

## B.Tech DEGREE EXAMINATION, MAY 2024

Seventh Semester

### 18ECC301T - WIRELESS COMMUNICATION

(For the candidates admitted during the academic year 2018-2019 to 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 40<sup>th</sup> 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)**

**Marks BL CO**

Answer **all** Questions

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|--|---|---|---|---|
| 1. Identify the channel to be used for a transmission of device power level from mobile station to base station.<br>(A) Forward Voice Channel<br>(C) Reverse Voice Channel | (B) Forward Control Channel<br>(D) Reverse Control Channel                        | 1 | 1 | 1 |
| 2. Adjacent channel interference can be minimized by<br>(A) Increasing number of base stations<br>(C) Careful filtering and channel assignments                            | (B) Increasing number of control channels<br>(D) Changing the hand off techniques | 1 | 1 | 1 |
| 3. What is the Co-Channel reuse value for a cluster size of 7?<br>(A) 3<br>(C) 6   | (B) 4.58<br>(D) 6.24  | 1 | 3 | 1 |
| 4. How many users can be supported for total traffic intensity of 1.13 Erlangs, if that each user generates 0.1 Erlangs of traffic?<br>(A) 9<br>(C) 11                     | (B) 10<br>(D) 12  | 1 | 3 | 1 |
| 5. Express 50 W power in units of dBm.<br>(A) 1.7<br>(C) 17  | (B) 4.7<br>(D) 47   | 1 | 2 | 2 |
| 6. Electromagnetic wave impinges upon an object which has very large dimensions than the wavelength of the propagating wave leads to.<br>(A) Diffraction<br>(C) Reflection | (B) Refraction<br>(D) Scattering  | 1 | 2 | 2 |
| 7. Calculate the Brewster angle for a wave impinging on ground having a permittivity of $\epsilon_r = 5$ .<br>(A) 5<br>(C) 25  | (B) 15<br>(D) 35  | 1 | 3 | 2 |
| 8. An antenna with maximum dimension of 1 m operates at frequency of 800 MHz. Calculate the Fraunhofer distance.<br>(A) 5.33 m<br>(C) 4.33 m                               | (B) 5.33 cm<br>(D) 4.33 cm  | 1 | 3 | 2 |
| 9. Time dispersion and frequency selective fading is due to<br>(A) Doppler effect<br>(C) angular spread  | (B) delay spread<br>(D) frequency modulation                                      | 1 | 2 | 3 |

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| 10. In slow fading channels, Doppler spread of the channel is much less than the _____.<br>(A) Coherent time of the channel<br>(C) Bandwidth of the transmitted signal             | (B) Symbol period of the transmitted signal<br>(D) Phase angle of the transmitted signal | 1 | 2 | 3 |
| 11. The Direct RF pulse system uses _____ detector<br>(A) noise<br>(C) envelope  | (B) coherent<br>(D) threshold  | 1 | 1 | 3 |
| 12. Consider a mobile user moving with a velocity of 500 kmph at carrier frequency 128 MHz and an angle of 25°. Find the Doppler shift.<br>(A) 59.25 Hz<br>(C) 53.71 Hz            | (B) 35.4 Hz<br>(D) 232 Hz  | 1 | 3 | 3 |
| 13. Shannon capacity of a fading channel with receiver CSI only is _____ the Shannon capacity of an AWGN channel with the same average SNR.<br>(A) greater than<br>(C) less than   | (B) equal to<br>(D) greater than or equal to   | 1 | 1 | 4 |
| 14. _____ is defined as the point at which the received power value falls below the minimum acceptable signal to noise ratio (SNR).<br>(A) Ergodic capacity<br>(C) Outage capacity | (B) Channel capacity<br>(D) Outage probability   | 1 | 2 | 4 |
| 15. Which of the following is not a category of space diversity technique?<br>(A) Selection diversity<br>(C) Feedback diversity  | (B) Equal gain diversity<br>(D) Polarization diversity                                   | 1 | 1 | 4 |
| 16. If the channel is bandlimited to 6 kHz & signal to noise ratio is 16, what would be the capacity of channel?<br>(A) 2.66 Kbps<br>(C) 24.52 Kbps                                | (B) 7.38 Kbps<br>(D) 48.52   | 1 | 3 | 4 |
| 17. In MIMO, which factor has the greatest influence on data rates?<br>(A) Number of transmit antenna<br>(C) Height of transmit antenna  | (B) Number of receive antenna<br>(D) Height of receive antenna                           | 1 | 2 | 5 |
| 18. _____ temporarily stores the IMSI and customer information for each roaming subscriber.<br>(A) AuC<br>(C) HLR  | (B) EIR<br>(D) VLR   | 1 | 2 | 5 |
| 19. IS-95 channel occupies _____ of spectrum on each one-way link.<br>(A) 25 KHz<br>(C) 1.25 MHz   | (B) 30 KHz<br>(D) 5 MHz  | 1 | 2 | 5 |
| 20. In cyclic prefix, guard time between adjacent symbols is inserted to eliminate _____.<br>(A) ICI<br>(C) PAPR   | (B) ISI<br>(D) Orthogonality   | 1 | 2 | 5 |

