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B.Tech DEGREE EXAMINATION, NOVEMBER 2023

Seventh Semester

18ECE220T - ADVANCED MOBILE COMMUNICATION SYSTEMS

(For the candidates admitted during the academic year 2020 - 2021 & 2021 - 2022)

Note:

i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

ii. **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours **Max. Marks: 100**

PART - A (20 × 1 = 20 Marks)

Answer **all** Questions

		Marks	BL	CO
1.	_____ provides broadband Internet connection wirelessly, alternative backhaul for Wi-Fi hot spots, and T1/E1 lines to business subscribers. (A) Advanced Mobile Phone Service (B) Cordless Telephone System (C) WiMAX (D) GSM	1	1	1
2.	Which of the following schemes is inefficient for handling asymmetric data services since data traffic may only occupy a small portion of a channel bandwidth at any given time (A) Frequency Division Duplex (B) Time Division Duplex (C) Time Duplex (D) Frequency Duplex	1	2	1
3.	Which of following standards support both time division duplexing and frequency division duplexing, as well as a half-duplex FDD, which allows for a low-cost system implementation? (A) IEEE 802.11 (B) IEEE 802.15 (C) IEEE 802.16e-2005 (D) IEEE 802.11a	1	2	1
4.	Release 10 LTE-Advanced is intended to provide data rates up to (A) 3Mbps (B) 300Mbps (C) 10Gbps (D) 1Gbps	1	1	1
5.	Which of the technologies incorporated into LTE enable high data bandwidths to be transmitted efficiently while still providing a high degree of resilience to reflections and interference? (A) Frequency Division Multiplexing (B) Time Division Multiplexing (C) Time Division Multiple Access (D) Orthogonal Frequency Division Multiplexing	1	1	2
6.	Consider an OFDM system operating a channel with a coherence bandwidth of 10KHz. Find a subchannel symbol time (A) 0.1ms (B) 0.01ms (C) 0.001ms (D) 1ms	1	2	2
7.	_____occurs when the voltage-controlled oscillator at the receiver is not oscillating at exactly the same carrier frequency as the voltage controlled oscillator in the transmitter. (A) Inter Symbol Interference (B) Inter Carrier Interference (C) Frequency Offset (D) Time Offset	1	1	2
8.	What is the subcarrier spacing frequency of 20MHz bandwidth and 64-point FFT of the IEEE 802.11 WLAN system? (A) 16.6MHz (B) 312.5KHz (C) 20MHz (D) 24MHz	1	1	2

9.	If the system bandwidth is B and symbol time period Ts, the Number of sub-carriers is (A) 2BTs (B) 2B/Ts (C) BTs (D) B/Ts	1	2	3
10.	Which of the following does not consume additional power associated with MIMO OFDM symbol time expansion (A) Cyclic Prefix (B) Pilot Carriers (C) Guard Time (D) Data subcarriers	1	1	3
11.	Which of the following systems improves the bandwidth efficiency and system reliability without the need to use extra bandwidth or transmit more power into the channel? (A) Single Input and Single Output (B) Single Input Multiple Output (C) Multiple Input and Single Output (D) Multiple Input and Multiple Output	1	2	3
12.	Which among the following is the function of out-of-band sensing? (A) Detection of primary base-station (B) Detection of spectrum holes (C) Detection of primary user (D) Detect xG users	1	1	4
13.	Which of the following techniques permits the same or different radio access technologies to use the same frequency band by using unoccupied sub-bands in an intelligent and coordinated way (A) Spectrum Sensing (B) Spectrum Decision (C) Spectrum Sharing (D) Spectrum mobility	1	2	4
14.	Which cognitive radio architecture is to allocate frequency bands to different radio access technologies? (A) Heterogeneous infrastructure (B) Asymmetrical infrastructure (C) Equivalence infrastructure (D) Symmetrical infrastructure	1	1	4
15.	In which model, all users can access the spectrum equally, subject to certain constraints on the characteristics of the transmit signal? (A) Dynamic exclusive model (B) Hierarchical access model (C) Open sharing model (D) closed sharing model	1	1	4
16.	Direct Conversion millimeter wave receivers are otherwise called as ..... (A) Zero – IF approach (B) Zero RF approach (C) Zero base band scheme (D) Hetero cryptic – IF scheme	1	1	5
17.	Millimeter waves are also known as extremely high frequency (EHF) that would allow transmission frequencies between (A) 30 Hz and 300 Hz (B) 30 Hz and 30 GHz (C) 3GHz and 30 GHz (D) 30GHz and 300GHz	1	1	5
18.	The Federal Communications Commission limits the equivalent EIRP of a 60GHz communication link to ___ (A) 20dBm (B) 40dBm (C) -20dBm (D) -40dBm	1	1	5
19.	OOK modulation is equivalent to (A) PSK (B) two level - PSK (C) two level - ASK (D) two level - FSK	1	2	3
20.	The millimeter-wave region of the electromagnetic spectrum corresponds to _____ range (A) EHF (B) HF (C) LF (D) Mid Frequency	1	1	5

