WIRELESS AND MOBILE COMMUNICATION
(ECEN 5102)

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

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
<u>any 4 (four)</u> from Group B to E, taking <u>one</u> 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)   Frequency reuse strategy is used
(a) for limited availability of spectrum   (b) limited geographical area
(c) to employ frequency hopping   (d) all of these.

(ii)   AMPS stands for
(a) Advanced Multiple Paging System   (b) Advanced Mobile Phone System
(c) Advanced Mobile Phone Service   (d) Associated Mobile Phone Service.

(iii)   Roaming in a mobile network is supported by
(a) AUC   (b) VLR
(c) MS   (d) None of these.

(iv)   CDMA uses the entire bandwidth of
(a) 1.25 GHz   (b) 125 kHz   (c) 1.25 MHz   (d) 1.25 kHz.

(v)   In GSM system, the same set of frequencies can be shared by
(a) an adjoining cell of same cluster
(b) same cell number of an adjoining cluster
(c) any cell of an adjoining cluster
(d) any random cell.

(vi)   IEEE 802.11 sets the standard for
(a) LAN   (b) LAN Security
(b) Bluetooth   (d) PAN.

(vii)   In DSDV routing table, the 'distance' representation is in
(a) Metres   (b) Feet
(c) Kms   (d) Number of hops

(viii)   In a GSM network, the unit that facilitates roaming is called
(a) HLR   (b) EIR   (c) AuC   (d) VLR.

(ix)   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).

(x)   Which of the following multiple access techniques are used by second generation cellular systems?
(a) FDMA/FDD and TDMA/FDD   (b) TDMA/FDD and CDMA/FDD
(c) FDMA/FDD and CDMA/FDD   (d) FDMA/FDD only.

Fill in the blanks with the correct word

(xii)   Bluetooth can support upto _____ nodes.

(xii)   If a normal GSM time slot consists of 6 training bits, 8.25 guard bits, 26 training bits and 2 traffic bursts of 58 bits of data, the frame efficiency is _____ %.

(xiii) The minimum spectrum allocation required by W-CDMA for _____.

(xiv)   Allocation of specific channels to a cell is known as _____.

(xv)   In addition to GSM circuit switched network, two new nodes, named as, _____ and _____ are introduced in GPRS to handle packet switching.

Group - B

2. (a)   Explain why hexagonal geometry is chosen for ideal cell structure in cellular network design.   *[(CO1,CO2)(Analyze/IOCQ)]*
    (b)   Define the term "co channel reuse ratio" with a suitable diagram and explain how the co channel cells are selected.   *[(CO1,CO2)(Understand/LOCQ)]*
    (c)   What is the purpose of "handoff" in a cellular network? Design two cellular networks with "hard" & "soft" handoff and comments on the merits and demerits of both schemes.   *[(CO1,CO2)(Analyze/IOCQ)]*

2 + 4 + (3 + 3) = 12

3. (a)   Establish the relationship K = (i^2+j^2+ij), where the notations have their usual meanings and K is the number of cells in a cluster.   *[(CO1)(Analyse/IOCQ)]*
    (b)   If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (i) four-cell reuse, (ii) seven-cell reuse, and (iii) 12-cell reuse. If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell for each of the three systems.   *[(CO1)(Evaluate/HOCQ)]*

6 + 6 = 12

Group - C

4. (a)   Draw the block diagram to explain the design of GSM architecture. What is the significance of MSC in GSM architecture?   *[(CO3)(Remember/LOCQ)]*

(b)   How can call be routed to a mobile subscriber from BTS in GSM network?

[(CO3)(Apply/IOCQ)]

(c)   What are the features of CDMA based IS 95 system? Explain the forward link of CDMA based IS-95 system.   *[(CO3)(Remember/LOCQ)]*

(3 + 2) + 3 + 4 = 12

5. (a)   Explain the role of GGSN in GPRS network.   *[(CO3)(Remember/LOCQ)]*

    (b)   Why is handoff in CDMA called soft one? Explain the soft handoff process in CDMA.   *[(CO3,CO6) (Apply/IOCQ)]*

    (c)   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?   *[(CO1,CO3)(Evaluate/HOCQ)]*

2 + 6 + 4 = 12

Group - D

6. (a)   State and explain Friis' equation for RF propagation. Why does this model fail in urban areas? How does Shadowing model work? Why so many RF propagation models like Okumura, Hata etc. been devised?   *[(CO3)(Analyse/HOCQ)]*

    (b)   Assume a receiver is located at 1 Km from a 5W transmitter. The carrier frequency is 1800 MHz and free space propagation is applied. Determine (i) the power at the receiver (ii) the magnitude of each field at the 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,CO3)(Apply/IOCQ)]*

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

7. (a)   What is near far problem in CDMA network? How can it be minimized?

[(CO3,CO6)(Analyze/IOCQ)]

    (b)   Describe the WLAN architecture and its components.   *[(CO4)(Remember/LOCQ)]*

    (c)   Why is CSMA/CD not suitable for wireless networks? Describe four features of an WiMAX system.   *[(CO4,CO6)(Apply/IOCQ)]*

4 + 4 + (2 + 2) = 12

Group - E

8. (a)   Explain the concept of care of address in a mobile IP network. What are the 4 basic entities of MIPv4?   *[(CO4)(Remember/LOCQ)]*

    (b)   What is snooping TCP? Explain the operation with a schematic diagram.

[(CO4)(Analysis/IOCQ)]

(3 + 3) + 6 = 12

9. (a)   List some of the characteristics of a routing protocol for ad hoc wireless networks.   *[(CO5) (Remember/LOCQ)]*

(b) Create a wireless ad hoc networks design with the principle of destination sequenced distance vector routing protocol with diagrammatic illustrations.

[(CO5)(Create/HOCQ)]

(c) Why does TCP not perform well in Adhoc wireless networks?

[(CO5, CO6)(Apply/IOCQ)]

3 + 6 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	29.17	46.87	23.96

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.