Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

## SEVENTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION DECEMBER 2018/JANUARY 2019 SUBJECT: SPREAD SPECTRUM COMMUNICATION (ECE - 4012)

## TIME: 3 HOURS

MAX. MARKS: 50

## **Instructions to candidates**

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- Show all intermediate steps while solving numerical or in a derivation.
- 1A. Find the first 7 chips of a Gold code created from the following two *m*-sequences. Provide the shift register implementation for the *m*-sequences and the Gold code.

	Generate polynomial	Initial State
<i>m</i> -sequence 1	[45]	11111
<i>m</i> -sequence 2	[75]	11111

Clearly show all intermediate steps.

- 1B. For Walsh-Hadamard Code, obtain Hadamard matrix of order 8, in two different ways.
- 1 C List the advantages of spread spectrum communication.

[4+3+3]

- 2A. Describe how PN sequence is used in frequency hopping spread spectrum (FHSS) system with the help of a neat labelled block diagram for FHSS transmitter. Support your answer with the figure for channel assignment and channel use for FHSS.
- 2B. Describe slow and fast FHSS systems and provide the pictorial representation of a transmitted signal for 4-ary FSK slow-FHSS using a data sequence of 011100111101 and a PN sequence of 0011011000 (2 bits are used for selecting the hop frequency).

[5+5]

- 3A. Describe the spreading and despreading operation in the QPSK DSSS system with the help of a block diagram of QPSK DSSS transmitter and receiver (provide the necessary equations). Also, provide the block diagram for modified QPSK DSSS transmitter using different data on the two QPSK channels.
- 3B. Describe RAKE receiver with the help of a block diagram.

[5+5]

4A. Consider a direct-sequence spread-spectrum system using a spreading code clock frequency,  $f_c = 3$  MHz. Suppose that the received carrier power-to-noise power spectral ratio is 46.25 dB-Hz, what sweep rate is required to yield a single sweep ( $P_d$ ,  $P_{fa}$ ) pair equal to (0.8, 10<sup>-3</sup>) and corresponding maximum SNR is 10.3 dB. Determine the average acquisition time and maximum acquisition time for serial search acquisition system? Assume  $N_c = 10^6$ , K = 100,  $\lambda = 500$ 

4B. Describe the RASE acquisition system with the help of a neat labelled block diagram.

[5+5]

- 5A. Describe the direct-sequence CDMA with the help of a neat labelled block diagram. Support your answer with suitable expressions wherever necessary.
- 5B. Describe the energy detector for detection of an unknown signal in AWGN, with the help of a neat labelled block diagram.

[5+5]