MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

**V SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
PROCTORED ONLINE MAKEUP EXAMINATIONS, FEBRAUARY 2022**

COMMUNICATION SYSTEMS [ELE 3151]
REVISED CREDIT SYSTEM

Time: 75 Minutes	Date: 19 February 2022	Max. Marks: 20

Instructions to Candidates:
- ❖ Answer **ALL** the questions.
- ❖ Missing data may be suitably assumed.
- ❖ Steps must be clearly shown

1A. Determine the amplitude spectra of an FM signal with modulation index β=5 and Ac=4.(Bessel function is given in Table 1)

Table 1: Bessel function

n \ β	0.2	0.5	1	2	5	8
0	0.990	0.938	0.765	0.224	−0.178	0.172
1	0.100	0.242	0.440	0.577	−0.328	0.235
2	0.005	0.031	0.115	0.353	0.047	−0.113
3			0.020	0.129	0.365	−0.291
4			0.002	0.034	0.391	−0.105
5				0.007	0.261	0.186
6					0.131	0.338
7					0.053	0.321
8					0.018	0.223
9						0.126
10						0.061

(04)

1B. A signal g(t)=2cos200πt + 6cos180πt is sampled at a frequency fs= 200 samples per sec. The sampled version g$_\delta$(t) is passed through a ideal LPF with a cutoff frequency 150Hz. Sketch the spectrum of sampled signal and filtered signal, mentioning the equations. **(03)**

1C. Let IEEE 802.11 standard uses fast FHSS for Bluetooth technology with the given specifications. If the input binary sequence transmitted is 011100111101 and PN sequence generated is 001101100010001110001011. Draw the frequency variation for one complete period of the PN sequence in fast FHSS. [Let number of MFSK tones (M) = 4 and length of PN segment per hop (k) = 2] **(03)**

2A. Consider a matched filter with impulse response $h(t)$ as shown in Figure Q2A. If the signal $s(t)$ is applied to the matched filter:

  a) Determine the output of the matched filter and plot it as a function of time.
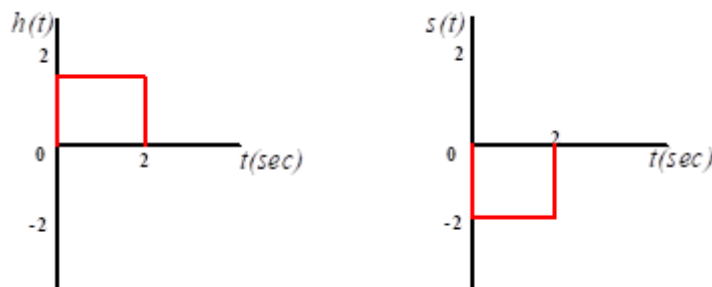 b) Determine the peak value of the output?

Figure Q2A **(04)**

2B. Consider the message sequence $m = [1010]$. Let the generator polynomial be $g(X) = X^3 + X^2 + 1$. Determine the 7 bit cyclic code word. **(03)**

2C. For a smart irrigation system with 2 soil moisture sensors, 2 temperature sensors, 2 humidity sensors, a relay to switch on /off the water pump and Node MCU as a controller,

  a) Develop a star topology wireless sensor actuator network scheme (Consider the devices used as ZigBee devices, hence assume appropriate device roles in the ZigBee network while representing the topology)

  b) Modify the same wireless sensor actuator network to MQTT protocol architecture. Consider Node MCU as the gateway, MQTT server and the application layer as mobile app. **(03)**