AIKTC KALSEKAR TECHNICAL CAMPUS

INNOVATIVE TEACHING   EXUBERANT LEARNING

Knowledge Resource & Relay Centre (KRRC)

AIKTC/KRRC/SoET/ACKN/QUES/2022-23/   Date: 25/01/23

School: **SoET-REV. C-SCHEME**   Branch: **EXTC ENGG.**   SEM: **V**

To,
Exam Controller,
AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following **Semester/Unit Test-I/Unit Test-II (Reg./ATKT)** question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format SC	Format HC	No. of Copies
1	Digital Communication	ECC501		✓	
2	Discrete Time Signal Processing	ECC502		✓	
3	Digital VLSI	ECC503		✓	
4	Random Signal Analysis	ECC504		✓	
5	Department Level Optional Course I Data Structures and Algorithm	ECC505		✓	
6	**Hons:** • Mathematics for AI & ML • Ethical Hacking • Vehicu;ar Systems and Dynamics			✓	

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

Sem-V - CBCS-19-Reg.

(3 Hours) [Total Marks : 80]

N.B. : (1) Question No 1 is Compulsory.
      (2) Attempt any three questions out of the remaining five.
      (3) All questions carry equal marks.
      (4) Assume suitable data, if required and state it clearly.

1   Attempt any FOUR   [20]

  a Calculate the entropy of the following symbols in bits/symbol and decit/symbol. The symbols are S_1, S_2, and S_3 with probabilities 0.6, 0.3 and 0.1 respectively.

  b Determine VRC bit for the data sequence 11110011 and show that it can detect 1-bit error.

  c Compare ISI and ICI

  d Explain AWGN and matched filter

  e Find the bandwidth for transmitting 120 bps using QPSK, 4-ary FSK, MSK, 8-ary PSK, and 16-ary QASK

2 a Calculate the maximum capacity of a Gaussian channel with a bandwidth of 3 kHz and SNR of 30dB. If the bandwidth is doubled, calculate the new channel capacity. [10]

  b Parity bits equations of a (6,3) linear block code are given below. Construct generator matrix, parity check matrix and implement encoder & decoder.
$P_3 = D_3 + D_2 + D_1, P_2 = D_3 + D_2$, and $P_1 = D_2 + D_1$ [10]

3 a Implement (7,4) cyclic code encoder and decoder using the generator polynomial $G(x) = x^3 + x^2 + 1$ [10]

  b Find 3-bit HRC and 3-bit checksum for the data 101011001111 and show that these codes can detect 3 continuous bit errors [10]

4 a Generator sequences of a convolutional encoder are given below. Calculate the impulse response of the encoder and sketch trellis diagram and using the trellis diagram determines the codeword for the input message 111.
$g^{(1)} = 111$ and $g^{(2)} = 101$ [10]

0312BDEBF29D5FE7342449F41E46647B

b   Sketch and compare NRZ unipolar, NRZ polar, NRZ Manchester and NRZ AMI   [10]
    formats in terms of bandwidth, power requirement, synchronization capability,
    DC level and polarity inversion error. Data sequence is 0011.

5   a   Find minimum variance Huffman code and Shannon-Fano code for the symbols   [10]
        S_1, S_2, S_3, S_4 and S_5 with probabilities 0.2, 0.1, 0.4, 0.2 and 0.1 respectively.
        Compare the efficiencies and variances of the generated codes.

    b   Sketch QPSK and offset-QPSK waveforms for the input message 00011011 and   [10]
        explain the advantage of offset-QPSK over QPSK.

6   a   Derive the PSD of BFSK, sketch the power spectrum and find the bandwidth.   [10]

    b   Find the error probability of 16-ary QASK using signal space representation and   [10]
        Euclidean distance.

Sem-V - CBCGS- Reg.

Duration: 3hrs   **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
     (2) Attempt any three questions out of the remaining five.
     (3) All questions carry equal marks.
     (4) Assume suitable data, if required and state it clearly.

