Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FIRST SEMESTER M TECH. (DECE) DEGREE END SEMESTER EXAMINATION

AUGUST 2021

SUBJECT: MODERN DIGITAL COMMUNICATION (ECE - 5153)

TIME: 2 HOURS **MAX. MARKS: 40**

Instructions to candidates

- Answer any **FOUR** full questions.
- Missing data may be suitably assumed.

1A. The two equivalent low pass signals are given as $S_1(t) = \{A, 0 < t < T$ and $S_2(t) = \begin{cases} A, 0 < t < T/2 \\ -A, T/2 < t < T \end{cases}$ are used to transmit a binary information sequence. The transmitted signals that are equally probable are affected by AWGN noise. Find transmitted signal energy. Also explain the term AWGN with necessary diagrams.

1B. What is meant by inner product of vectors? What is the angle between two vectors if their inner product is zero.

(7+3)

2A. Signals S1(t), S2(t), S3(t), S4(t) are represented by matrices S1=$[0\ 1\ 0]^T$, S2=$[1\ 1\ 0]^T$, S3=$[0\ 3\ 0]^T$, S4=$[-1\ 1\ 0]^T$. Show these signals as linear combinations of basis functions. What is the use of Gram-Schimdt process in solving the problem?. Find the energy of the signals S1, S2, S3 and S4.

2B. Draw the diagrams of synthesizer and analyser.

(7+3)

3A. If a good channel is provided for communication, which modulation scheme among 16 QAM, QPSK, BPSK will you choose? Explain the reason for selection of modulation scheme.

3B. Given the probability of symbol error of M-PAM, derive probability of symbol error of M-QAM. Draw the signal space diagram and message points of 16-QAM.

(4+6)

4A. Given H=[2 -6 0; 1 4 0; 0 0 1], x =[1; 1; 1]. Explain how parallelization is achieved in the above-mentioned system with necessary diagrams.

4B. Explain the use of water filling algorithm in optimal power allocation in MIMO using necessary diagrams for the above mentioned channel. Use transmit power as -1.25 dB and noise power as 3 dB.

(5+5)

5A. What is the difference between multi carrier modulation and OFDM. Also explain the use of cyclic prefix.

5B. Explain how MIMO can be used along with OFDM with proper diagram

(6+4)

6A. What is meant by water filling algorithm. Define and explain the problem leading to it mathematically.

6B Explain the use and advantage of using alamouti code in 1x2 MISO system.

(5+5)