

MOBILE COMPUTING
(CSEN 4232)

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) Which of the following is true regarding capacity enhancement of cellular networks?
(a) Cell splitting increases transmission power requirement
(b) Directional antennas are employed in cell sectoring
(c) In Microcell zone concept, handoff means a new channel reassignment to an ongoing call when different zones are traversed
(d) Microcell zones can increase interference especially near the boundaries of zones.
- (ii) Guard band is
(a) the small unused bandwidth between the frequency channels to avoid interference
(b) the bandwidth allotted to the signal
(c) the channel spectrum
(d) the spectrum acquired by the noise between the signal.
- (iii) The advantages of FDMA over TDMA includes
1. Division is simpler
2. Propagation delays are eliminated
3. Cheaper filters with less complicated logic functions
4. Linearity
(a) (1), (2) and (3) are correct
(b) (1) and (2) are correct
(c) (1) and (4) are correct
(d) All four are correct.
- (iv) The problem of a station not being able to detect a potential competitor for the medium because it thinks that there is activity between them is called _____
(a) Exposed Station Problem
(b) Collision Avoidance Problem
(c) Hidden Station Problem
(d) Access Grant Problem.
- (v) Which one gives the least amount of encapsulation overhead for Mobile IP?
(a) IP In IP
(b) Minimal
(c) GRE
(d) They are all same.
- (vi) The early FM push-to-talk telephone systems were used in
(a) simplex mode
(b) half duplex mode
(c) full duplex mode
(d) none of the above.

- (vii) A certain routing protocol uses Distance Vector protocol to create a routing table per node for each destination. It however only exchanges routing table information with its neighbours when there is some demand for route exists. Which kind of routing protocol is this?
 (a) Hybrid (b) Proactive (c) Reactive (d) Zonal.
- (viii) Which of the following is true about mobility enhancement to TCP?
 (a) I-TCP requires ACKS be sent between a Mobile Node and the Correspondent Node only
 (b) S-TCP requires buffering only for the traffic directed to the Mobile Node at the Foreign Agent
 (c) S-TCP eliminates need for end to end ACK
 (d) No mobility enhancement is needed for TCP to operate properly in a wireless environment.
- (ix) TDMA is a multiple access technique that has
 (a) different users in different time slots
 (b) each user is assigned unique frequency slots
 (c) each user is assigned a unique code sequence
 (d) each signal is modulated with frequency modulation technique.
- (x) OFDM is a technique of
 1. encoding digital data 2. multiple carrier frequencies
 3. wide band digital communication 4. 4G mobile communication
 (a) 1, 2 and 3 are correct (b) 2 and 3 are correct
 (c) 1, 2 and 4 are correct (d) All the four correct.

Group - B

2. (a) In a cellular system, the co-channel constraint is 2 and adjacent channel constraint is 1. Each cell is assigned two channels. There are four cells in this cellular system, arranged in such a manner that each cell is adjacent to two cells and not to the third cell.

[So if you arrange the cells alphabetically, and call these A,B,C,D, then A is adjacent to B,D; B is adjacent to C,A; etc.]

Design a feasible channel assignment of these four cells.

[[CO1](Apply/IOCQ)]

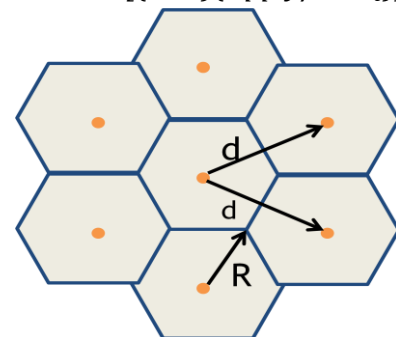
- (b) Prove that

(i) $d = \sqrt{3}R$ (d and R are as shown in the figure).

(ii) Express area of a hexagonal cell in terms of R.

Please assume same prerequisites as in case of any cellular networks.

[[CO1](Apply/HOCQ)]



- (c) Assume a cluster of N hexagonal cells arranged in a larger (almost) hexagonal structure. The value of N is given by (approximately) the following equation:

$$N = i^2 + i*j + j^2$$

(i) Explain the significance of the parameters 'i' and 'j'.

(ii) Tabulate 'i', 'j' for K = 7 and K = 12.

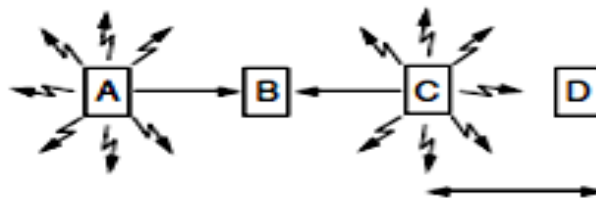
[[CO1](Analyze/IOCQ)]

$$4 + 4 + (2 + 2) = 12$$

3. (a) What is a pn-sequence? Name an algorithm to generate pn-sequences and apply it to generate pn-sequences for 8 nodes. [[CO1](Apply/IOCQ)]
- (b) Draw and explain the GPRS architecture. What are the advancements of GPRS over GSM network? [[CO2](Remember/LOCQ)]
- (2 + 1 + 3) + 6 = 12**

