KATHMANDU UNIVERSITY
End Semester Examination [C]
June/July 2024

Marks Scored:

Level : B.E.
Year : IV

Course : ETEG 432
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 08 JUL 2024

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate answer.

1. The primary advantage of wireless communication over wired communication is_____
   a. Portability b. Security c. Throughput d. Cost

2. Among the following, _____ protocol is used for purpose of secure wireless communication.
   a. HTTP b. FTP c. HTTPS d. WPA3

3. The band _____ is commonly referred to as millimeter waves.
   a. 1-3 GHz b. 3-30 GHz c. 30-300 GHz d. 300-3000 GHz

4. Among the following, _____ is not a sector of ITU.
   a. ITU-I b. ITU-T c. ITU-R d. ITU-D

5. The main objective of CELL in a cellular mobile communication system is
   a. Handoff b. Frequency reuse c. Power save d. Noise cancellation

6. In cellular mobile communication, _____ is responsible for tracking the location of mobile user.
   a. Base Station Controller b. Mobile Switching Center
   c. Home Location Register d. Visitor Location Register

7. _____ is the organization responsible for developing 5G standard.
   a. IEEE b. ETSI c. ITU d. 3GPP

8. _____ technology is commonly used for delivering SMS.
   a. VoIP b. Circuit switching c. Packet switching d. OTT

9. For the Hata model, the typical range for the base station antenna height is _____
   a. 10-100 meters b. 20-100 meters c. 30-200 meters d. 40-300 meters

10. Wideband PCS microcell model revealed that _____ model is good estimation for path loss in OBS microcell.
    a. Friss free space b. Two ray ground reflection
    c. Log-distance path loss d. Indoor shadowing

11. Typically a building with small amount of metal and hard partition has delay spread upto_____
a. 20 ns b. 60 ns c. 100 ns d. 300 ns

12. Flat fading channel are also known as_____
a. Amplitude varying channel b. Frequency varying channel
c. Time varying channel d. wideband channel

13. _____ technique is applied to combat fading and multipath effects by using multiple antenna elements at the transmitter and receiver ends.
a. Time diversity b. Frequency diversity
c. Space diversity d. Polarization diversity

14. _____ multiple access technique is known for its ability to mitigate the near-far problem.
a. FDMA b. TDMA c. CDMA d. SDMA

15. VoLTE is known for _____ battery life and _____ call set up in comparison to traditional circuit-switched voice calls.
a. low, slow b. high, fast c. high, slow d. low, fast

16. OFDM achieves resistance to ISI _____
a. By using a single carrier with a high symbol rate
b. By spreading the signal across multiple subcarriers
c. By applying forward error correction techniques
d. By using cyclic prefix

17. Spectrum sensing in cognitive radio networks means _____
a. Monitoring spectrum holes b. Creating spectrum holes
c. Filtering spectrum holes d. Regulating spectrum holes

18. Beamforming technique results into _____ interference and _____ coverage.
a. Decreased, decreased b. Increased, decreased
c. Decreased, increased d. Increased, increased

19. In comparison to Bluetooth ZigBee has
a. Higher battery life and Higher data rate
b. Lower battery life and lower data rate
c. Higher battery life and lower data rate
d. Lower battery life and higher data rate

20. _____ Wi-Fi standard is also known as Wi-Fi 6.
a. IEEE 802.11n b. IEEE 802.11ac c. IEEE 802.11ax d. IEEE 802.11ad

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Semester : II
F.M. : 40

SECTION "B"

Attempt ALL questions. Marks are indicated inside brackets. Symbols have their usual meanings. Urgent appropriate assumptions are permissible.

1.
   a. Discuss how improved telecommunications connectivity can enhance national economy in context of Nepal? [3]
   b. What are the fundamental differences between the terms "Radio Wave" and "Microwave" in wireless communication? [2]

2.
   a. What is interference? Discuss the causes of interference in wireless communication systems. [3]
   b. How does 4G achieve higher data rates compared to 3G (discuss any two features only)? [2]

3.
   a. Define free space propagation in the context of wireless communication. How does distance and frequency influence received signal in free space? [2]
   b. Calculate the path loss according to the Okumura-Hata model for a cell of a medium sized city operating at 900 MHz with base station antenna height of 30 meters and receiver antenna height of 2 meters if the distance between base station and receiver is 5 kilometers. [3]

[**Hint**: *select the appropriate correct mobile antenna correction factor from the following*

$$a(h_{re}) = (1.1\log f_c - 0.7)h_{re} - (1.56\log f_c - 0.8)\ dB$$

$$a(h_{re}) = 3.2(\log 11.75h_{re})^2 - 4.97\ dB \quad for\ f_c \geq 300\,MHz$$

$$a(h_{re}) = 8.29(\log 1.54h_{re})^2 - 1.1\ dB \quad for\ f_c \leq 300\,MHz$$

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4.
   a. Explain how SDMA differs from other multiple access techniques such as TDMA, FDMA, and CDMA. [3]
   b. Define smart antenna and explain how they differ from conventional antennas. [2]

5.
   a. What are the factors that you think we need to consider while designing the indoor propagation model and on what measures are they different than the factors that we normally consider in outdoor propagation models? [2]
   b. What role does fading distributions such as Rayleigh and Rician distributions play in modeling the variability of received signal strength in wireless channels? [3]

P.T.O.

6.

a. Explain the principle of Maximal Ratio Combining (MRC) in diversity reception and explain how it utilizes multiple received signals to improve the overall signal-to-noise ratio? [3]

b. Describe the difference between spatial diversity and spatial multiplexing in MIMO. [2]

7.

a. Identify and explain the major challenges associated with the implementation of cognitive radio technology. [3]

b. What aspect of SDR is fundamentally different than traditional radios? [2]

8.

a. Explain the basic principle of Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum (FHSS) techniques. [3]

b. What is the Wi-Fi direct method? [2]