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

CLASS: BE **SEMESTER : VII**
BRANCH: EEE **SESSION : MO/18**

SUBJECT: EE8225 APPLIED CONTROL THEORY

TIME: 3 HRS. **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
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.

Q.1(a) Explain the concept and significance of system 'state'. [2]

Q.1(b) A system is represented by the its state model as [4]

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

$$y = [1 \quad 0]x$$

Find unforced response of the system.

Q.1(c) Determine the state model of the system using phase variables [6]

$$G(s) = \frac{s+2}{s^3 + 3s^2 + 2s + 10}$$

Q.2(a) Explain the concept of asymptotic stability and BIBO stability. [2]

Q.2(b) Define diagonalization and discuss its utility. [4]

Q.2(c) Check the controllability of a system describe as [6]

$$[\dot{x}] = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & 0.5 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

Q.3(a) Explain the Basic concept and methodology of state feedback for pole placement. [2]

Q.3(b) The state model of the system is given as :- [4]

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

$$y = [1 \quad 0]x$$

Design state feedback controller for the given system such that the close loop poles are placed at s=-5 and s=-6

Q.3(c) The state model of second order system is given as [6]

$\dot{x_1} = -2x_1 + x_2$

$\dot{x_2} = -x_2 + u$

$y = x_1 + x_2$

suppose u is given as

$$u = -k_1 x_1 - k_2 x_2$$

where k_1 and k_2 are state feedback coefficients. Show that the system remains completely controllable for any arbitrary values of k_1 and k_2.

Q.4(a) With the help of suitable example distinguish between incidental and intentional non-linearity. [2]

Q.4(b) Define describing function and explain its significance in the analysis of nonlinear system. [4]

Q.4(c) The system matrix A is given as [6]

$$A = \begin{bmatrix} -1 & 4 \\ -2 & 5 \end{bmatrix}$$

Draw the phase portrait

PTO

Q.5(a)	What is optimal control?	[2]
Q.5(b)	Describe the roll of performance measure in optimal control.	[4]
Q.5(c)	Explain the use of Lagrangian and Hamiltonian function for obtaining alternate state models.	[6]
Q.6(a)	Define the term adoptive control.	[2]
Q.6(b)	Discuss the significance of identification function in adoptive control system.	[4]
Q.6(c)	Explain the working of Model Reference Adoptive Control System.	[6]
Q.7(a)	Explain the stability in sense of Liapunov.	[2]
Q.7(b)	Define the local stability and global stability of the system and its significance.	[4]
Q.7(c)	Find the Describing function of a relay with a dead zone.	[6]

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