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BTECH
(SEM VI) THEORY EXAMINATION 2021-22
DIGITAL COMMUNICATION

Time: 3 Hours**Total Marks: 100****Notes:**

- Attempt all Sections and Assume any missing data.
- Appropriate marks are allotted to each question, answer accordingly.

SECTION-A	Attempt All of the following Questions in brief	Marks(10X2=20)	CO
Q1(a)	A coin is flipped thrice. Determine the probability of getting two heads.		1
Q1(b)	Define probability mass function.		1
Q1(c)	Differentiate between noise and inter symbol interference.		2
Q1(d)	Draw waveform of NRZ- polar code for a digital message 111101.		2
Q1(e)	Why is scrambling done?		3
Q1(f)	Draw waveform of ASK modulated signal for a data string 111010.		3
Q1(g)	What is the probability of error of a matched filter?		4
Q1(h)	Define transmission data rate.		4
Q1(i)	What is mutual information?		5
Q1(j)	Find average length of three messages 0, 10 and 111 with their probabilities $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{4}$ respectively.		5

SECTION-B	Attempt ANY THREE of the following Questions	Marks(3X10=30)	CO
Q2(a)	Prove that power spectral density and autocorrelation are Fourier transform pairs.		1
Q2(b)	Write Short Notes on any two of the following: i) Various line coding properties ii) Gram-Schmidt orthogonalization procedure iii) Eye diagram		2
Q2(c)	Explain the DPSK modulation and demodulation with suitable block diagram and waveforms. Compare it with BPSK system.		3
Q2(d)	Describe matched filter with suitable diagram? Prove that impulse response of a matched filter is proportional to a shifted version of the input signal to which filter is matched.		4
Q2(e)	Briefly explain entropy, average length and redundancy. Prove the relationship between different entropies $H(XY) = H(Y/X) + H(X)$		5

SECTION-C	Attempt ANY ONE following Question	Marks (1X10=10)	CO
Q3(a)	Differentiate between wide sense stationary and strict sense stationary random process. Also briefly explain statistical averages of continuous random process.		1
Q3(b)	Explain Gaussian random process and relate central limit theorem to it with a suitable example.		1

SECTION-C	Attempt ANY ONE following Question	Marks (1X10=10)	CO
Q4(a)	What is the Nyquist criterion for zero ISI in pulse shaping? Explain the pulse shapes required to fulfill the condition.		2
Q4(b)	Explain the function of scrambler and unscrambler with neat block diagram.		2

SECTION-C	Attempt ANY ONE following Question	Marks (1X10=10)	CO
Q5(a)	Explain QAM system with suitable block diagram and constellation diagram.		3
Q5(b)	How does the QPSK modulator transmit digital data over channel? Also explain the demodulation process of the QPSK modulated signal from an ideal channel.		3



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SECTION-C	Attempt ANY ONE following Question	Marks (1X10=10)	CO
Q6(a)	Derive the expression for probability of error in ASK modulation system. Notify all the assumed parameters clearly. Why is it not better than FSK?	4	
Q6(b)	Describe the spread spectrum modulation with FHSS and DSSS with suitable diagrams involved.	4	

SECTION-C	Attempt ANY ONE following Question	Marks (1X10=10)	CO
Q7(a)	Design and explain an encoder for a block code of (7, 4) generating matrix $g(x) = 1+x+x^3$ and data signal 1110. Also find the systematic code for a string 0111.	5	
Q7(b)	Construct Shannon Fanocode for six messages m_1, m_2, m_3, m_4, m_5 and m_6 with probabilities $1/2, 1/4, 1/8, 1/16, 1/32, 1/32$, respectively. Calculate the entropy and average length of the codes.	5	

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