1   Attempt any FOUR   [20]

  a   Find the DFT of $x[n]=\{5, 6, 7, 8\}$. Using answer and not otherwise find DFT of $x1[n]=\{8, 5, 6, 7\}$.

  b   Find the impulse response if the frequency response of the system is given as
$$H(e^{j\omega}) = e^{-j3\omega}(1 + 0.5 \cos \omega - 0.95 \cos 2\omega)$$

  c   Realize the linear phase FIR filter given as $h[n] = \{1, -0.5, 0, 0.5, -1\}$ using minimum number of multipliers.

  d   For linear phase FIR filter, one of the zeros is at $0.2e^{j\frac{\pi}{4}}$. Find other compulsory zeros for Odd Symmetric FIR filter. Determine the transfer function.

  e   Compare FIR filters with IIR filters

2 a   Find the DFT of a real sequence $x[n] = \{1, -2, 3, 5, 1, 3, -4, 2\}$ using DIT FFT.   [10]

  b   The second order IIR filter is defined as   [10]

$$H(z) = \frac{1}{(1 - 0.95z^{-1} + 0.225 z^{-2})}$$

Determine the shift of poles in direct form and cascade form realization if coefficients are represented by 3 bits.

3 a   Determine the digital IIR digital filter from analog filter transfer function which   [10]
is given as $H(s) = \frac{10}{(s^2+7s+15)}$ with T=0.02sec. using impulse invariant transformation method.

  b   Find DFT of $x1[n]=\{1, 4, 3, -2\}$ and $x2[n]=\{1, -2, 4, 5\}$ using DIF FFT only   [10]
once.

13805   **Page 1 of 2**

4   a   Design a digital filter with flat passband and flat stopband which satisfies   [10]
        following constraints using bilinear transformation method. Assume Ts=0.1s.

$$0.8 \leq |H(e^{j\omega})| \leq 1 \qquad 0 \leq \omega \leq 0.25\pi$$
$$|H(e^{j\omega})| \leq 0.2 \quad 0.65\pi \leq \omega \leq \pi$$

    b   Find the output of the system having impulse response h[n]={2,1,2} for input   [10]
        sequence x[n]={1, -2, 4, 5, 3, 2, 2, 1, 5, 7, -3, -1, 4, 2} using Overlap-save
        Method (Assume N=6).

5   a   Design a digital FIR filter using Hanning window for M=7 for given   [10]
        specifications.

$$H(e^{j\omega}) = \begin{cases} e^{-j3\omega} & ; \quad \frac{\pi}{8} \leq |\omega| \leq \frac{\pi}{4} \\ 0 & ; \quad \text{otherwise} \end{cases}$$

    b   Realize the filter function by lattice realization structure.   [10]

$$H(z) = 1 + \frac{3}{4}z^{-1} + \frac{1}{2}z^{-2} + \frac{1}{4}z^{-3}$$

6   a   Explain group delay and phase delay.   [6]

    b   Explain how DTSP is used in echo cancellation process.   [7]

    c   Write a short note on Limit cycle oscillations   [7]

ET Sem- V

Date :28/11/22 Reg.

Duration: 3hrs CBCS-19 [Max Marks:80]

N.B. : (1) **Question No 1 is Compulsory.**
   (2) **Attempt any three questions out of the remaining five.**
   (3) **All questions carry equal marks.**
   (4) **Assume suitable data, if required and state it clearly.**

1		Attempt any FOUR	[20]
	a	1-bit 5 stage shift register	
	b	Explain the working of floating gate transistor in Flash memory.	
	c	For enhancement type NMOS transistor threshold voltage V_T–0.7V, $\mu nCox$ =40 $\mu A/V2$, W = 30μm, L = 10 μm. Calculate I_D if for VGS = 2 , V_{DS}= 2V	
	d	Explain clock distribution in VLSI design.	
	e	Draw HLSM of soda dispenser machine	

2 a Consider a CMOS inverter with following parameters: [10]

nMOS	VTN – 0.6 V	$\mu nCox$ =60 $\mu A/V2$	(W/L)n = 8
pMOS	VTp – -0.7 V	$\mu pCox$ =25 $\mu A/V2$	(W/L)p = 12

Calculate the V_{IL} and V_{TH}. The power supply voltage is VDD = 3.3 V.

	b	Explain pWell fabrication process with neat diagrams.	[10]
3	a	Realize SR flip flop using CMOS logic and draw its layout.	[10]
	b	Explain 6T SRAM with its read and write operation.	[10]
4	a	Realize the expression Y=A(B+C) D using the following logic style.	[10]

