CBCS SCHEME

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15EC52

Fifth Semester B.E. Degree Examination, Aug./Sept. 2020
Digital Signal Processing

Time: 3 hrs. Max. Marks: 80

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Use of Normalized filters tables is permitted.

Module-1

1 a. Compute the circular convolution of the following sequences using DFT and 1DFT method $x(n) = \{1, 2, 3, 4\}$ and $h(n) = \{4, 3, 2, 1\}$. **(08 Marks)**

b. Given $x(n) = \{1, -2, -2, 5, 8, 2\}$, evaluate the given expression $\sum_{K=0}^{5} e^{-j2\pi k/3} X(K)$ without computing DFT. **(04 Marks)**

c. Obtain the relationship of DFT with z-transforms. **(04 Marks)**

OR

2 a. Explain frequency domain sampling and reconstruction of signals. **(09 Marks)**

b. Consider the finite length sequence $x(n) = \delta(x) + 2\delta(n-5)$

i) Find the 10 point DFT of x(n)

ii) Find the sequence that has a DFT $y(k) = e^{\frac{j2k2\pi}{10}} x(k)$. **(07 Marks)**

Module-2

3 a. Evaluate the linear convolution of the following sequences using DFT and 1DFT method. $x(n) = \{1, 2, 3\}$ and $h(n) = \{1, 2, 2, 1\}$. **(08 Marks)**

b. A long sequence x(n) is filtered through a filter with impulse response h(n) to yield the output y(n). If $x(n) = \{1, 1, 1, 1, 1, 3, 1, 1, 4, 2, 1, 1, 3, 1\}$ and $h(n) = \{1, -1\}$. Compute y(n) using overlap save technique. Use only a 5-point circular convolution. **(08 Marks)**

OR

4 a. State and prove the following properties of DFT i) Parseval's theorem **(06 Marks)**
ii) Time shifting property. **(04 Marks)**

b. Determine the response of an LTI system with $h(n) = \{1, -1, 2\}$ for an input $x(n) = \{1, 0, 1, -2, 1, 2, 3, -1, 0, 2\}$ use overlap add method with block length L = 4. **(06 Marks)**

Module-3

5 a. Find the DFT of the sequence using decimation in time FFT algorithm and draw the flow graph indicating the intermediate values in the flow graph.
$x(n) = \{1, -1, -1, -1, 1, 1, 1, -1\}$. **(08 Marks)**

b. Derive the computational arrangement of 8-point DFT using radix – 2 DIF-FFT algorithm. **(08 Marks)**

OR

6 a. What is Goertzel algorithm? Obtain direct form–II realization of second order goertzel filter. **(08 Marks)**

b. Find the 1DFT of the sequence using DIF-FFT algorithm :
$X(k) = \{0, 2\sqrt{2}(1-j), 0, 0, 0, 0, 2\sqrt{2}(1+j)\}$. **(08 Marks)**

Module-4

7 a. Draw the block diagrams of direct form – I and direct form – II realizations for a digital IIR filter described by the system function :

$$H(z) = \frac{8z^3 - 4z^2 + 1\,\text{lz} - 2}{(z - \frac{1}{4})(z^2 - z + \frac{1}{2})}.$$ **(08 Marks)**

b. Show that the bilinear transformation maps the s-plane to z-plane efficiently in the transformation of analog to digital filter. **(08 Marks)**

OR

8 a. Design a two pass Butterworth analog filter to meet the following specifications :
i) Attenuation of –1db at 20rad/sec
ii) Attenuation is greater than 20db beyond 40rad/sec. **(09 Marks)**

b. The transfer function of analog filter is $H(s) = \frac{2}{(s+1)(s+2)}$. Find H(z) using impulse invariance method. Show H(z) when T_S = 1sec. **(07 Marks)**

Module-5

9 a. A low pass filter is to be designed with the following desired frequency response

$$H_d(e^{j\omega}) = H_d(\omega) = \begin{cases} e^{-j2\omega}; & |\omega| < \pi/4 \\ 0; & \pi/4 < |\omega| < \pi \end{cases}$$

Determine the filter coefficients $h_d(n)$ and h(n) if $\omega(n)$ is a rectangular window defined as follows : $\omega_R(n) = \begin{cases} 1; & 0 \le n \le 4 \\ 0; & \text{otherwise} \end{cases}$. **(08 Marks)**

b. Realize the direct from the linear phase FIR filters for the following impulse response

$$h(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2) + \frac{1}{4}\delta(n-3) + \delta(n-4).$$ **(08 Marks)**

