Statistical Signal Processing

M.E. (EXTC) sem I

QP Code : 841901

T6621A

(3 Hours)

[Total Marks : 80

N.B. : (1) Question No. 1 is compulsory.
  (2) Attempt any three questions from the remaining five questions.
  (3) Assume **suitable data** if needed and state it clearly.
  (4) Figures to right indicate full marks.

1. Solve **any five** :
   (a) Define and explain the terms "Basis of vector space" and "subspace of a vector space". 4
   (b) Two statistically independent random variables X and Y have mean values 2 and 4 respectively. If W = 3X- Y, Find the mean and variance of random variable W. 4
   (c) State the important properties of General correlation matrices. 4
   (d) Describe application of DKLT (Discrete Karhunen-Loeve Transform) in data compression. 4
   (e) State the CRLB theorem. 4
   (f) Give assumptions about the state variable system used in Kalman filtering. 4

2. (a) Check whether the following vectors are independent $[1\ 3\ 2]^T$, $[2\ 1\ 3]^T$ $[3\ 2\ 1]^T$. 6
   (b) Explain the four fundamental subspaces of linear operator. 6
   (c) Explain Gram-Schmidt orthogonalization procedure. 8

3. (a) Let $x(n) = A + w(n)$ n=0,1....., N-1 where w(n) is WGN with zero mean and variance σ^2. Determine the CRLB for A. 10

   (b) Consider a linear transformation $y = A^T x$. The mean vector $\mu_x = [2\ 1]^T$, Find the mean vector of y if A is 2x2 identity matrix. 4
   (c) State and explain central limit theorem (CLT). 6

4. (a) Explain the concept of Innovations representation. What is whitening process. 6
   (b) Define and explain following
       (i) Bias of Estimator 4
       (ii) Efficient estimator

[TURN OVER]

    (c)   Compare and contrast orthogonal and triangular decompositions for zero mean random vectors.   **10**

5. (a) What is Kalman filtering? Discuss in detail.   **10**

    (b) A random process is defined as $X(n) = A \cos(2\pi n)$, where A is a Gaussian random variable with zero mean and variance σ^2.   **10**

        (i)   Determine the density function of $X(0)$ and $X(1)$.

        (ii)   Is $X(n)$ a stationary process in any sense?

6. (a) A causal LTI system is described by the difference equation   **10**

$$y(n) = \frac{1}{2} y(n-1) + x(n) + x(n-1)$$ is driven by zero mean WSS process with

autocorrelation $R_x(\ell) = 2\,\delta(n)$.

        (a)   Determine the cross power spectral density between input and output

        (b)   Power spectral density at the output

    (b) It is desired to estimate the value of a DC level A in WGN or   **10**
$x(n) = A + w(n)$, n=0,1,...., N-1.
where $w(n)$ is zero mean and uncorrelated and each sample has variance $\sigma^2 = 1$. Consider following estimator

$$\hat{A} = \frac{X(0) + X(N-1)}{2}$$

Find the mean of the estimator. Is the estimator biased? Compute the variance of the estimator.

Q. 6(A)

Read the line

Autocorrelation $R_x(l) = 2\delta(n)$ as

Autocorrelation $R_x(l) = 2\delta(l)$ where l is lag.

(3Hours) [Total Marks: 80]

N.B.: (1) Attempt any **four** questions out of five questions.

(2) Assume **suitable** data wherever required with justification.

(3) **Figures** to the **right** indicate full marks.

1. (a) Draw and explain with Flow diagram various procedural steps in the process of Embedded systems product design. **10**

   (b) State and explain various techniques available for validation of electronic system design with illustrations. **10**

2. (a) Why are there different operating modes in ARM core? Support your answer with ARM core register model with banking concept. **10**

   (b) List and give application of different Modes and States of ARM Cortex M3 processor. Give the necessary Mode-State transition Diagram. **10**

3. (a) Compare and contrast non real time OS and RTOS with examples stating additional Requirements of RTOS. **10**

   (b) For task scheduling in RTOS, discuss the working of Earliest Deadline First and Rate Monotonic Algorithm. **10**

4. (a) Explain mailbox and pipe method for interprocess communication. Compare these two methods. **10**

   (b) Discuss IOT with respect to an application "Soil erosion". Briefly list the interfacing modules which may be required. **10**

5. Briefly explain **any two:** **20**
   (a) Barrel Shifter Utilities with instructions in ARM Core.
   (b) Multicore architecture for embedded systems.
   (c) Communications security in embedded systems.