   1. CMOS logic
   2. Pseudo NMOS
   3. Dynamic Logic
   4. Domino Logic

   b Implement the following [10]

   1. 3x3 Array multiplier
   2. 4:1 mux using TG

5 a Implement the following [10]

   1. 4 bit carry lookahead adder carry using dynamic logic
   2. 8-bit carry bypass adder

D4EE16A5EA4142624BC4E00247978B8A

b   Draw 4 *4 bit NAND based array and NOR based array to store the following data   [10]
    in respective memory locations.

Memory address	Data
1000	0101
0100	1101
0010	0010
0001	1011

6   a   Design a 'serial FIR filter' using the RTL design process. Draw HLSM,FSM,   [10]
        interface and Datapath

    b   Realize the expression $Y = A + BC (D+E) + F$ using CMOS logic. Find equivalent   [10]
        CMOS inverter for simultaneously switching of all input. Assume $(\frac{W}{L})p = 15$,
        $(\frac{W}{L})n = 10$

****

Time: 3 hours   ET-R(19) Sem-V-CBCS-19-Reg. 30/11/23   **Max. Marks: 80**

N.B. : 1) Question no. 1 is compulsory
2) Answer any 3 questions from remaining five questions

Q1   Answer any four questions

a. Explain Bayes theorem and total probability theorem.   05
b. Define joint distribution function. What are its properties?   05
c. Find the Binomial distribution if the mean is 4 and variance is 3.   05
d. Find the characteristic function of a random variable X with uniform distribution   05
in [-1, 1]   05
e. List the properties of autocorrelation function and prove any two properties.

Q2   a. The joint pdf of R.V. X & Y is given as   10
$$f_{XY}(x,y) = c\, e^{-x}\, e^{-y} \quad ,0 < y < x < \infty$$
$$= 0 \text{ , elsewhere}$$
Find
i.   c
ii.   f(x) & f(y)
iii. f(x/y) & f(y/x)

b. A biased coin tossed till a head appears for the first time. What is the probability that the   06
numbered required tosses are odd?
c. Show that $p(A \cup B) = P(A) + P(B) - P(A \cap B)$ 04

Q3   a. If X, Y are two independent exponential random variables with common parameter λ. find   10
the pdf of (U, V) where U = X+Y and V = X-Y. Also find f (u) and f (v).
b. Find mean and variance of Gaussian distribution function with parameters N (0, 1).   10

Q4   a. Explain the central limit theorem   05
b. Define SSS process and WSS process   05
c. Random Process is given as X (t) = sin (wt+Y) Where Y is uniformly distributed over (0,2π)   10
and w is a constant. Verify that X (t) is WSS or not.

Q5   a. The joint probability distribution of X and Y is given by   10

$$P(X=x, Y=y) = \frac{x + 3y}{24} \text{ where x=1, 2 and y=1, 2. Find}$$

i.   Marginal distributions of x and y
ii. $P(X \le 2, Y \le 1)$
iii. $P(X \le 1)$

b.
Two dimensional random variables (X, Y) has the following distribution   10
$$f_{XY}(x,y) = 2-x-y \ , \ \ 0 \le x \le 1, 0 \le y \le 1$$
$$= 0 \text{ , elsewhere}$$
Find
i.   E(XY)
ii.   Cov (X, Y)

Q6   a. Prove that for a linear time invariant system, if the input is a WSS process, then output is   10
also WSS Process.
b. From the following data, obtain the two regression equations.   10

Sales	91	97	108	121	67	124	51	73	111	57
Purchases	71	75	69	97	70	91	39	61	80	47

****

11874   **Page 1 of 1**

ET (R-19)

2/12/22

Sem-V-CBCS-19-Reg

Duration: 3hrs   [Max Marks:80]

N.B. : (1) Question No 1 is Compulsory.
        (2) Attempt any three questions out of the remaining five.
        (3) All questions carry equal marks.
        (4) Assume suitable data, if required and state it clearly.

