Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem Examination Dec 2024

IT3CO27 Information Theory & Data Communication

Programme: B.Tech. Branch/Specialisation: IT

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	BL	PO	CO	PSO
Q.1	i.	The method of converting a word to stream of bits is called as- (a) Binary coding (b) Source coding (c) Bit coding (d) Cipher coding	**1**	1	1	1	
	ii.	When the base of the logarithm is 2, then the unit of measure of information is- (a) Bits (b) Bytes (c) Nats (d) None of these	**1**	1	2	1	
	iii.	The channel capacity is- (a) The maximum information transmitted by one symbol over the channel (b) Information contained in a signal (c) The amplitude of the modulated signal (d) All of these	**1**	1	2	2	
	iv.	The mutual information- (a) Is symmetric (b) Always non negative (c) Both (a) and (b) (d) None of these	**1**	1	2	2	
	v.	What type of transmission is involved in communication between a computer and a keyboard? (a) Simplex (b) Half duplex (c) Full duplex (d) All of these	**1**	1	1	3	

vi.	_____the average number of samples obtained in one second. (a) Sampling rate (b) Data rate (c) Sampling frequency (d) Bit rate	**1**	2	2	3
vii.	What is the full form of CDMA? (a) Code Division Multiple Access (b) Carrier Division Multiple Access (c) Code Division Multiplexing Access (d) Code Digital Multilevel Access	**1**	1	2	4
viii.	Which of the following is the sequence for PCM? (a) Sampler, Encoding, Quantizing (b) Quantizing, Sampling, Encoding (c) Sampler, Quantizing, Encoding (d) None of these	**1**	1	1	4
ix.	In CRC if the data unit is 100111001 and the divisor is 1011 then what is the dividend at receiver? (a) 100111001101 (b) 100111001011 (c) 100111001 (d) 100111001110	**1**	2	2	5
x.	A parity check usually can detect _____. (a) 1 bit error (b) 2-bit error (c) 8-bit error (d) None of these	**1**	1	2	5

Q.2	i.	Define term entropy.	**2**	1	1	1
	ii.	What do you understand by information? What are its units? How does it relate to entropy?	**3**	1	1	1
	iii.	Consider a discrete memoryless source with a source alphabet A = { so, s1, s2} with respective probs. p0 = ¼, p1 = ¼, p2 = ½. Find the entropy of the source.	**5**	2	2	1
OR	iv.	Apply Shannon-fano coding for following: 0.30,0.25,0.15,0.12,0.10,0.08 And find codewords, entropy and efficiency.	**5**	3	2	1

Q.3	i.	Define term mutual information.	**2**	1	1	2
	ii.	Explain following: (a) Joint probability matrix (b) Binary symmetric channel	**8**	2	2	2
OR	iii.	A source emits one of four symbols S0, S1, S2 and S3 with probabilities- 1/3, 1/6, 1/4, 1/4 respectively. The successive symbols emitted by the sources are statistically independent. Calculate the entropy of the source.	**8**	2	3	2
Q.4	i.	Describe types of transmission modes.	**3**	1	1	2
	ii.	Explain transmission impairment in detail.	**7**	1	2	3
OR	iii.	An information source produces sequences of independent symbols A, B, C, D, E, F, G with corresponding probabilities 1/3, 1/27, 1/3,1/9, 1/9, 1/27, 1/27. Construct a binary code and determine its efficiency and redundancy using Shannon –Fano coding procedure.	**7**	2	2	3
Q.5	i.	Write a short note on- (a) CDMA (b) PSK	**4**	1	1	4
	ii.	Explain different types of analog data to digital signals encoding.	**6**	2	2	4
OR	iii.	What do you mean by multiplexing? Explain any two types of it.	**6**	2	3	4
Q.6		Attempt any two:				
	i.	What do you mean by error? Explain its types.	**5**	1	2	5
	ii.	What is a perfect code? Explain the features of (7, 4) Hamming code.	**5**	2	2	5
	iii.	Explain VRC in detail and its advantages and disadvantages.	**5**	1	2	5

