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

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2022

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.

Q.1 i. The amount of uncertainty in a system of the symbol is called- **1**
(a) Bandwidth (b) Entropy (c) Loss (d) Quantum

ii. Information rate is defined as- **1**
(a) Information per unit time
(b) Average number of bits of information per second
(c) rH
(d) All of these

iii. The channel capacity is- **1**
(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 the above

iv. The memory less source refers to **1**
(a) No previous information
(b) No message storage
(c) Emitted message is independent of previous message
(d) None of these

v. Which data communication method is used to send data over a serial communication link? **1**
(a) Simplex (b) Half duplex
(c) Full duplex (d) All of these

vi. _____the average number of samples obtained in one second. **1**
(a) Sampling rate (b) Data rate
(c) Sampling frequency (d) Bit rate

P.T.O.

	vii.	Which of the following is not a multiplexing technique? (a) TDM (b) PCM (c) FDM (d) WDM	**1**
	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**
	ix.	A parity check usually can detect _____. (a) 1-bit error (b) 2-bit error (c) 8-bit error (d) None of these	**1**
	x.	What is the hamming distance between the codes '11001011' and '10000111? (a) 2 (b) 3 (c) 4 (d) 5	**1**
Q.2	i.	Define term entropy.	**2**
	ii.	Consider a discrete memoryless source with a source alphabet A = $\{s_0, s_1, s_2\}$ with respective probs. $p_0 = ¼$, $p_1 = ¼$, $p_2 = ½$. Find the entropy of the source.	**3**
	iii.	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**
OR	iv.	Write and prove any two properties of entropy.	**5**
Q.3	i.	Define term mutual information.	**2**
	ii.	Explain following: (a) Joint probability matrix (b) Binary symmetric channel.	**8**
OR	iii.	Draw and explain the framework of discrete communication channel in detail.	**8**
Q.4	i.	Describe types of transmission modes.	**3**
	ii.	What are the four possible line coding techniques? Give examples.	**7**
OR	iii.	Explain transmission impairment in detail.	**7**
Q.5	i.	Write a short note on: (a) CDMA (b) PSK	**4**
	ii.	What do you mean by multiplexing? Explain any two types of it.	**6**
OR	iii.	Explain different types of analog data to digital signals encoding.	**6**

Q.6		Attempt any two:	
	i.	Explain VRC and its advantages and disadvantages.	**5**
	ii.	What do you mean by error? Explain its types.	**5**
	iii.	A bit word '1011' is to be transmitted. Construct even parity seven-bit hamming code.	**5**

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Marking Scheme

IT3CO27 Information Theory and Data Communication

Q.1	i)	The amount of uncertainty in a system of the symbol is called. **B. entropy**	**1**
	ii)	Information rate is defined as **D. all of the above**	**1**
	iii)	The channel capacity is **A. The maximum information transmitted by one symbol over the channel**	**1**
	iv)	The memory less source refers to **C. Emitted message is independent of previous message**	**1**
	v)	Which data communication method is used to send data over a serial communication link? **C . Full Duplex**	**1**
	vi)	_____the average number of samples obtained in one second **C. Sampling Frequency**	**1**
	vii)	Which of the following is not a Multiplexing technique. **B. PCM**	**1**
	viii)	Which of the following is the sequence for PCM **C. Sampler, Quantizing, Encoding**	**1**
	ix)	A parity check usually can detect ____ **A.1 bit error**	**1**
	x)	What is the Hamming Distance between the codes **'11001011'** and **'10000111** **B. 3**	**1**
Q.2	i.	Define term Entropy Entropy - 1 mark Formula -1 mark	**2**
	ii.	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 Formula - 1 mark **H= 1.5 bit/sec** - 2marks	**3**
	iii.	Apply Shannon-fano coding for following: **0.30,0.25,0.15,0.12,0.10,0.08** And find codewords , entropy and efficiency. **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 - 1mark Efficiency = 98.69 - 1 mark	**5**
OR	iv.	Write and prove any two properties of Entropy Properties of Entropy : -2 marks Proof : -3 marks	**5**
Q.3	i.	Define term Mutual Information Definition of Mutual Information -2marks	**2**
	ii.	Explain following: 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	**8**
OR	iii.	Draw and explain the framework of Discrete Communication Channel in detail. Diagram : - 3 marks Description : - 5 marks	**8**
Q.4	i.	Describe types of Transmission modes Transmission modes	**3**

		Simplex -1 mark Half Duplex - 1 mark Full Duplex - 1 mark	
	ii.	What are the four possible line coding techniques? Any four techniques each for - 1 mark example - 3marks	**7**
OR	iii.	Explain Transmission impairment in detail. Transmission impairment : - 1 marks Attenuation - 2 marks Delay distortion - 2 marks Noise - 2 marks	**7**
Q.5	i.	Write a short note on : A. CDMA B. PSK CDMA- 2marks PSK- 2 marks	**4**
	ii.	What do you mean by multiplexing ? Explain any two types of it. multiplexing : 2 marks TDM/FDM/WDM : Any two for 2 marks each	**6**
OR	iii.	Explain different types of Analog data to Digital signal encoding? PAM- 2 marks PCM - 2 marks DM - 2 marks	**6**
Q.6			
	i.	Explain VRC and its advantages and disadvantages. VRC -2 marks diagram - 1 marks advantages - 1 marks disadvantages. - 1 marks	**5**
	ii.	What do you mean by error? Explain its types. Error: 2 marks Single bit - 1 mark Multiple bit -1 mark	**5**
		Burst Error - 1 mark	
	iii.	A bit word '**1011'** is to be transmitted. Construct Even parity 7 bit Hamming code Hamming code for **1011** : 1010101 - 5 marks	**5**

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