OR

10 a. The frequency response of an FIR filter is given by :

$$H(\omega) = e^{-j3\omega}(1 + 1.8\cos 3\omega + 1.2\cos 2\omega + 0.5\cos\omega).$$

Determine the coefficients of the impulse response h(n) of the FIR filter. **(06 Marks)**

b. Obtain the coefficients of FIR filter to meet the specification given below using the window method :
i) Pass band edge frequency f_p = 1.5KHz
ii) Stop band edge frequency f_s = 2KHz
iii) Minimum stop band attenuation = 50db (Hamming)
iv) Sampling frequency F_S = 8KHz. **(10 Marks)**

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15EC53

Fifth Semester B.E. Degree Examination, Aug./Sept. 2020
Verilog HDL

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. What is HDL? Explain typical design flow for designing of VLSI IC circuits and importance of it. **(10 Marks)**

b. Define the following terms with examples :
i) Module ii) Instances iii) Instance name. **(06 Marks)**

OR

2 a. What is stimulus in verilog? Explain components of a simulation with an example of ripple carry counter. **(12 Marks)**

b. Explain trends in HDL's. **(04 Marks)**

Module-2

3 a. Explain the following lexical conventions
i) Whitespace ii) Operators iii) Strings iv) Keywords. **(08 Marks)**

b. Explain the system tasks in verilog with examples. **(08 Marks)**

OR

4 a. What is the module definition in verilog? And explain the components of a verilog module. **(10 Marks)**

b. What are the different ports is verilog? Explain internal and external port connection rules. **(06 Marks)**

Module-3

5 a. Design a 4-to-1 multiplexer using primitives in verilog and draw a logic diagram for it. **(10 Marks)**

b. What are rise, fall and turn-off delays? How they are specified in verilog? **(06 Marks)**

OR

6 a. Discuss the different assignment statements with example in verilog HDL. **(08 Marks)**

b. Explain the following : i) Bitwise operators ii) Concatenation
iii) Conditional operators iv) Replication operators. **(08 Marks)**

Module-4

7 a. Write the difference between blocking and non-blocking statement. **(06 Marks)**

b. Explain the following with proper examples
i) For loop statement ii) Repeat iii) Forever loop **(06 Marks)**

c. What is inferring latch? Explain casex and casez with examples. **(04 Marks)**

OR

8 a. Explain sequential and parallel blocks with examples. **(08 Marks)**

b. Write a verilog program for 4 to 1 mulitplexer using if-else-if conditional statement. **(08 Marks)**

Module-5

9 a. Explain the declaration of constant, veriable and signal in VHDL with example. **(08 Marks)**

b. Explain font convention in VHDL. **(08 Marks)**

OR

10 a. What are the different data types and attributes in VHDL and explain each. **(08 Marks)**

b. Write a VHDL program for 4-bit magnitude comparator. **(08 Marks)**

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15EC54

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Information Theory and Coding

Time: 3 hrs. Max. Marks: 80

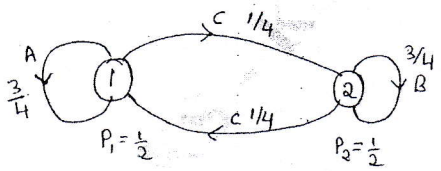
Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Derive an expression for average information content (entropy) of long independent sequence. **(04 Marks)**

b. Consider an information source modeled by a discrete ergodic Markoff random process whose graph is shown in Fig.Q.1(b). Find the source entropy H and the average information content per symbol in messages containing one, two and three symbols that is, find G_1, G_2 and G_3. **(12 Marks)**

Fig.Q.1(b)



OR

2 a. A code is composed of dots and dashes. Assuming that a dash is 3 times as long as a dot and has one third the probability of occurrence. Calculate the information in dot and dash. **(04 Marks)**

b. Design a system to report the heading of a collection of 400 cars. The heading is to be quantized into three levels: heading straight (S), turning left (L), and turning right (R). This information is to be transmitted every second. Based on the test data given below, construct a model for the source and calculate the source entropy and information rate.

i) On the average, during a given reporting interval, 200 cars were heading straight, 100were turning left, and 100 cars were turning right.

ii) Out of 200 cars that reported heading straight during a reporting period, 100 of them (on the average) reported going straight during the next reporting period, 50 of them reported turning left during next period, and 50 of them reported turning right during the next period.

iii) On the average out of 100 cars that reported as turning during a signaling period, 50 of them continued their turn during the next period and the remaining headed straight during the next reporting period.

iv) The dynamics of the cars did not allow them to change their heading from left to right or right to left during subsequent reporting periods. **(12 Marks)**