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Marking Scheme

IT3CO27 (T) Information Theory & Data Communication (T)

Q.1	i)	b) Source coding		**1**
	ii)	a) Bits		**1**
	iii)	a) The maximum information transmitted by one symbol over the channel		**1**
	iv)	c) both a and b are correct		**1**
	v)	a) Simplex		**1**
	vi)	c) Sampling Frequency		**1**
	vii)	a) Code division multiple access.		**1**
	viii)	c) Sampler, Quantizing, Encoding		**1**
	ix)	(b) 100111001011		**1**
	x)	a) 1 bit error		**1**
Q.2	i.	Entropy	- 1 mark	**2**
		Formula	-1 mark	
	ii.	Definition	-1 marks	**3**
		Unit	-1 marks	
		Relation	-1 marks	
	iii.	Consider a discrete memoryless source with a source alphabet A = {so, s1, s2} with respective probs. p0 = ¼, p1 = ¼, p2 = ½. Find the entropy of the source.		**5**
		Formula	-1 marks	
		H= 1.5 bit/sec	- 4 marls	
OR	iv.	Apply Shannon-fano coding for following: **0.30,0.25,0.15,0.12,0.10,0.08** And find codewords, entropy and efficiency.		**5**
		msg codeword		
		0.30 - 00		
		0.25-01		
		0.15- 100		
		0.12-101		
		0.10-110		
		0.08- 111	**-** 2 marks for above	
		Entropy H= 2.418 bits	- 1 marks	
		L= 2.45 bits	- 1 mark	
		Efficiency = 98.69	- 1 mark	

Q.3	i.	Define term mutual information.		**2**
	ii.	Explain following:		**8**
		A. Joint Probability Matrix		
		B. Binary symmetric channel.		
		Joint Probability matrix -	-2mark (Total 4 marks)	
		Matrix -	- 2marks	
		Binary symmetric channel -	- 2mark (Total 4 marks)	
		Matrix -	- 1 mark	
		Diagram(Graph)	- 1 mark	
OR	iii.	A source emits one of four symbols S0, S1, S2 and S3 with probabilities 1/3, 1/6, 1/4, 1/4 respectively. The successive symbols emitted by the source are statistically independent. Calculate the entropy of the source. **1.959 bits/symbols**		**8**
Q.4	i.	Describe types of Transmission modes		**3**
		Transmission modes		
		Simplex	-1 mark	
		Half Duplex	- 1 mark	
		Full Duplex	- 1 mark	
	ii.	Explain Transmission impairment in detail.		**7**
		Transmission impairment:	- 1 marks	
		Attenuation	- 2 marks	
		Delay distortion	- 2 marks	
		Noise	- 2 marks	
OR	iii.	An information source produces sequences of independent symbols A, B, C, D, E, F, G with corresponding probabilities 1/3, 1/27, 1/3,1/9, 1/9, 1/27, 1/27. Construct a binary code and determine its efficiency and redundancy using Shannon –Fano coding procedure.		**7**
		formula	-1 marks	
		efficiency	-3 marks	
		redundancy	- 3 marks	
Q.5	i.	Write a short note on A. CDMA		**4**

P.T.O.

B. PSK

CDMA - 2marks

PSK - 2 marks

ii. Explain different types of Analog data to Digital signal encoding. **6**

PAM - 2 marks

PCM - 2 marks

DM - 2 marks

OR iii. What do you mean by multiplexing? Explain any two types of it. **6**

multiplexing: - 2 marks

TDM/FDM/WDM: Any two for - 2 marks each

Q.6 Attempt any two:

i. What do you mean by error? Explain its types. **5**

Error: -2 marks

Single bit - 1 mark

Multiple bit -1 mark

Burst Error - 1 mark

ii. What is a perfect code? Explain the features of (7, 4) Hamming code. **5**

Perfect code -2 marks

Hamming code. -3 marks

iii. Explain VRC in detail and its advantages and disadvantages. **5**

VRC -2 marks

diagram - 1 marks

advantages - 1 marks

disadvantages. - 1 marks

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