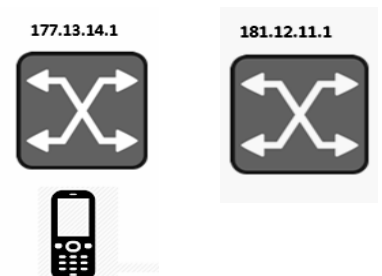
Group - C

4. (a) Explain how various inter frame spacing (IFS) times present in the WLAN protocol help resolve collision in the WLAN MAC layer. [[CO3](Understand/IOCQ)]
- (b) (i) Suppose A is transmitting to B. How can you ensure a concurrent transmission from C cannot garble up the communication between A and B?
- (ii) Now B is transmitting to A. Can a transmission from D to C happen at the same time? You may assume the existence of CSMA/CA protocol. [[CO3](Analyze/IOCQ)]



- (c) Why does the Mobile IP protocol rely so heavily on the Encapsulation process? What is the significance of the names given to the three different types of encapsulation in Mobile IP protocol? [[CO4](Remember/LOCQ)]
- 4 + (2 + 2) + (2 + 2) = 12**

5. (a) In the figure, the mobile node has the HA as the device with IP 177.13.14.1. It moves to a foreign network where the FA is with IP address 181.12.11.1. Show the sequence of messages which flows back and forth when another node wants to communicate with the mobile node. [[CO4](Apply/IOCQ)]



- (b) Compare behaviour in the following scenarios among the three protocols I-TCP/S-TCP/M-TCP:
- (i) Buffering of packets at FA
- (ii) End to end connection management between CN, FA and MN
- (iii) Data retransmission between FA and MN, between FA and CN and between MN and CN (MN, FA, CN have their usual meanings). [[CO4](Remember/LOCQ)]
- (c) Describe the difference in behaviour of the above three mobile TCP protocols when there is a handoff with undelivered/in-flight packets in the FA. [[CO4](Understand/IOCQ)]
- 4 + (3 × 2) + 2 = 12**

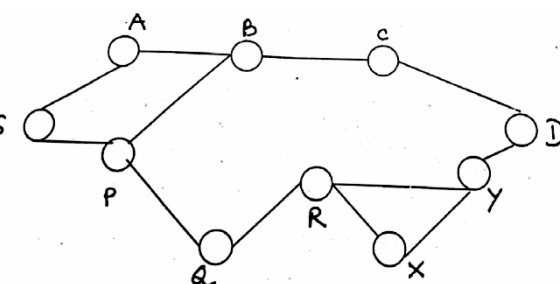
Group - D

6. (a) Draw and explain the functionality of each layer of the WAP protocol stack. [[CO6](Remember/LOCQ)]
- (b) What do you understand by the count to infinity problem? How can we overcome them? [[CO5](Apply/IOCQ)]
- (c) State the differences between static and dynamic routing. [[CO5](Remember/LOCQ)]
- 6 + (2+2) + 2 = 12**

7. (a) Consider above network and the following situations.

Case 1: S wants to send traffic to D for the first time. Show how the routing takes place using the DSR protocol.

Case 2: After some time, P wants to send traffic to D. Show how DSR caching can improve the routing performance in this case. You may assume the link cost between any two nodes is a fixed value (say 1).



[[CO5](Understand/LOCQ)]

(b) Now assume the node C gets away from D and is now attached to P, B, Q and R.

(i) Draw the modified network.

(ii) Repeat the route computation in two cases above, assuming enough time elapsed so that all DSR caches were invalidated in the meantime.

(iii) Now assuming route caches so built earlier were still active, what are the nodes that will be mostly playing important roles in reducing route calculation via caching?

[[CO5](Apply/HOCQ)]

(c) Comment on the advantages and disadvantages of using DSDV in place using DSR in the above networks.

[[CO5](Analyze/LOCQ)]

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

Group - E

8. (a) What is MIMO? How easy it is to deploy MIMO antennas on the current infrastructure?

[[CO3](Analyze/IOCQ)]

(b) What are the components present in a sensor device?

[[CO1](Remember/LOCQ)]

(c) What do you understand by the term "Vertical Handover"? When does it occur?

[[CO3](Remember/LOCQ)]

(d) State the advancements of 5G over the 4G network.

[[CO2](Remember/IOCQ)]

(2 + 2) + 2 + 4 + 2 = 12

9. (a) What are the concepts of Control Plane and Data Plane? How does SDN separate the two?

[[CO1](Remember/LOCQ)]

(b) What is Cognitive Radio (CR)? What are the modes of operation of Overlay and Underlay types of CR?

[[CO1](Understand/LOCQ)]

(c) Mention a few advantages of WSN. What are reactive and proactive WSNs? What is Dynamic Channel Allocation policy in WSN?

[[CO1](Remember/IOCQ)]

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

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	44.80	44.80	10.40

Course Outcome (CO):

After the completion of the course students will be able to

CO1: To Learn the wireless and mobile networking fundamentals.

CO2: To learn the evolution of different generations of mobile networks.

CO3: To analyze different inter-networking challenges and solutions in mobile wireless networks.

CO4: To analyze the modifications necessary in normal IP and TCP protocols to make them mobility enabled.

CO5: To understand the basics of MANET, WAN, LAN and PAN.

CO6: To learn WAP basics.

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