Computer Science and Engineering Department, S V N I T, Surat.
End-Semester Examinations, May 2022
M Tech I (CO), 2nd Semester
Course: (CO602) Wireless Network and Mobile Computing

Dated: 2 May 2022 Time: 12:00 hrs to 15:00 hrs Marks: 50

Instructions:

- **Please start** the answer to **each question on new page ONLY** of your answer sheets.
- Please write your correct exam no without fail on the answer sheets as well as the question papers.
- Please be brief and to-the-point in the attempting the answers to the theory questions. Unnecessary and unjustified elaboration will not fetch more marks.
- Bloom's Taxonomy level and Course outcome mapping – Understanding – CO1, Apply – CO2, Analysis – CO3, Evaluate – CO4 and Design – CO5

Q.1 Explain the Carrier Sense Multiple Access with (a) collision detection (b) collision avoidance (c) exposed terminal (d) hidden terminal. For ad hoc network, describe the MACAW – MAC level protocol with different scenarios of transmitter- receiver positions in the field and how the different control signals ensure the proper functioning each scenario. [5] CO1 (H)

Q.2 For multi user detection, (i) formulate the generalized received signal r(t) in presence of different communication technology TDMA, FDMA and CDMA along with interference and ambient noise, (ii) derive the solution for estimating user wise message bit using maximum likelihood approach, (iii) extend the solution of (ii) using maximum a posterior approach. [5] CO1 (H) CO5 (H)

Q.3 For localization in wireless sensor network, (i) explain the basic coarse location estimation techniques in brief, (ii) explain the concept of Multi-Dimensional Scaling (MDS) technique and (iii) derive the necessary expression for location estimation based on Eigen vector analysis. [5] CO1 (H) CO2 (M)

Q.4 Consider a PCS system where the physical size, traffic load, and speed of mobile movement are as follows: [5] CO2 (H) CO3 (M) CO4 (M)

Hexagonal cell radius = 0.4 km
Number of cells per cluster = 30
Mobile speed = 20 km/hr
Percentage of subscribers in the coverage area that are active = 10%
Percentage of mobile stations that are powered on = 60%
Traffic load per mobile station = 0.06 Erlangs

(i) Assume a mobility model in which the mobiles are distributed uniformly in a cell and the direction of mobile movement relative to the boundary of a cell or a cluster is uniformly distributed on $[0,2\pi]$. For the traffic conditions specified in the problem, the resultant rate of boundary crossing is 28.64 crossing/cell/second. Determine the population density of subscribers per cell.

(ii) Assuming the cluster shape is approximated by a hexagon, determine the number of boundary crossings/cluster/second.

(iii) Determine the number of intracluster handoffs per hour and the number of intercluster handoffs per hour.

(iv) Determine the number of location updates per hour in the cluster.

Q.5 A cellular system has a total of 500 duplex voice channels (without frequency reuse). The service area is divided into 150 cells. The required signal-to-cochannel interference ratio is 18 dB. Consider the path loss exponent κ equal to 3, 4, and 5, respectively. Based on the formulas $q = \sqrt{(3N)}$ and $q = (6 \times S/I)^{1/\kappa}$, for each value of κ determine the following. [5] CO2 (H) CO3 (M) CO4 (M)

(i) the cell cluster size

(ii) the number of cell clusters in the service area

(iii) the maximum number of users in service at any instant

Comments of the results derived for the given cellular system in terms of its capacity.

Q.6 Consider a cellular system with a total bandwidth of 30 MHz. Each full duplex voice or control channel uses two 25 kHz simplex channels. It is assumed that (1) the system uses a 9-cell reuse pattern and 0.75 MHz of the total bandwidth is allocated for control channels; (2) the system service area consists of 50 cells; (3) the call blocking probability bound is 2%, as given by the Erlang-B formula. If the offered traffic per user is 0.025 Erlangs, calculate [5] CO2 (H) CO3 (M) CO4 (M)

(i) the traffic load of each cell and the trunking efficiency,

(ii) the total number of users in each cell and in the system, respectively,

(iii) the number of mobile users per channel in each cell and in the system, respectively, and

(iv) the maximum number of users in service at any instant in the system.

Trunking efficiency is defined as the carried traffic intensity in Erlangs per channel.

Q.7 Answer the following with respect to Multi-Input Multi-Output (MIMO) system. Explain the following: Receiver Diversity, Transmit Diversity, Spatial Diversity. Derive the channel capacity of MIMO system using Equivalent system representation with necessary expression. [5] CO1 (H) CO2 (H) CO3 (M)

Q.8 Why is Mobile IP packet required to be forwarded through a tunnel? Explain IP-in -IP technique of encapsulation? How is minimal encapsulation different from IP-in-IP technique of encapsulation? [5] CO1 (H) CO3 (M)

Q.9 a. Explain the mechanisms of TCP that influence the efficiency in mobile environment? [5] CO1 (H)

b. How do the TCP packets transfer from a mobile node to the receiver node in snooping TCP? What is the role of foreign agent in snooping TCP? List the advantages and disadvantages of snooping TCP. CO2 (M)

Q.10 a. Explain the different types of synchronization and state the application of each. [5]

b. Explain Client-Server computing with adaption. CO1 (H)