WIRELESS AND MOBILE COMMUNICATION
(ECEN 5102)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) AMPS is a cellular system with ____ technology.
(a) 1G (b) 2G (c) 2.5G (d) 3G

(ii) Handsoff is controlled by
(a) PSTN (b) MTSO (c) BSC (d) Cell site.

(iii) Present day mobile service operators in India offer
(a) Voice over LTE (b) Zero latency
(c) Streaming video (d) Firewall.

(iv) In cellular network, a group of channels assigned to a cell
(a) is repeated in the same cluster
(b) is repeated in different clusters in a different manner
(c) is repeated in different clusters in the same manner
(d) varies cell by cell.

(v) The interference between the neighbouring base stations is avoided by _____
(a) Assigning different group of channels
(b) Using transmitters with different power level
(c) Using different antennas
(d) Using different base stations

(vi) Bluetooth can support up to _____ nodes.
(a) 49 (b) 69 (c) 29 (d) 79

(vii) In GSM, the uplink is always lower because
(a) the path-loss is more (b) the path loss is less
(c) mobiles run on battery (d) both (b) and (c).

(viii) Free Space Propagation Model is mathematically represented by
(a) Log distance path model (b) Friis formula
(c) Log normal model (d) Okumura Hata model.

(ix) What is the minimum spectrum allocation required by W-CDMA?
(a) 5 MHz (b) 20 MHz (c) 1.25 MHz (d) 200 kHz.

(x) When we divide band of Orthogonal Frequency Division Multiplexing (OFDM) into sub bands, it diminishes effects of _____
(a) noise (b) collision (c) interference (d) signals absence.

Group - B

2. (a) In mobile communication system, what do you understand by "Generation"? Explain the 2.5G GSM network highlighting its features and applications.
[(CO1) (Remember/LOCQ)]

(b) Explain the frequency reuse concept in cellular communication. How has it helped in proliferation of cellular networks. [(CO2, CO6) (Understand/IOCQ)]

(2 + 4) + 6 = 12

3. (a) "Cellular communication increases spectral efficiency, but spectral efficiency also depends upon the cluster size". Justify the statement. [[CO1,CO2], Analyze/IOCQ]]

(b) With suitable diagram explain the process of Hard Hand Off in cellular system?
[[CO1,CO2] Analyze/IOCQ]

(c) How the co channel interference is reduced by suitable placement of sectored antenna in a centre excited cell strategy? Explain with 60 degree sectoring diagram.
[[CO1, CO2] Evaluate / HOCQ]]

4 + 3 + 5 = 12

Group - C

4. (a) What are the specific properties of CDMA that have made this scheme very useful? What is IMT 2000? [(CO3,CO6) (Analyze/IOCQ)]

(b) What are the various functional groups in GPRS as per the required functions?
[(CO3) (Remember/LOCQ)]

(5 + 3) + 4 = 12

5. (a) In a GSM system with a 25-MHz forward link, there are 200 kHz radio channels allocated for voice communication using TDMA/FDD, and each channel can support 8 simultaneous speech channels each with a time slot of 0.577 ms. (i) What are the total numbers of users that can be supported? (ii) What is the duration of a frame? (iii) What is the time gap between two successive transmissions for a particular user? [[CO3, CO6] Evaluate/HOCQ]]

(b) Discuss how spectrum allocation is done in a GSM cellular system.
[CO3,CO6] Analyze/IOCQ]

(c) How is a call routed to a GSM mobile? [CO3,CO6] Analyze/IOCQ]

4 + 4 + 4 = 12

Group - D

6. (a) (i) State and explain Friss equation for RF propagation. Why does this model fail in urban areas?

(ii) Why have so many RF propagation models like Okumura, Hata etc. been devised? [(CO4)(Remember/LOCQ), Analyze/IOCQ]

(b) Assume that a receiver is located at a distance of 1 km from a 5 W transmitter. The carrier frequency is 1800 MHz and free space propagation is applied. Determine (i) the power at the receiver (ii) the magnitude of the E-field at receiver antenna (iii) the rms voltage applied to the receiver input. (Consider the receiver antenna to be purely resistive with an impedance of 50 ohms and to be matched to the receiver circuit. $G_t = 1$ and $G_r = 2$). [(CO2) (Evaluate/HOCQ)]

(3 + 1 + 2) + (2 + 2 + 2) = 12

7. (a) What are the advantages in spread spectrum technology? [CO1,CO2] Remember/LOCQ]

(b) Write down the features of Bluetooth. What are the major differences between Wi-Fi and WiMAX systems? [CO1,CO4] Remember/LOCQ]

(c) Explain and draw the network architecture of IEEE802.11. [CO1,CO4] Analyze/IOCQ]

3 + (2 + 2) + 5 = 12

Group - E

8. (a) What are the main functional entities for Mobile IP? Explain with suitable diagram. [CO1,CO5] Analyze/IOCQ]

(b) What is triangular routing in mobile IPv4 wireless networks? [CO4,CO6] Analyze/IOCQ]

(c) How agent discovery and registration are performed in MIPv4 (explain with the help of suitable diagram)? [CO4,CO6] Analyze/IOCQ]

4 + 4 + 4 = 12

9. (a) Why are Ad Hoc networks called so? Compare reactive and pro-active routings. [(CO5) (Remember/LOCQ)]

(b) How are route establishment and route discovery performed in DSDV protocol? [(CO5)(Analyze/IOCQ]

(b) Describe some approaches to reduce power consumption in Ad Hoc network nodes. [(CO1,CO6) (Understand/LOCQ)]

(2 + 2 + 4) + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	26.04	53.13	20.83

Course Outcome (CO):

After the completion of the course students will be able to

1. The students will understand the challenges of wireless and mobile communication.
2. They will be able to analyse the factors like fading, SNR.

3. The students should be able to explain the working of a cellular system- both GSM and CDMA.
4. They will have knowledge about protocols like TCP/IP.
5. The students will be able to apply suitable routing for a transfer.
6. They will be able to analyse performance of cellular and other wireless networks

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.