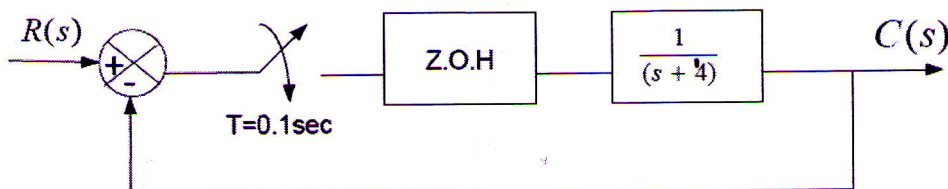
Answer any two full questions, each carries 15 marks.

Marks

- 1 a) Derive the transfer function of Zero order holder circuit. Discuss about the frequency domain characteristics of ZOH. (7.5)
- b) Prove that different state-space model of the same system has same transfer function. (7.5)
- 2 a) What is pulse transfer function? Explain. (3)
- b) Derive the state-space model of the system shown below using physical variables. The input is τ_a and output is θ_1 . (12)



- 3 a) Derive the pulse transfer function of the system shown below. (12)



- b) Explain why system matrix got that name. (3)

PART B*Answer any two full questions, each carries 15 marks.*

- 4 a) Discuss about Cayley Hamilton theorem. (7.5)
 b) Discuss about different nonlinearities. (7.5)
- 5 a) Explain the concept of controllability and observability. (3)
 b) Find the singular point of the system (12)

$$\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 2x = 0.$$

Explain the type of this singular point after drawing the phase plane using Isocline method. (Use normal graph sheet)

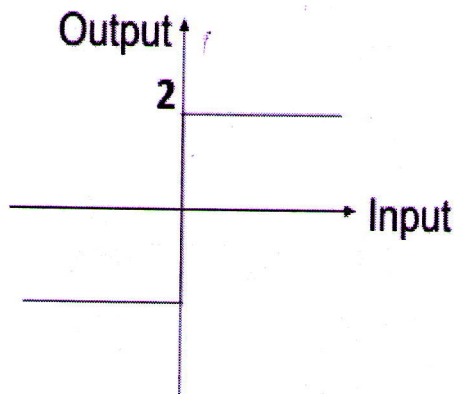
- 6 a) Find the response of the two state variables of the system (12)
- $$\dot{x}_1 = -2x_1 + u$$
- $$\dot{x}_2 = x_1 - x_2$$

to a constant step input with magnitude 5 and initial conditions $x(0) = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$.

- b) Explain about jump resonance. (3)

PART C*Answer any two full questions, each carries 20 marks.*

- 7 a) Explain the concept of describing function. (10)
 b) Explain Lyapunov stability analysis of LTI continuous system. (10)
- 8 a) Derive the describing function of ON-OFF nonlinearity shown below. (10)

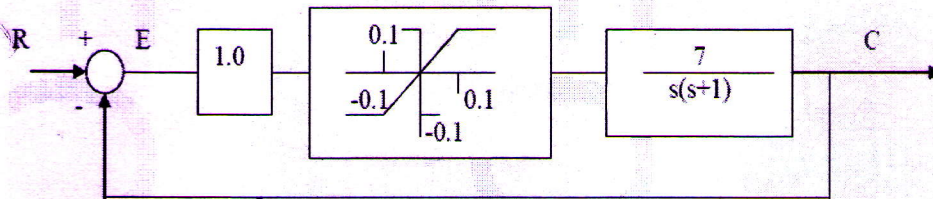


- b) Check the stability of a system using Lyapunov's method. (10)

$$\dot{x}_1 = -x_1 + x_2 + x_1 x_2$$

$$\dot{x}_2 = x_1 - x_2 - x_1^2 - x_2^3$$

- 9 a) Study the stability of nonlinear system shown below. (10)



(Use normal graph sheet)

- b) Find the stability of (10)

$$\dot{x} = Ax + bu$$

Using Lyapunov's stability analysis where $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & 5 & 6 \end{bmatrix}$