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QP CODE : 855601

Time : 3 Hours   Marks: 80

N.B.:1) Q.1 is compulsory

    2) Attempt any **three** from remaining **five** questions

Q.1 a). Explain in detail Cyber defamation.   [5]

   b). Explain various types cyber criminals?   [5]

   c) Discuss types of stalker and their mitigation technique.   [5]

   d) Discuss law related to electronics banking.   [5]

Q.2 a). Explain in detail mitigation techniques for DOS and DDOS attack.   [10]

   b). Explain various challenges posed by mobile devices and their counter measures.   [10]

Q.3 a). What is "social Engineering"? What are the security threats that can emanate from social networking sites?   [10]

   b). Explain various types of phishing attacks and its countermeasures.   [10]

Q.4 a). Discuss in details buffer overflow problem? Discuss any 3 tools used to defend buffer overflow problem.   [10]

   b) What is Indian perspective of cyber laws? Are there adequate infrastructure to protect from cyber crimes.   [10]

Q.5 a). What is cloud computing? Is it safe from cyber attacks? Explain in detail.   [10]

   b). What are the strengths and limitations of Indian IT Act 2000 (ITA -2000).   [10]

Q.6 Short note on (Any two)   [20]

   a) A global Perspective on cybercrimes

   b) legal prerequisites of E- Contract.

   c) Keyloggers.

Modern Digital Signal Procering
& Appln

Q. P. Code : 842100

13/12/20

ME [EXTC] Choice based Sem I

Total Marks: 80

(3 Hours)

N.B. : (1) Questions No.1 is **compulsory**.
     (2) Solve any three questions out of remaining **five** questions
     (3) Draw neat labeled diagram whenever necessary
     (4) Assume suitable data if necessary

Q.1	Solve any four out of five	
	i) Explain Power spectral density	5
	ii) What is Harr Wavelet? Write its properties.	5
	iii) What are Time Domain operations in Musical Sound Processing	5
	iv) Write any four characteristics of adaptive system	5
	v) Compare Bartlett ,Welch and Blackman-Tukey methods of Power Spectrum Estimation	5
Q.2	a) Explain Yule-Walker method for AR model Parameters.	10
	b) What is QRS complex in ECG and Explain any method for QRS complex detection.	10
Q.3	a) What are the time and frequency domain ECG parameters? Explain with the ECG waveforms.	08
	b) Explain with neat block diagram the Adaptive Echo Cancellation.	12
Q.4	a) Derive LMS Algorithm and mention its limitations	10
	b) Explain Application of Wavelet Transform for Signal Denoising.	10
Q.5	a) How Occular Artifacts are removed from Human EEG? Explain with neat diagram.	10
	b) Explain the Three Basic Filters used in Equalization of Digital Audio Signals.	10
Q.6	a) What is Short Time Fourier Transform and explain how it is suitable for analysis of Speech Signals.	08
	b) Explain with block diagram the Adaptive Linear Combiner.	06
	c) Compare Short Time Fourier Transform and Wavelet Transform	06

(3 Hours) [Total Marks : 80

N. B. : (1) Question No. 1 is **compulsory**.
(2) Attempt any **three** questions out of the remaining **five** questions.
(3) Assume suitable data whenever necessary and justify the same.

1. (a) Define path, line and section used in the SONET/SDH frame.   20
   (b) How the signal get degraded in optical fiber communication? Explain in brief.
   (c) Compare stimulated Raman scattering and stimulated Brillouin scattering.
   (d) Explain in brief the Dimensioning wavelength network.
   (e) What is unidirectional and bidirectional WDM system?

2. (a) Explain Self phase and Cross phase modulation. What are Kerr nonlinearities?   10
   (b) Explain Dispersion Compensating fibers in detail.   10

3. (a) Explain four wave mixing in detail.   10
      Consider 75 km link of dispersion shifted single mode fiber carrying two wavelengths. At 1540.0 nm and 1540.5 nm, then calculate new frequency generated due to Four wave mixing (FWM).
   (b) List the properties of Solitons, and explain Loss managed Solitons in detail.   10

4. (a) What is optical transport network (OTN)? Explain OTN frame structure in detail.   10
   (b) Explain resonant cavity enhancement (RCE) Photo detector in detail.   10

5. (a) What is optical amplifier? Compare Semiconductor optical amplifier, Raman amplifier and Erbium doped amplifier.   10
   (b) List and explain different Lightpath topologies, and write the equations for number of Wavelength needed to support the traffic and router ports required.   10

6. Write short notes on: 20
   (a) Four RWA algorithms
   (b) Metro Network
   (c) Optical Cross connect
   (d) Optical Switching

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