MOBILE COMPUTING
(CSEN 4232)

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) 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

(ii) WLANs use which of the following frequency band?
(a) 900 MHz (b) 1800 MHz (c) 2.4 MHz (d) 2.4 GHz.

(iii) In MIMO, which factor has the greatest influence on data rates?
(a) The size of antenna (b) The height of the antenna
(c) The number of transmit antennas (d) The area of receive antennas.

(iv) 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.

(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 method of transporting mobile stations from any given base station to another one is known as
(a) MIN (b) Handoff or handover
(c) Forward channel (d) None of (a), (b) & (c)

(vii) Which access method is used by DCF in IEEE 802.11?
(a) CSMA/CA (b) CSMA/CD
(c) ALOHA (d) None of (a), (b) & (c).

(viii) Bluetooth is the wireless technology for
(a) Local area network (b) Personal area network
(c) Metropolitan area network (d) Wide area network

(ix) Why neighbouring base stations are assigned different group of channels in cellular system?
(a) To minimize interference (b) To minimize area
(c) To maximize throughput (d) To maximize capacity of each cell.

(x) 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.

Fill in the blanks with the correct word

(xi) WAP is a protocol designed for _____.

(xii) In WML, the tag which is used for line breaking is _____.

(xiii) _____ is the IFS used when two WLAN stations are in a dialog exchange.

(xiv) Time slot duration used in Bluetooth for FH_TDD is _____ msec.

(xv) In a _____ channel assignment strategy, each cell is assigned a predetermined set of frequencies.

Group - B

2. (a) Draw the architecture diagram of a Cellular system and briefly explain the functions of its various components.
[(CO2)(Remember/LOCQ)]

(b) What are the different methods adopted by network engineers to increase the capacity of a cellular network?

[(CO1,CO2)(Apply/IOCQ)]

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

[(CO1)(Analyze/IOCQ)]

4 + 4 + (2 + 2) = 12

3. (a) What are the advancements of

(i) The GSM Technology over the AMPS technology

(ii) The GPRS technology over the GSM technology

(iii) The UMTS technology over the GPRS technology

[(CO2)(Remember/LOCQ)]

(b) Briefly mention a few characteristics of the 4G/LTE protocol. *[(CO2)(Understand/LOCQ)]*

(c) Distinguish between Soft Handoff and Hard Handoff strategies. *[(CO1)(Analyse/IOCQ)]*

(2 + 2 + 2) + 3 + 3 = 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)

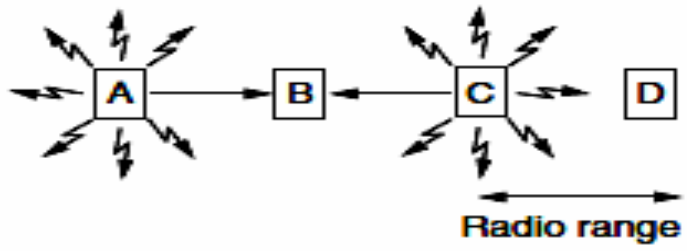

Fig. 1

(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)

Fig. 2

In the above 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. *[(CO3/CO4)(Analyze/IOCQ)]*

(b) Explain with a diagram what happens to source and destination address fields of an IP packet undergoing encapsulation and de-encapsulation stages. *[(CO3/CO4)(Remember/LOCQ)]*

(c) Describe the difference in behaviour of the three mobile TCP protocols when there is a handoff with undelivered / in-flight packets in the FA. *[(CO4)(Understand/IOCQ)]*

5 + 4 + 3 = 12

Group - D

6. (a) List the advantages and disadvantages of AODV routing protocols. Briefly explain the concept of ZRP. *[(CO5)(Understand/LOCQ)]*

(b) Discuss the challenges and issues in implementing MANETs. *[(CO3,CO5)(Remember/IOCQ)]*

(c) What is WAP? How does WAP gateway work between a client and web server? *[(CO5)(Understand/HOCQ)]*

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

7. (a)

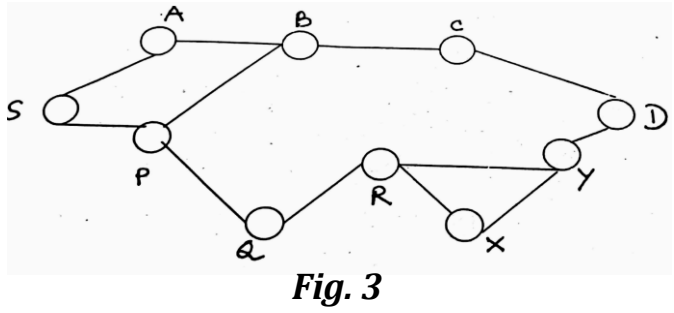

Fig. 3

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) Answer the following questions on 5G in each case by a single sentence or two:
(i) What is Spatial Multiplexing?
(ii) How can radiated energy efficiency be improved in Massive MIMO? *[(CO1,CO2)(Remember/IOCQ)]*

(b) Point out a frequency band supporting Millimeter wave technology. How can absorption loss of MM wave be used to the advantage of 5G call quality? *[(CO1,CO2)(Remember/IOCQ)]*

(c) Contrast the nature of interference in 5G cells (esp. around the cell boundaries) with earlier generation cells. How can MRC and ZF help in solving some of these interference issues in 5G? *[(CO1,CO2)(Remember/IOCQ)]*

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

9. (a) Draw the 4-stage IoT architecture and explain the different layers. *[(CO1)(Understand/LOCQ)]*

(b) What are the major differences between ad hoc wireless networks and sensor networks? Explain the advantages of a clustered architecture over a layered architecture in a sensor network? *[(CO5)(Analyze/IOCQ)]*

(c) How does cooperative spectrum sensing differ from non-cooperative spectrum sensing in cognitive radio? *[(CO1)(Analyze/IOCQ)]*

4 + (3 + 3) + 2 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	36.5	53.3	10.2

Course Outcome (CO):

After the completion of the course students will be able to
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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.*