Module-2

3 a. Consider a source with Alphabet S = (A, B, C, D) with the corresponding probabilities P = (0.1, 0.2, 0.3, 0.4). Find the code words for symbol using Shannons encoding algorithm. Also find the source efficiency and redundancy. **(06 Marks)**

b. Consider the following source:
S = (A, B, C, D, E, F)
P = (0.10, 0.15,0.25, 0.35, 0.08, 0.07)
Find the codewords for the source using Shannon Fano-Algorithm. Also find source efficiency and redundancy. **(06 Marks)**

c. Illustrate with example whether the code is uniquely decodeable or not by applying kraft inequality. **(04 Marks)**

OR

4 a. An information source produces a sequence of independent symbols having the following probabilities:

A	B	C	D	E	F	G
1/3	1/3	1/9	1/9	1/27	1/27	1/27

Construct binary code using Huffman encoding procedure and find its efficiency and redundancies. **(08 Marks)**

b. Discuss the following coding technique with example:
i) Arithmatic coding ii) Lempel-zev algorithm. **(08 Marks)**

Module-3

5 a. The Joint probability matrix of a channel is given by

$$P(xy) = \begin{bmatrix} 0.05 & 0 & 0.20 & 0.05 \\ 0 & 0.1 & 0.10 & 0 \\ 0 & 0 & 0.20 & 0.10 \\ 0.05 & 0.05 & 0 & 0.10 \end{bmatrix}$$

Compute: i) H(X) ii) H(X,Y) iii) $H\left(\frac{Y}{X}\right)$ iv) $H\left(\frac{X}{Y}\right)$ **(08 Marks)**

b. The noise characteristics of channel as shown in Fig.Q.5(b). Find the channel capacity. **(05 Marks)**

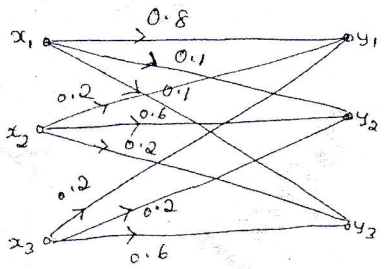


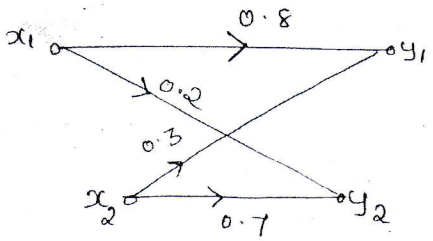
Fig.Q.5(b)

c. State the properties of mutual information. **(03 Marks)**

OR

6 a. A CRT terminal is used to enter alphanumeric data into a computer. The CRT is connected through a voice grad telephone line, usable bandwidth of 3kHz and an output S/N of 10db. Assume that the terminal has 128 characters and data is sent in an independent manner with equal probabilities.
i) Find the average information per character
ii) Find capacity of the channel
iii) Find the maximum rate at which data can be sent from the terminal to the computer without error. **(08 Marks)**

b. Find the mutual information for the channel shown in Fig.Q.6(b). Given that $P(x_1) = 0.6$ and $P(x_2) = 0.4$ **(08 Marks)**



FigQ.6(b)

Module-4

7 a. For a systematic (6, 3) linear block code the parity matrix P is given by

$$P = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

Find all possible code vector. **(05 Marks)**

b. Construct the standard array for a (6, 3) linear block code whose generator matrix is given below:

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$$

Decode the received vector 111100 **(06 Marks)**

c. For a (7, 4) binary cyclic code the generator polynomial is $g(x) = 1 + x + x^3$. Obtain code word for the message 1010 in systematic and non systematic form. **(05 Marks)**

OR

8 a. Design an encoder for the (7, 4) binary cyclic code generated by $g(x) = 1 + x + x^3$ and verify its operation using the message vector (0101). **(06 Marks)**

b. For (7, 4) cyclic code, the received vector $z(x) = 1110101$ and generator polynomial is $g(x) = 1 + x + x^3$. Draw the syndrome calculation circuit and correct the single error in the received vector. **(06 Marks)**

c. Define Hamming weight, Hamming distance and minimum distance with example. **(04 Marks)**

Module-5

9 a. Write a explanatory note on Golay code. **(04 Marks)**

b. The convolution encoder has the following two generator sequence $g^{(1)} = (111)$, $g^{(2)} = (101)$.

i) Draw the convolution encoder

ii) Find the output for the message 10011 using time domain approach. **(06 Marks)**

c. Explain Viterbi algorithm. **(06 Marks)**

OR

10 a. Consider a (3, 1, 2) convolution encoder with $g^{(1)} = (110)$, $g^{(2)} = (101)$ and $g^{(3)} = (111)$.

