ME/EXTC/SEM-I/(Choice Based)/Statistical Signal Processing/ Nov. 2017

Q. P. Code: 27003

(03 Hours) Total Marks 80

N.B.:

(1)Question No.1 is compulsory.
(2)Attempt any three questions from remaining five questions.
(3)Assume suitable data if necessary and state it clearly.
(4)Figures to right indicates full marks.

1. Solve any five 20

   (a) Explain the concepts of column space and nullspace. For a $m \times n$ matrix of rank r, state the dimensions of column space and nullspace.

   (b) Let $y = 3x + 5$, where x is a random variable with mean 2 and variance 4. Find the mean and variance of y

   (c) State the Kalman filtering problem also state the important assumptions about the underlying state variable system.

   (d) State the CRLB (Cramer-Rao lower bound) theorem.

   (e) Write a short note on white noise process.

   (f) Explain any one method for generation of real-valued random vector $\mathbf{x}$ with zero mean using given autocorrelation matrix $\mathbf{R_x}$

2. (a) Let $\mathbf{p}_1 = [1\ 6\ 5]^T$, $\mathbf{p}_2 = [-2\ 4\ 2]^T$, $\mathbf{p}_3 = [1\ 1\ 0]^T$, $\mathbf{p}_4 = [2\ 2\ 0]^T$

      i. Check whether the set $T_1 = \{\mathbf{p}_2\ \mathbf{p}_3\ \mathbf{p}_4\}$ is independent 5

      ii. Check whether the set $T_2 = \{\mathbf{p}_1\ \mathbf{p}_2\ \mathbf{p}_3\}$ is independent. 5

   (b) Write a note on positive-definite matrices 5

   (c) Define and explain l_1, l_p and l_∞ norms. Find l_∞ norm of $\mathbf{v}$=[3 7 -8] 5

3. (a) Let $x[n] = A + w[n]$, $n = 0, 1, ..., N-1$. It is desired to estimate the value of a DC level A in WGN $w[n]$ where $w[n]$ is zero mean and uncorrelated and each sample has variance $\sigma^2 = 1$. Consider the two estimators

      i. $\hat{A} = \frac{1}{N}\sum_{n=0}^{N-1} x[n]$

      ii. $\check{A} = x[0] + x[N-1]$

      Find mean and variance of each estimator. State whether these estimators are unbiased. Which one is better according to variance? 10

(P.T.O.)

(b) A WSS process with PSD $R_x(e^{j\omega}) = \frac{1}{1.64 + 1.6\cos\omega}$ is applied to a causal system described by the following difference equation $y[n] = 0.6\, y[n-1] + x[n] + 1.25\, x[n-1]$. Compute

i. the cross-PSD $R_{xy}(e^{j\omega})$ between the input and output 5

ii. the PSD of the output. 5

4. (a) Define and illustrate following statistical averages with the help of figures 8

i. Mean ii. Standard Deviation iii. Skewness iv. Kurtosis

(b) Consider following random processes

i. $X(t) = A\cos(\omega t + \phi)$ where ϕ is a random variable uniformly distributed in the interval $[0\ 2\pi)$

ii. $X[n] = A\cos(\omega n)$ where A is a Gaussian random variable with mean 0 and variance 1

Determine whether these random processes are WSS or not. 12

5. (a) Consider a stationary random process with correlation matrix

$$\mathbf{R}_x = \begin{bmatrix} 1 & a \\ a & 1 \end{bmatrix}$$

Find eigen values, eigen vectors and verify 12

i. $\det\mathbf{R}_x = \lambda_1\lambda_2$.

ii. $\mathbf{Q}^H\mathbf{Q} = \mathbf{I}$,

where $-1 < a < 1$, $\mathbf{Q}$=[$\mathbf{q_1}$ $\mathbf{q_2}$] is the eigenmatrix of $\mathbf{R}_x$, $\mathbf{q_1}$ and $\mathbf{q_2}$ are eigen vectors normalized to unit length , det and $\mathbf{I}$ denotes determinant and identity matrix respectively, λ_1 and λ_2 are eigen values.

(b) Compare and contrast orthogonal and triangular decompositions for zero-mean random vectors. 8

6. (a) Explain MVU estimator. Compute the CRLB for estimating A in the process $x[n] = A + w[n]$, $n = 0, 1, ..., N-1$ where $w[n]$ is WGN with variance σ^2 and zero mean. 13

(b) Write a note on Kalman filter. 7

E | Sem-I (Choice Based) | EXTC | Optical Comm" | Nov-17; Network

Q.P. Code :25165

[Time: Three Hours] [Marks:80]

Please check whether you have got the right question paper.

N.B:
1. Question 1 is compulsory.
2. Attempt any 3 questions out of remaining five questions.
3. All questions carry equal marks.
4. Assume suitable data wherever necessary, with proper justification.