PART - B (5 × 4 = 20 Marks) **Marks BL CO**

Answer **any 5** Questions

21.	Illustrate the structure of WiMAX frame structure	4	1	1
22.	Determine the data of an IEEE 802.11a WLAN system assuming 16-QAM and a code rate of 2/3	4	3	2
23.	Write short notes on the benefits of MIMO -OFDM system	4	3	3
24.	Write the pros and cons of spectrum sensing techniques	4	2	4
25.	Describe the characteristics of millimeter wave communication	4	2	5
26.	Describe the MIMO VBLAST Architecture with neat diagram	4	2	3
27.	Discuss the drawbacks of OFDM transceiver	4	2	2

PART - C (5 × 12 = 60 Marks)

Answer **all** Questions

		Marks	BL	CO
28.	(a) Illustrate and explain the functional block diagram of Long Term Evolution architecture in detail	12	2	1
	(OR)			
	(b) Discuss the working principle of WiMAX network architecture with neat sketch			
29.	(a) (i) Illustrate and explain the working principle of the OFDM system [8 Marks]	12	3	2
	(ii) Discuss the IEEE 802.11a OFDM system design parameters [4 Marks]			
	(OR)			
	(b) (i) Consider an OFDM system with total bandwidth B = 1 MHz. A single-carrier system would have symbol time Ts = 1 μs. The channel has a maximum delay spread of Tm = 5 μs. Assume an OFDM system with M-QAM modulation applied to each subchannel. To keep the overhead small, the OFDM system uses N = 128 subcarriers to mitigate ISI. The length of the cyclic prefix is set to μ = 8 > Tm/Ts to ensure no ISI between OFDM symbols. For these parameters, find the subchannel bandwidth, the total transmission time associated with each OFDM symbol, the overhead of the cyclic prefix, and the data rate of the system assuming M = 64.[8 Marks]			
	(ii) Discuss the impact of CFO in OFDM [4 Marks]			
30.	(a) (i) A 3 x 3 flat fading channel matrix is given by $H=\begin{vmatrix} 2 & -0.5 & 0 \\ 0.6 & 1 & 0 \\ -0.4 & 0 & 0.2 \end{vmatrix}$. The input signal is Gaussian with zero mean, power constraint P = 1, and the bandwidth of the channel is 50KHz. The channel noise is Gaussian with zero mean and variance of 0.1. Calculate the MIMO channel capacity, assuming that the channel knowledge is unknown to the receiver. [8 Marks]	12	3	3
	(ii) Explain the spatial multiplexing technique with a neat sketch [4 Marks]			
	(OR)			
	(b) (i) Derive the channel capacity via singular value decomposition [6 Marks]			
	(ii) Consider a 2x2 MIMO system with channel gain matrix H given by $\mathbf{H} = \begin{vmatrix} .3 & .5 \\ .7 & .2 \end{vmatrix}$. Assume H is known at both the transmitter and receiver, and that there is a total transmit power of 10 and bandwidth B = 100 KHz. Find the capacity of this channel [6 Marks]			

31.	(a) Describe the working principle of interleaving with neat diagram	12	2	4
	(OR)			
	(b) Explain in detail about cognitive transceiver architecture with necessary diagram			
32.	(a) (i) Discuss the role of modulation techniques for millimeter wave communications [6 Marks] (ii) Discuss the millimeter wave standards [6 Marks]	12	3	5
	(OR)			
	(b) Illustrate and explain the functional block diagram of millimeter wave transceiver with neat sketch			

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