INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
UNA [HP]
An Institute of National Importance under MoE
Saloh, Una (HP) – 177 209
Website: www.iiitu.ac.in

School of Electronics
CURRICULUM: HITUGECE22
Cycle Test - I
August 14, 2023
Time: 09:00 AM to 10:00 AM

Degree	B. Tech.	**Branch**	ECE
Semester	V		
Subject Code & Name	ECPE11: Data Communication and Networks		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	Identify the manufacturer ID from the following MAC address. Express it in Hexadecimal form. 01011010 10000001 01010101 00010001 10101010 00011111	1
1.b	For *n* devices in a network, calculate the number of cable links required for a mesh, ring, bus, and star topology.	2
1.c	Identify whether the following IP addresses are valid or not? Justify. a) 192.168.100.1 b) 220.62.1.199 c) 192.188.24.9.78 d) 192.144.256.10	2
2.a	Identify the difference between datalink layer, network layer, and transport layer delivery.	1
2.b	The signal-to-noise ratio is 36 dB and the channel bandwidth is 2 MHz. Calculate the theoretical channel capacity of the system.	2
2.c	How do the layers of an internet model correlate to the layers of the OSI model? Mention the protocols with full names at each layer in TCP/IP model.	2
3.a	Classify and compare Digital modulation techniques.	1
3.b	i) Is the frequency domain plot of a voice signal discrete or continuous? Explain the reason. ii) Is the frequency domain plot of an alarm system discrete or continuous? Explain the reason. iii) A voice signal is sent from a microphone to a recorder. Is this baseband or broadband transmission? Explain the reason. iv) Several voice signals are modulated and sent through the air. Is this baseband or broadband transmission? Explain the reason.	2 (0.5*4)
3.c	The telephone line has 4 KHz bandwidth. Calculate the maximum number of bits that can be sent using each of the following techniques. Let d =0. a. ASK b. QPSK c. 16-QAM d. 64-QAM	2
4.a	What is the bandwidth of a signal that can be decomposed into five sine waves with frequencies at 0, 10, 20, 50, and 100 Hz? All peak amplitudes are same. Draw the spectrum and show bandwidth.	1

4.b	Assume that a voice channel occupies a bandwidth of 4 kHz. 10 voice channels have to be multiplexed with guard bands of 500 Hz using FDM. Calculate the required bandwidth.	
4.c	In Fig. 1, assume that the communication is between a process running at computer A with port address *i* and a process running at computer D with port address *j*. Create the packets and frames at the network, data link, and transport layer for each hop. At each transmission link address is mentioned as X/Y where X-Logical address and Y-Physical Address.	

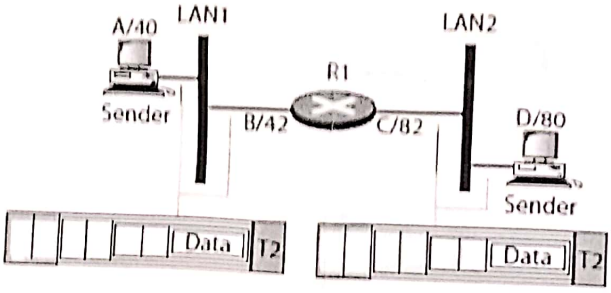

Fig. 1

**** GOOD LUCK ****

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AY 2023-24
School of Electronics
CURRICULUM: IIITUGECE22
Cycle Test – I
14, Aug.'23

Degree	B. Tech.	Branch	ECE
Semester	V		
Subject Code & Name	ECPE21: DIGITAL SIGNAL PROCESSING		
Time: 60 Minutes	Answer All Questions	Maximum: 20 Marks	

Sl. No.	Question	Marks
1.a	State the Energy and Power signal with a suitable example.	1
1.b	Discuss the advantages and disadvantages of digital processing schemes of an Analog signal.	2
1.c	Sketch the block diagram representation of the discrete time system using basic building blocks, described by given input-output relation: $y(n) = \frac{1}{2}y(n-2) + \frac{1}{4}x(n) + \frac{1}{2}x(n-1) + \frac{1}{3}x(n-2)$	2
2.a	Explain the concept of Correlation with respect to discrete time signals.	1
2.b	Define discrete time systems. Explain the following systems with an example: (i) Linear and Non-linear Systems (ii) Stable and unstable systems	2
2.c	Obtain the Circular and Linear Convolution of sequences $x(n) = \{2, 1, 2, 1\}$ and $h(n) = \{1, 2, 3, 4\}$.	2
3.a	State Initial and Final value theorem with respect to Z-transform.	1
3.b	Find the Z-transform of $x(n) = 2^n u(n-2)$.	2
3.c	Determine the causal signal $x(n)$ having Z-transform $X(z) = \frac{z}{(z-1)^2(z+2)}$	2
4.a	Obtain Discrete Time Fourier Transform (DTFT) of $cosw_0n$ and $sinw_0n$.	1
4.b	Find the Discrete Fourier Transform (DFT) of $x(n) = \{4, 3, 2, 1\}$.	2
4.c	Explain the Frequency response curve of High Pass, Low Pass, and Band Pass filters.	2