**PART - B (5 × 4 = 20 Marks)**

Answer **any 5** Questions

- |  |   |   |   |
|--|---|---|---|
| 21. "Paging system is an example of simplex communication". Justify the aforementioned statement with the help of a block diagram. | 4 | 2 | 1 |
| 22. What are the sources of Adjacent Channel Interference (ACI)? Prescribe suitable solutions to mitigate ACI.                     | 4 | 4 | 1 |
| 23. State the significance of channel propagation models.  | 4 | 4 | 2 |

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|--|---|---|---|
| 24. Find the far field distance for an antenna with maximum dimension of 2 m and operating frequency of 2.4 GHz. | 4 | 3 | 2 |
| 25. List and discuss the factors influencing small scale fading.   | 4 | 2 | 3 |
| 26. Compare selection combining and feedback combining techniques.   | 4 | 4 | 4 |
| 27. What is meant by multicarrier modulation? What are its advantages?   | 4 | 2 | 5 |

**PART - C (5 × 12 = 60 Marks)**

Answer **all** Questions

**Marks BL CO**

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|--|----|---|---|
| 28. (a) (i) Derive an closed form expression of signal to co-channel interference ratio in a cellular system by stating all assumptions used. [ 6 Marks].<br>(ii) If a signal to interference ratio of 15 dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity if the path loss exponent n is 4? Assume that there are 6 co-channels cells in the first tier, and all of them are at the same distance from the mobile. [6 Marks].<br><b>(OR)</b><br>(b) Analyze any two techniques in detail with relevant illustrations to improve capacity of cellular systems. | 12 | 4 | 1 |
| 29. (a) Derive expressions of received signal power for Free space and two ray propagation models.<br><b>(OR)</b><br>(b) Explain Okumura and Hata empirical path loss models with relevant expressions. Analyze their suitability for propagation study in urban environments.   | 12 | 4 | 2 |
| 30. (a) Derive an equation for impulse response of discrete multipath mobile radio channel and explain its power delay profile with relevant diagrams.<br><b>(OR)</b><br>(b) (i) Define: Delay spread, coherence bandwidth, Doppler spread and coherence time. Classify fading with reference to above parameters. [ 6 Marks].<br>(ii) Describe the working of Spread spectrum correlator channel sounding method with neat diagram [6 Marks].   | 12 | 4 | 3 |
| 31. (a) (i) Explain the working principle of RAKE receiver in CDMA systems with a neat block diagram. [6 Marks].<br>(ii) Give the taxonomy of equalizers and compare the adaptive algorithms. [6 Marks]<br><b>(OR)</b><br>(b) Derive an expression for capacity of the flat fading channel and its outage when the CSI is not known at both transmitter and receiver.  | 12 | 2 | 4 |
| 32. (a) Explain in detail the various subsystems of the GSM system with neat block diagram. Also give its air interface specifications.<br><b>(OR)</b><br>(b) Explain with neat diagram, the operation of OFDM transceiver.  | 12 | 2 | 5 |

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