i) Draw the encoder block diagram

ii) Draw state table

iii) Draw state transition table

iv) Draw state diagram

v) Find the encoder output by traversing through the state diagram for input message sequence of (11101)

vi) Draw code trellis and obtain the output of the encoder for the same input sequence of (11101). **(12 Marks)**

b. Briefly explain BCH codes. **(04 Marks)**

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15EC553

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Operating System

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain goals and key concerns of an operating system. **(08 Marks)**

b. Describe Resource Allocations with diagram. **(08 Marks)**

OR

2 a. Explain time sharing systems. **(08 Marks)**

b. Explain features of distributed operating system. **(08 Marks)**

Module-2

3 a. Explain Operating Systems view of processes. **(08 Marks)**

b. Write note on: i) Process Control Block ii) Event Control Block. **(08 Marks)**

OR

4 a. Explain Threads. **(04 Marks)**

b. Perform FCFS scheduling and find average turn around time, average weighted turn around time of given set of processes.

Processes	P1	P2	P3	P4	P5
Arrival Time (Sec)	0	2	3	4	8
Service Time (sec)	3	3	5	2	3

(06 Marks)

c. Explain long, medium and short term scheduling in time sharing systems. **(06 Marks)**

Module-3

5 a. Explain contiguous memory allocation technique. **(08 Marks)**

b. Explain concept of paging. **(08 Marks)**

OR

6 a. Explain demand paging with diagram. **(08 Marks)**

b. Explain FIFO page replacement policy. **(08 Marks)**

Module-4

7 a. Explain with neat diagram file systems and IOCS. **(08 Marks)**

b. List and explain different file operations. **(08 Marks)**

OR

8 a. Explain with neat diagram Interface between file system and IOCS. **(08 Marks)**

b. Explain Allocation of disk space. **(08 Marks)**

Module-5

9 a. Explain message passing and issues related to it. **(08 Marks)**

b. Explain with diagram mailbox and its advantages. **(08 Marks)**

OR

10 a. Explain message passing implementation. **(08 Marks)**

b. Describe Resource stat modeling. **(08 Marks)**

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15EC562

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Object Oriented Programming using C++

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the structure of a C++ program. **(04 Marks)**

b. What is the difference between a reference and a pointer variable? Explain with examples. **(06 Marks)**

c. Explain about the memory management operators in C++. **(06 Marks)**

OR

2 a. Explain about the built-in datatype used in C++. **(04 Marks)**

b. Mention different types of expression in C++ with examples. **(06 Marks)**

c. Explain control structures in C++ with its syntax. **(06 Marks)**

Module-2

3 a. Explain the format of a class definition. Also explain the importance of friend function with an example. **(10 Marks)**

b. Explain function overloading with an example. **(06 Marks)**

OR

4 a. Explain the difference between call by value and call by reference. **(08 Marks)**

b. What is recursion? Write a recursive program to find the factorial of a number. **(08 Marks)**

Module-3

5 a. Mention the use of parameterized constructors and multiple constructors in a class. **(06 Marks)**

b. Develop a class STUDENT containing the following data members: NAME, USN, MARKS. Provide appropriate set of constructors for the class and write supporting main( ) that exercises these constructor. **(06 Marks)**

c. Write a note on destructor in a C++ program. **(04 Marks)**

OR

6 a. What is operator overloading? Write a program for overloading unary minus operator. **(08 Marks)**

b. Write a program with class name TIME that has three data members hour, minute and second. Write two constructors of which one should initialize to all zero and another initialize to values provided as parameters. Write supporting main( ) to exercise these constructor. **(08 Marks)**

Module-4

7 a. Define multilevel inheritance and multiple inheritance with example program. **(10 Marks)**

b. Mention the role of access specifiers in inheritance. **(06 Marks)**

OR

8 a. Briefly explain virtual function with rules. **(06 Marks)**
b. Illustrate how to use pointers can point to an object created by a class. **(06 Marks)**
c. Mention the use of 'this' pointer. **(04 Marks)**

Module-5

9 a. List and explain C++ stream classes. **(08 Marks)**
b. Elaborate any four ios format functions with example. **(08 Marks)**

OR

10 a. Describe the classes for file stream operations. **(08 Marks)**
b. Write a program to append "VTU" and "BELGAVI" texts to a file and display it on the monitor. **(05 Marks)**
c. In file stream operation which function is used to find the end of a file. Illustrate with syntax. **(03 Marks)**

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