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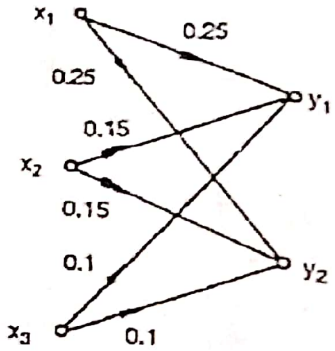
School of Electronics
CURRICULUM: IIITUGECE22
Cycle Test - I
Aug.' 16, 2023
09:00 AM-10:00 AM

Degree	B. Tech.	**Branch**	ECE
Semester	V		
Subject Code & Name	ECPE31: Communication Theory		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

Sl. No.	Question	Marks
1.a	What is the Bayes' Theorem? How is ergodic process different from stationary process?	1
1.b	Write the statistical average of commonly used pdf in communication theory.	2
1. c	A random variable X is gaussian having zero mean and unity variance. What is the probability that $\|X\| > 2$ and that $X > 2$ respectively? During transmission over a channel error occurs with probability 'p'. If a block of k bits is transmitted then what is the probability almost 1 bit error and at least one error?	2
2.a	A random variable V is uniformly distributed on the interval (-5, 5). Another random variable $Y = e^{-X/5}$ is formed. Find E[Y].	1
2.b	Justify that the random process as A cos(ωt+Φ) is ergodic in the autocorrelation.	2
2.c	An honest coin is tossed three times. Sketch the applicable sample space S showing all possible elements. Let X be a random variable that has values representing the number of heads obtained on any triple toss. Sketch the mapping of S onto the real axis defining X. The random variable Y has the following probability density function: $f_Y(y) = \begin{cases} \pi/5 \, \mathrm{Sin}[\pi y/8]; -4 \le y \le 4 \\ 0; otherwise \end{cases}$ Find: its mean value $\overline{Y}$, second moment $\overline{Y^2}$, and standard deviation.	2
.a	Write chain rule of entropy.	1

3.b	A high-resolution colour TV picture consists of about 2×10^6 picture elements and 16 different brightness levels. Pictures are repeated at the rate of 32 per second. All picture elements are assumed to be independent, and all levels have equal likelihood of occurrence. Calculate the average rate of information conveyed by this TV picture source.	2
3.c	Explain the relationship in between entropy and mutual information. Verify that I (X; Y) = I (Y; X). Find relation in between relative entropy and mutual information.	2
4.a	A continuous signal is band limited to 5 kHz. The signal is quantized in 2 levels of a PCM system with the probabilities 0.5, 0.5. Calculate the entropy and the rate of information.	1
4.b	*Write short notes on fundamental inequality, Information theory inequality, and divergence inequality.*	2
4.c	*Find the mutual information for channel diagram given in Figure 1:*  **Figure 1:** Channel Diagram	2

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AY 2023-24
SCHOOL OF COMPUTING
CURRICULUM: IIITUGCSE22
Cycle Test – 1
16, Aug.'23

Degree	B. Tech.	Branch	CSE/IT/ECE
Semester	V		
Subject Code & Name	CSSE21 Relational Database Management Systems		
Time: 60 Minutes	Answer All Questions		Maximum: 20 Marks

Sl. No.	Question	Marks
1.a	Can a nondense index be used in the implementation of an aggregate operator? Why or why not? Illustrate with an example.	(1)
1.b	A file of 4,096 blocks is to be sorted with an available buffer space of 64 blocks. How many passes will be needed in the merge phase of the external sort-merge algorithm?	(2)
1.c	Give examples of a conjunctive selection and a disjunctive selection query and discuss how there may be multiple options for their execution.	(2)
2.a	Consider the following database schema: Trip (fromAddrId, toAddrId, date) Address (id, city, state) Write an SQL query R that returns the city of all addresses in 'Himachal Pradesh' that are destination of a trip on '16/08/2023'	(1)
2.b	Find the number of blocks in the SQL query R of Q. No. 2.a and write a relational algebra expression for each block. Write a resultant relational algebra expression for the entire query R.	(2)
2.c	Construct an initial query tree for the SQL query R of Q. No. 2.a. Apply different transformation rules on the initial query to get an optimized query tree.	(2)
3.a	Explain different algorithms that can be used for implementing UNION operation.	(1)
3.b	Discuss alternative ways of eliminating duplicates when a "SELECT Distinct <attribute>" query is evaluated.	(2)
3.c	Consider the following database schema: Employee (EmpID, Name, Email, Dno) Department (DNumber, DName, Mgr_ID) Nested loop algorithm has been selected to implement the join operation: *Employee* $\bowtie_{Dno=Dnumber}$ *Department*. Assume that the number of buffers available in main memory	(2)

	for implementing the join is 9 blocks (buffers). Also, assume that the DEPARTMENT file consists of 95 records stored in 25 disk blocks and that the EMPLOYEE file consists of 7,500 records stored in 3,000 disk blocks. Calculate the total number of block accesses required to implement the join operation. Also, explain how can the selection of outer and inner loop file affect the number of block accesses.	
4.a	What is the difference between pipelining and materialization?	(1)
4.b	What is meant by the term heuristic optimization? Discuss the main heuristics that are applied during query optimization.	(2
4.c	What is the difference between query tree and query graph? If query optimization needs the order of the execution of operators in the query which will be more suitable?	(2

95000
7500
8250

27000
7500
34500

225
95