1   Attempt any FOUR   [20]

   a   Match the following

A	Completeness	i	How long does it take to find a solution
B	Time Complexity	ii	How much memory need to perform the search
C	Space Complexity	iii	Is the strategy guaranteed to find the solution when there in one
D	Efficient complexity	iv	$O(2\wedge n)$
		v	$O(n\wedge 2)$

   b   Explain linear and non-linear data structures with examples.

   c   List the practical applications of link list data structure.

   d   Calculate the time complexity of the following code:

```
int a = 0, b = 0;
for (i = 0; i < N; i++) {
a = a + rand ();}
for (j = 0; j < M; j++) {
b = b + rand ();}
```

   e   What is Stack data structure and what are its applications.

2   a   Explain types of Trees and application of Tree Data structure with an examples.   [10]

    b   Apply the concept of link list to express the following polynomials P1 and P2   [10]
        into linked list form and add them to form new polynomial P3. Write proper
        steps with sketches.

   $P1 = 5 X^2 + 4 X + 2$

   $P2 = - 5 X - 5$

3 a Explain circular queue and doubly ended Queue with examples. [10]

  b Consider the following in order and preorder traversal of a tree. Is it possible to [10]
     obtain the POSTORDER Traversal of the same tree? If yes, construct a binary
     tree.

In-order	D	B	E	F	A	G	H	C
Pre-order	A	B	D	E	F	C	G	H

4 a Explain any five operations performed on Binary Search Tree. [10]

  b Give different searching techniques. Explain with example binary search [10]
     algorithm.

5 a Explain the application of Huffman coding with an example. [10]

  b Write a short note on (any one): [10]

      a. Bubble Sort algorithm

      b. Quick Sort algorithm

      c. Merge Sort algorithm

6 a What is the use of hashing? What is mean by collision? Show hash table entries [10]
     for the given dataset: 12, 45, 67, 88, 27, 78, 20, 62, 36, 55. Use modulo division
     method for hash table size 10.

  b Write a short note on (Any one) [10]

      a. Tree Traversal Algorithm

      b. Graph Traversal Algorithm

_____

7/12/22

(3 Hours) JET   Total Marks: 80

HONS.   Sem-V-CBCS-19-Reg

N.B. :   (1) Question No. 1 is compulsory.

(2) Attempt any three questions out of remaining five questions

Q.1. (a) Find the Eigen values and Eigen vectors of $A = \begin{bmatrix} -5 & 2 \\ -7 & 4 \end{bmatrix}$ (5)

(b) A random variable X has following probability distribution   (5)

X	0	1	2	3	4	5	6
P(X=x)	K	3K	5K	7K	9K	11K	13K

Find (i) Value of K and Mean of X

(ii) Find Cumulative Distribution function of X

(c) Compare discrete and continuous data.   (5)

(d) Obtain the Hessian Matrix for the function   (5)
$$Z = x_1 x_2 + 9x_1 + 6x_3 - x_1^2 - x_2^2 - x_3^2$$

Q.2. (a)   (10)
Find Singular Value of Decomposition of matrix $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ -1 & 1 \end{bmatrix}$

(b) Two samples of sizes 9 and 8 give the sum of squares of deviations from   (10)
their respective means as 160 inches square and 91 inches square
respectively. Test the hypothesis that the variances of the two populations
from which the samples are drawn are equal at 10% level of significance.
(Given $f_{((8,7),0.05)}=3.73$, $f_{((8,7),0.95)}=0.286$)

Q.3. (a) The following table gives the random sample of marks obtained by   (10)
students in two schools, A and B

School A	63	72	80	60	85	83	70	72	81
School B	86	93	64	82	81	75	86	63	63

Is the variance of Marks of the students in School A is less than that of
those in School B? Test at 5% level of significance.
(Given $F_{((8,8),0.95)}=0.291$)

(b) Explain types of data. Compare and contrast quantitative and qualitative   (10)
data.

