CELLULAR COMMUNICATION
(ECEN 4125)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) What causes co-channel interference in a cellular network?
(a) Adjacent frequencies overlapping
(b) Multiple users sharing the same channel
(c) Equipment malfunction
(d) Weather disturbances

(ii) Which of the following models is suitable for large-scale path loss prediction in free space?
(a) Log-normal shadowing model (b) Two-ray ground model
(c) Free space propagation model (d) Small-scale fading model

(iii) Which random access method results in maximum collisions?
(a) Slotted ALOHA (b) Pure ALOHA
(c) CSMA/CD (d) CSMA/CA

(iv) The BTS is part of which GSM subsystem?
(a) NSS (b) OSS (c) BSS (d) HLR

(v) The main function of GPRS in 2.5G networks is:
(a) Voice communication (b) Circuit-switched video
(c) Packet-switched data (d) Analog data transmission

(vi) Which of the following is a constant envelope modulation technique?
(a) QPSK (b) QAM (c) GMSK (d) OFDM

(vii) In CDMA, the near-far problem arises due to:
(a) Equal signal strengths (b) Delay in handoff
(c) Varying signal power at the receiver (d) Synchronization error

(viii) In WLAN, infrastructure mode means:
(a) No base station is used (b) Devices connect directly
(c) Devices connect via Access Point (d) Only Bluetooth is used

(ix) What is the purpose of tunnelling in Mobile IP?
(a) Security encryption (b) Transmitting broadcast messages
(c) Delivering packets to mobile node (d) Assigning dynamic IP addresses

(x) In MIPv4, which component stores the mobile node's current location?
(a) Foreign Agent (b) Home Agent
(c) Base Station (d) Mobile Gateway

Fill in the blanks with the correct word

(xi) The device responsible for controlling multiple base stations in a cellular network is called a _____.

(xii) The technology used in GSM networks for multiple access is primarily _____.

(xiii) In CSMA/CD, when a collision is detected, each station waits for a random time before _____.

(xiv) A WAN connects devices over a _____ geographical area than a LAN.

(xv) One of the key technologies enabling high data rates in 5G is _____, which uses multiple antennas at both transmitter and receiver.

Group - B

2. (a) Compare the difference between co-channel and adjacent channel interference. *[(CO3)(Remember/LOCQ)]*

(b) Analyse the impact of cell splitting and sectoring on system capacity. *[(CO4)(Analyse/IOCQ)]*

(c) Evaluate any one technique to improve cellular capacity with justification. *[(CO2)(Evaluate/HOCQ)]*

4 + 4 + 4 = 12

3. (a) Define Doppler shift and explain its significance in wireless systems. *[(CO3)(Remember/LOCQ)]*

(b) List and explain the main types of small-scale fading. *[(CO4)(Analyse/IOCQ)]*

(c) Propose a solution to mitigate small-scale fading in high-mobility scenarios. *[(CO2)(Create/HOCQ)]*

4 + 4 + 4 = 12

Group - C

4. (a) Describe the working principle of Spread Spectrum techniques. *[(CO3)(Understand/LOCQ)]*

(b) Discuss the advantages of Space Division Multiple Access (SDMA) in modern wireless systems. *[(CO4)(Apply/IOCQ)]*

(c) Propose a hybrid access scheme combining two techniques to reduce interference and increase throughput. *[(CO2)(Evaluate/HOCQ)]*

4 + 4 + 4 = 12

5. (a) Describe the GSM air interface and frequency bands used. *[(CO3)(Remember/LOCQ)]*

(b) Analyse the logical channel structure of GSM and its functionalities. *[(CO4)(Analyse/IOCQ)]*

(c) Propose an optimised GSM channel allocation strategy for a dense urban area. *[(CO2)(Create/HOCQ)]*

4 + 4 + 4 = 12

Group - D

6. (a) Explain the concept and benefits of spread spectrum modulation in wireless systems. *[(CO3)(Understand/LOCQ)]*

(b) Describe the working of Quadrature Amplitude Modulation (QAM). *[(CO4)(Understand/LOCQ)]*

(c) Analyse how QAM combines amplitude and phase modulation to increase data rate. *[(CO2)(Analyse/IOCQ)]*

4 + 4 + 4 = 12

7. (a) Define and classify the different types of UMTS channels. *[(CO3)(Remember/LOCQ)]*

(b) Explain how UMTS supports both voice and data services through logical channels.? *[(CO4)(Understand/LOCQ)]*

(c) Design a basic channel mapping diagram for a video calling application over UMTS. *[(CO2)(Create/ HOCQ)]*

4 + 4 + 4 = 12

Group - E

8. (a) List and briefly describe the different 802.11x WLAN standards. *[(CO3)(Remember/LOCQ)]*

(b) Explain the system architecture of a typical IEEE 802.11 WLAN.? *[(CO4)(Understand/LOCQ)]*

(c) Compare infrastructure and ad-hoc modes in WLAN with examples. *[(CO2)(Analyse/IOCQ)]*

4 + 4 + 4 = 12

9. (a) List and describe the basic entities involved in Mobile IPv4. *[(CO3)(Remember/LOCQ)]*

(b) Explain the registration process in MIPv4.? *[(CO4)(Understand/LOCQ)]*

(c) Analyze the tunnelling and reverse tunnelling operations in MIPv4. *[(CO2)(Analyse/IOCQ)]*

4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	50	29.16	20.83