PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2018 - 19 Examination

Semester: 6   Date: 09/05/2019
Subject Code: 03112380   Time: 10:30am to 1:00pm
Subject Name: System Identification Techniques   Total Marks: 60

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1   **Objective Type Questions** - (All are compulsory) (Each of one mark)   **(15)**

1.   Least square estimation method is proposed by_____
      a) Karl Gaurs
      b) Richard Hoffman
      c) Nicole jones
      d) Albert jones

2. $y(t) = u(t-T)$ equation is true for _____.
      a) Static system
      b) Dynamic System
      c) Anti-causal system
      d) None of these

3.   What is the difference between stochastic process and deterministic process?
4.   Which are the parameters give effects on normal distribution curve?
5.   In state space representation, _____ matrix is also known as Null matrix.
6.   _____ is heart of the sample and hold circuit.
7.   Justify the significance of System Identification.
8.   Define identifiability with respect to model.
9.   LTI stands for_____.
10.   Among the following, which opposite pairs of types of model is improper?
      a) Deterministic models - Stochastic models
      b) Lumped parameter models - Distributed parameter models
      c) Single input Single output (SISO) models – multivariable models
      d) None of these

11.
$$u(t) + c_1u(t - 1) + \ldots + c_mu(t - m) = e(t) + d_1e(t - 1) + \ldots$$
$$+ d_me(t - m)$$

The above equation is true for _____.
      a) AR
      b) MA
      c) ARMA
      d) None of these.

12.   Differentiate Black Box and Gray Box modeling.
13.   Define random variable.
14.   Write down equation based model for ARMAX.
15.   What is the difference between impulse and dirac function?

Q.2   **Answer the following questions. (Attempt any three)**   **(15)**

A)   Analyse step response of second order damped oscillator with necessary equations and diagrams. Explain all the parameters involved with diagram and equations, wherever required.

B) Draw a block diagram for the following SISO system:

$$\begin{vmatrix} x1 \\ x2 \\ x3 \end{vmatrix} = \begin{vmatrix} -4 & 2 & -3 \\ 2 & 2 & 0 \\ 0 & 10 & 1 \end{vmatrix} \begin{vmatrix} x1 \\ x2 \\ x3 \end{vmatrix} + \begin{vmatrix} 1 \\ 0 \\ 1 \end{vmatrix} u(t)$$

$$Y(t) = \begin{vmatrix} 1 & 2 & 1 \end{vmatrix} \begin{vmatrix} x1 \\ x2 \\ x3 \end{vmatrix} + [0]u(t)$$

C) Define: Static system, dynamic system, linear system, non-linear system, Time-variant system.

D) Illustrate ARX model and draw block diagram of it.

Q.3 A) What do you mean by stationary process? List and explain properties of Strict Sense Stationary and Weak Sense Stationary processes. **(07)**

B) Explain maximum likelihood with normal curve and derive necessary equations for it. **(08)**

OR

B) Consider transforming system to find conjugate matrix of state space matrix. **(08)**

$$A = \begin{vmatrix} -1 & -2 & -3 \\ 4 & 2 & 0 \\ 1 & 0 & 1 \end{vmatrix}, B = \begin{vmatrix} 1 \\ 0 \\ 1 \end{vmatrix}, C = \begin{vmatrix} 0 & -2 & 0 \end{vmatrix}, D = [0].$$

Q.4 A) Find the value of U using singular value decomposition of the matrix $C = \begin{bmatrix} 5 & 5 \\ -1 & 7 \end{bmatrix}$ **(07)**

OR

A) What do you mean by causal system? (ii) Illustrate how feedback mixes up causality. **(07)**

B) (i) What do you mean by covariance? How it is related with the correlation? **(08)**

(ii) Compute the covariance of the following sequences X and Y. Find the correlation coefficient between X & Y. What you conclude from this answer? Given X= {1, 2, 3, 4, 5, 6, 7, 8, 9} and Y= {5, 4, 5, 6, 5, 8, 9, 10, 13, 12}.