BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B Tech
BRANCH: EEE

SEMESTER : VII
SESSION : MO/2024

SUBJECT: EE439 APPLIED CONTROL THEORY

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Consider a system described by its differential equation $\ddot{y} + 3\dot{y} + 5y = 0$. Obtain the state space representation	[5]	1,2	1,2,3
Q.1(b)	Define Diagonalization and discus it's utility.	[5]	1,2	2,3

Q.2(a) A Linear time invariant system represented by following dynamic equation. [5] 2 2,3

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

Determine the state feedback gain matrix that such the system poles are placed at s=-5 and s=-1

Q.2(b) A LTA system is characterized by the following non homogenous equation [5] 3 2,3,

$$\begin{bmatrix} \dot{x1} \\ \dot{x2} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix}\begin{bmatrix} x1 \\ x2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U$$, X(0)= $\begin{bmatrix} 1 \\ 0 \end{bmatrix}$ Where U is unit step function find the solution of the equation

Q.3(a) What are three different method of Phase plain analysis? Explain with Example. [5] 3 1,2

Q.3(b) [5] 3 1,2,3
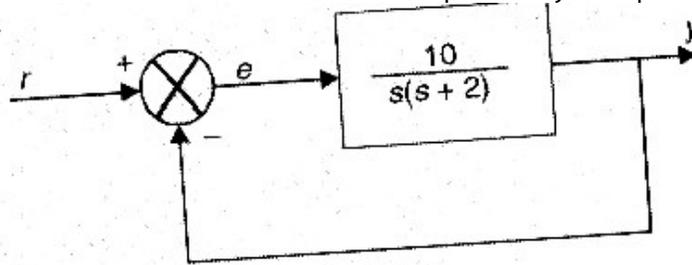
For the system shown in fig determines the singular point and comments on stability

Q.4(a) What is the different causes of non-linearity present in the system and what are the method of analysis? [5] 4 2.3,

Q.4(b) What are the procedure for determination of existence of limit cycle? [5] 4 2,3

Q.5(a) Discus the various form of performance measure in optimal control problems [5] 5 2,3

Q.5(b) [5] 5 3,4

Find the extremal curve for the functional J(x)= $\int_{0}^{1} \frac{1}{\dot{x}} dt$

The boundary condition are given x(0)=0, x(1)= 1