Reg. No.

## MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

## V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING) END SEMESTER ON-LINE PROCTORED EXAMINATIONS

## DECEMBER 2021

## **COMMUNICATION SYSTEMS [ELE 3151]**

REVISED CREDIT SYSTEM

Time:	75 Minutes + 10 Minutes	Date: 21 December 2021	Max. Marks: 20
Instruc	tions to Candidates:		
	✤ Answer ALL the questions.		
	Missing data may be suitably assumed.		
	<ul> <li>Steps must be clearly shown</li> </ul>		
	<ul> <li>Time: 75 minutes for writing + 10 minutes for uploading.</li> </ul>		
<b>1A.</b> The message signal at 20Hz is modulated using carrier frequency 500kHz to produce NBFM output with modulation index of 0.5			

- 500kHz to produce NBFM output with modulation index of 0.5 radian. This NBFM signal is used to generate a WBFM using multipliers. It is expected that the WBFM signal produced has carrier frequency 108MHz and frequency deviation 76kHz. Let the mixer be supplied with a carrier frequency be 9.5MHz.
  - 1. Calculate the frequency multiplication factors  $n_1$  and  $n_2$  (preceding and following the mixer) which satisfy these specifications.
  - 2. Specify the values of the carrier frequency and frequency deviation at the output of modulator, mixer and multipliers.
- (4)

(3)

- **1B.** Demonstrate "**aliasing**" and suggest a corrective measure used to prevent aliasing.
- **1C.** Let IEEE 802.11 standard uses slow FHSS for the Wi-Fi technology with the given specifications. If the input binary sequence transmitted is 01110011110110000011 and PN sequence generated is 0011011000. Draw the frequency variation for one complete period of the PN sequence in slow FHSS. [Let number of MFSK tones (M)= 4 and length of PN segment per hop(k) = 2]
- (3)

- **2A.** Consider the signal s(t) shown in Figure Q2A.
  - a) Determine the impulse response of a filter matched to this signal and sketch it as a function of time.
  - b) Determine the output of the matched filter and plot it as a function of time.

(4)



**2B.** A convolutional encoder with rate  $r = \frac{1}{2}$  has constraint length K = 3, two modulo-2 adders, and an output multiplexer. The generator sequence of the encoder are as follows:

 $g^{1}(D) = (1,0,1)$  $g^{2}(D) = (1,1,1)$ 

- 1. Construct the state diagram for this encoder.
- 2. Use the state diagram and trace the path corresponding to the message sequence 10110...starting from the all-zero state.
- 2C. i. Suggest a low power, low data rate networking technology for home automation application. In the home automation scenario, let the devices used are a motion detector, a door lock sensor, a smoke detector and a temperature sensor. The microcontroller gathers the sensed signals and generates the control signals corresponding to the actuators :- a luminaire, an AC and an alarm. Develop a star topology wireless sensor actuator network scheme (Assume appropriate device roles in the network while representing the topology of the networking scheme) for the mentioned home automation scenario with suitable networking technology.
  - Modify the same home automation scenario to MQTT protocol architecture of an IoT based home automation system. Consider NodeMCU as the gateway, MQTT server and the application layer as mobile app for the system.

(3)

(3)