Q.4. (a) What is a Graph? Explain any four   types of Graph along with its uses.   (10)

(b) Describe with example and action to be taken for the following   (10)

➢ Data cleaning

➢ Irrelevant data

➢ Incorrect data

➢ Handle Missing Data

➢ Outliers

Q.5. (a) Minimize the function $f(x_1, x_2) = 4x_1 + 8x_2 - x_1^2 - x_2^2$ (10)
subject to $x_1 + x_2 = 4$, $x_1, x_2 \geq 0$

(b) Find the minimizer of $f(x) = x^2 + \frac{54}{x}$ using bisection method in (2,5)   (10)
within a range of 0.3

15500   Page 1 of 2

Q.6.   Write short notes on (any four)   (20)
- (a) Four Fundamental Subspaces.   (5)
- (b) Linear Discriminant Analysis technique.   (5)
- (c) Principal Component Analysis (PCA) algorithm.   (5)
- (d) Machine learning Models.   (5)
- (e) Non gradient based optimization technique.   (5)
- (f) Time series graph.   (5)

_____

(3 Hours) [Total Marks: 80]

N.B. : (1) Question No 1 is Compulsory.
      (2) Attempt any three questions out of the remaining five.
      (3) All questions carry equal marks.
      (4) Assume suitable data, if required and state it clearly.

1   Attempt any FOUR.

  a Write a note on Lightweight Cryptographic algorithms. [5]

  b Describe the various vulnerabilities and possible attacks on passwords. [5]

  c Compare WEP, WPA, WPA-2. [5]

  d Explain the role of steganography in data hiding. [5]

  e Write a note on account harvesting. [5]

2 a Write a note on VPN security. [10]

  b What is ethical hacking? Describe the steps of the ethical hacking process. [10]

3 a Explain various stages in penetration testing. [10]

  b A user has received a link on SMS to claim the bonus prize money that he has [10]
      won in a lottery. What action does the user take on receiving such SMS? Should
      he claim the amount by clicking on the link, or not? Justify. What are the various
      attacks that can happen through the SMS and how do we prevent these attacks?

4 a Outline the top ten security projects in OWASP with their analysis. [10]

  b What are physical unclonable functions? How are they implemented? Explain [10]

      with the help of examples.

5 a Write a note on session hijacking and management. [10]

  b What is a side-channel attack? Explain various side-channel attacks with suitable [10]
      examples.

6 a Explain protocol vulnerabilities with the help of examples. [10]

  b Explain phishing and pharming in detail. [10]

22F03EBD8D3B1E647F907018F4055DA2

EE |ET   Sem-V-CBCS-Reg   8/12/22
Hons

2:30

Duration: 3hrs   **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
        (2) Attempt any three questions out of the remaining five.
        (3) All questions carry equal marks.
        (4) Illustrate your answer with neat sketches wherever necessary.

Q.1   Attempt **any four** from following five questions

   a Differentiate between 2WD and 4WD   [05]
   b Describe with neat sketch Front Engine Rear Wheel Drive Layout of a car. [05]
      Also explain the advantages and disadvantages of both.
   c Describe the process of double declutching for shifting from lower gear to [05]
      higher gear
   d Discuss the basic concepts of hybrid traction, introduction to various hybrid [05]
      drive-train topologies.
   e Discuss the Fuel Energy losses incurred in conventional engine, with their [05]
      tentative values in percentage.

Q. 2 a Describe with neat sketch the construction and working of 3 forward and 1 [10]
             reverse speed synchromesh gearbox.

       b Discuss impact of Electric Vehicle on power grid and environment.   [10]

Q. 3 a Define different efficiencies associated with performance of conventional [10]
             engine. Also state their tentative ranges.

       b Describe the construction and working of Recirculating Ball type of steering [10]
             gear

Q. 4 a Determine brake thermal and indicated thermal efficiencies of a 4-stroke CI [10]
             engine whose power developing capacity is 25 KW. The fuel consumption is 5
             liters/hr. Mechanical efficiency of engine = 85%. Take specific gravity of oil =
             0.85 and its CV = 42 MJ/kg.
       b Describe the construction and working of MCPherson Strut type of Suspension [10]
             System

Q. 5 a Illustrate Plug in Hybrid Electric Vehicles with neat sketch and state its [10]
             advantages over mild hybrid

       b Describe the construction and working of Master Cylinder used in hydraulic [10]
             braking system

Q. 6 a With a neat sketch, explain the configuration of Series hybrid electric drive [10]
             train.
       b Describe with neat sketch the construction and working of single plate dry [10]
             friction clutch.

_____