Q.1 Attempt any four.

a) Define attenuation wrt optical communication. What are its different types. 05

b) Derive the expression for Numerical Aperature. Hence find the numerical aperature of optical fiber if R.I of core is 1.48 and RI of cladding is 1.46 05

c) Compare between spontaneous and stimulated emission. 05

d) Define line, path and section wrt SONET. 05

e) Write the application of (i) optical multiplexer (ii) Optical repeater. 10

Q.2 a) Explain Resonant Cavity Enhanced (RCE) photo detector in detail. 10

b) Calculate the carrier frequency and energy in eV for optical communication system operating at wavelength of 0.85μm and 1.3μm. Velocity of light is assumed to be 3×10^8 m/s. 10

Q.3 a) Explain EDFA optical amplifier. 10

b) Draw the connection matrix for 16-channel WADM for following 10
i) Channel 5-12 are through
ii) Channel 1-4 are added
iii) Channel 13-16 are dopped

Q.4 a) Explain First passage model and blocking model for statistical wavelength routing network. 10

b) Write short note on detailed Ring Network. 10

Q.5 a) What is Optical Transport Network (OTN)? Explain OTN frame structure in detail. 10

b)Explain the rationale for selecting 51.84 Mbps data for SONET. Mention merits and demerits of SONET. 10

Q.6 Write short note on- 10

a) Optical MEMS 10
b) Optical Switch

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ME I (EXTC)/(CBSGS) Nov/Dec-2017
Modern Digital Sig. Processing

Q. P. Code :27327

(3 Hours) **Total Marks: 80**

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 **(5x4)**

i) Determine the output power spectral density of the system whose impulse response is $h(n) = 0.5^n U(n)$. Input to the system is white noise with PSD = σ^2

ii) Explain an Adaptive System with suitable example.

iii) Describe filter bank theory related to wavelet transform.

iv) Explain with block diagram the data acquisition system for ECG.

v) With mathematical concept explain the generation of reverberation effect synthetically using signal processing.

Q.2 a) Compare Short Time Fourier Transform and Spectrogram with the mathematical concept and plots. **6**

b) Describe Welch method for determination of Power Spectrum estimate **6**

c) Explain with suitable mathematical approach Steepest-Descent Algorithm (SDA) **8**

Q.3 a) Derive Least Mean Square (LMS) adaptive algorithm. Discuss convergence and stability properties of the LMS algorithm? **12**

b) Given that input sequence f = [8, 6, 5, 5, 4, 6, 10, 12], find level-1 Haar wavelet transform and verify the result by using its inverse Haar transform. **8**

Q.4 a) Explain with suitable diagram the application of adaptive system for echo cancellation in data transmission over telephone channel. **10**

b) Describe how Wavelet transform can be used for signal denoising. Also, discuss hard thresholding and soft thresholding for wavelet based denoising. **10**

Q.5 a) Describe the Multi-Resolution Analysis (MRA)? How Discrete Wavelet Transform (DWT) is used for MRA. **10**

b) Explain various pre-processing operations required to perform before analysis of ECG signal with suitable mathematical concepts. **10**

Q.6 a) Describe audio processing for generating chorus effect and flanging effect with block diagram and mathematical concept. **10**

b) Explain with the block diagram and algorithm for adaptive removal of Ocular Artefacts from human EEGs. **10**

E/ EXTC/ Sem-I (Choice Based)/ Next Generation Network
Nov-17

Q. P. Code: 25231

Time: 3 Hours Marks: 80

N.B. (1) Question No.1 Compulsory

(2) Solve any three from the remaining questions

1. Attempt the following 20
   (a) Compare IPV4 and IPV6 based NGN
   (b) What are the key features of NGN?
   (c) Explain QOS in NGN. How it is different then QOE?
   (d) Why we need MPLS?

2. (a) Draw IPTV architecture and explain it in detail. 10
   (b) Explain cognitive radio with its types. 10

3. (a) Explain Fixed mobile convergence (FMC) in NGN. 10
   (b) Explain AAA scheme in NGN. 10

4. (a) What are the ID's used in TISPAN NGN? How NGN ID's are administered? 10
   (b) Explain migration of PSTN networks to NGN. 10

5. (a) Explain packet flow through the network in MPLS based VPN. 10
   (b) What are factors which act as drivers towards NGN? 10

6. Write short note on(any two) 20
   (a) FTTH
   (b) EVDO
   (c) NGN Evolution
   (d) VOIP

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ME/ Sem I / INST, EXTC, INFT/ Dec 2017

Management Information Systems

Q.P. Code: 24385

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question **No.1** is **Compulsory.**

(2) Attempt any 3 questions out of rest.

(3) Figure to the right indicate full marks.

(4) All questions carry equal marks.

1. Hospital wants to design database for Hospital Management system.
   a) Design tables (Doctor, Patient, Rooms, Records and Time) with assuming suitable attributes and normalize the database. **5**
   b) Define primary key, foreign key with its importance in database design. List Primary and foreign key in each table of above tables. **5**
   c) Draw Star schema and Snowflake schema for above design. **5**
   d) Explain difference between star schema and snowflake schema **5**

2. a) Explain Enterprise Resource Planning system with its functions, benefits and limitations. **10**
   b) Define Customer relationship Management. Explain in detail Operational And Analytical CRM. **10**

3. a) Define Business Intelligence. Explain Business Intelligence applications for Data Analysis. **10**
   b) Explain B2B, B2C, C2C AND B2E electronic commerce. **10**

4. a) Explain Several ways in which IT impacts employees at work. Also explain how IT might change manager's job. **10**
   b) What is Social Commerce? Briefly describe the benefits and risks of social commerce to business. **10**

5. a) Explain Cloud Computing with various types of Clouds. **10**
   b) Explain Importance of Information System to Society. **10**

6. Write short notes on any two **20**
   a) Transaction Processing System
   b) Data ware houses and Data Marts
   c) Big Data

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