

(A constituent unit of MAHE, Manipal)

FIFTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION DECEMBER 2020/JANUARY 2021 SUBJECT: ANALOG AND DIGITAL COMMUNICATION (ECE - 3151)

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- 1A. The power spectral density of a signal g(t) is shown in the Fig. Q1A below. Find the autocorrelation function. Calculate the average power.



1B. Draw the block diagram of Coherent detector for an SSB wave detection. Explain the significance of "coherence" for the same. Explain the bandwidth and guard band width requirements for the filter for effective detection. Consider message signal bandwidth as f_mHz and assume that SSB signal has the upper sideband.

(5+5)

- 2A. With the block diagram, and proper mathematical analysis explain the indirect method of FM generation.
- 2B. Write down the expression for generalized correlative coding. Construct a correlative coder which has tap weights W0=+1, W1=0 and W2=-1. Encode the binary sequence **001011010** using the same coder.

(5+5)

- 3A Derive the maximum likelihood detection rule for the detection of known equiprobable M-ary signals in noise. Also obtain the expression for probability of error for the same.
- 3B. Derive the impulse response of a matched filter that gives maximum value of output SNR. Also state any two properties of matched filter.

(5+5)

- 4A. With proper mathematical analysis, obtain the expression for the variance of quantization error of a robust quantizer. Also obtain the compression characteristic for the same and write down its limitations.
- 4B. Determine the expression for a probability of error in Quadri-phase shift keying giving necessary justifications for every step written. Draw the signal constellation.

(5+5)

- 5A. Let X and Y are input and output random variables of a binary channel respectively. Let the input to the channel is defined by an alphabet, $X = \{0,1\}$ and the output of the channel is defined by an alphabet, $Y = \{0,1\}$. This channel is characterized by $P = \begin{bmatrix} 9/10 & 1/10 \\ 1/20 & 19/20 \end{bmatrix}$. If P(X = 0) = 3/4, Compute
 - (i) Probability Matrices, P(X, Y) and P(X/Y)
 - (ii) H(X/Y = 0), H(X/Y = 1)
 - (iii) H(X/Y), H(Y/X), and Mutual Information
- 5B. Construct a minimum variance binary Compact code for a source with 8 equiprobable symbols emitted by a discrete memoryless source. Compute Code redundancy and efficiency.

(5+5)