Reg. No.									

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

SECOND SEMESTER M.TECH. (DEFENCE TECHNOLOGY)
END SEMESTER EXAMINATIONS, MAY-2024

DIGITAL & SATELLITE COMMUNICATION AND NAVIGATION FROM SPACE
[AAE 5281]

Time: 3 Hours **Date: 3rd MAY 2024** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

Q.NO	Questions	Marks	CO	BTL
1A.	Calculate the modulation index and % of modulation if instantaneous voltage of modulation signal and carrier signal are 40Sin ωmt and 50sin ωct.	(02)	C01, C04	BL2
1B.	The tuned circuit of the oscillator in a simple AM transmitter employs a 50µH coil and 1nf capacitor. If the oscillator o/p is modulated by audio frequency up to 10 kHz, what is the range occupied by the sideband.	(03)	C01, C02	BL4
1C.	An audio frequency signal 10sin ($2\pi *500$ t) is used to amplitude modulate a carrier of 50sin($2\pi * 10^5$ t) . Calculate: 1. Modulation Index 2. Sideband frequencies 3. Amplitude of each sideband frequencies 4. Bandwidth required 5. Total power delivered to the load of 600Ω 6. Tx. Efficiency	(05)	C01, C05	BL5
2A.	A DMS emits one of five symbols one every millisecond with probabilities of [1/2, 1/4, 1/8, 1/16, 1/16], determine the source entropy & information rate.	(02)	C02, C01	BL2
2B.	Explain the basic block diagram of wireless transmission with three examples.	(03)	C02, C03	BL4
2C.	Calculate the % power saving when the carrier is suppressed in an AM wave modulated to a depth of (a) 100% and (b) 50%. Repeat the same when the carrier and one of the sideband are suppressed.	(05)	C02, C04	BL5
3A.	Define Transmission Media.	(02)	C03	BL2

<table>
<tr><td>3B.</td><td>Create line coding for the following code [1011001] With proper waveform.</td><td>(03)</td><td>C03, C04</td><td>BL4</td></tr>
<tr><td>3C.</td><td>Elaborate on why TEM waves cannot propagate in a rectangular waveguide and derive the corresponding expression.</td><td>(05)</td><td>C03, C05</td><td>BL4</td></tr>
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<tr><td>4A.</td><td>Explain three propagation methods with an appropriate sketch.</td><td>(02)</td><td>C04</td><td>BL2</td></tr>
<tr><td>4B.</td><td>Draw the Bandwidth of the transmitter and receiver communication system and explain it.</td><td>(03)</td><td>C04, C02</td><td>BL4</td></tr>
<tr><td>4C.</td><td>Analyze electromagnetic spectrum for wireless communication with different frequency bands and their applications.</td><td>(05)</td><td>C04, C03</td><td>BL5</td></tr>
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<tr><td>5A.</td><td>A system is using NRZ-I to transfer 1-Mbps data. What are the average signal rate and minimum bandwidth?</td><td>(02)</td><td>C05, C01</td><td>BL2</td></tr>
<tr><td>5B.</td><td>Find Huffman and Shannon feno coding for the given data and identify length of the code, entropy and efficiency.
<table><tr><td>S1</td><td>S2</td><td>S3</td><td>S4</td><td>S5</td><td>S6</td></tr><tr><td>.30</td><td>.25</td><td>.15</td><td>.12</td><td>.10</td><td>.08</td></tr></table></td><td>(03)</td><td>C05, C02</td><td>BL4</td></tr>
<tr><td>5C.</td><td>What is AM wave? Derive the mathematical expression for AM wave standard form, modulation index, bandwidth, power.</td><td>(05)</td><td>C05, C04</td><td>BL5</td></tr>
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