Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech(CSE)/SEM-2/CSTE-22/2013

2013

MOBILE NETWORKING AND COMPUTING-II

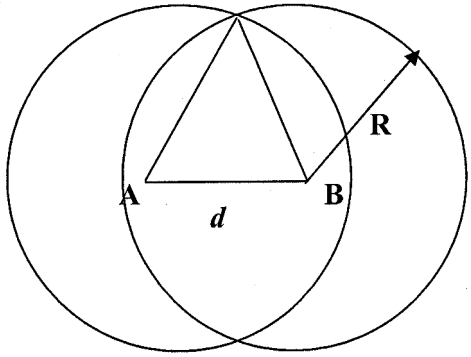
Time Allotted : 3 Hours *Full Marks :* 70

The figures in the margin indicate full marks.

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

Question No. 1 is compulsory and answer any *four* from the rest.

1. Consider the following figure. Transmission is going on between nodes *A* and *B* that are separated by a distance *d*. *R* is the transmission range of each node. Mark in the figure the regions that could contain the hidden and the exposed terminals. Also calculate the area of each region. 10



2. a) Amaresh sits in his car and listens to radio F.M. He has to stop at a red light. Right at the stop, the quality of the music becomes very poor. When he goes back 1 meter, the music is fine again. Give different explanations for this phenomenon. Cal these phenomena also happen with acoustic voices (around 1000 Hz) ? Explain. 3 + 2

b) Describe the main differences and similarities between the original IEEE 802.11 and IEEE.802.11b standards in terms of physical layer characteristics. 5

c) Describe how a station gets connected to an IEEE 802.11 wireless LAN when it first powered up and how the power-saving mode works in an IEEE 802.11 device. 5

3. a) A QPSK/DSSS WLAN is designed to transmit in the 902-828 MHz ISM band. The symbol transmission rate is 0·5 Mega symbols/sec. An orthogonal code with 16 symbols WLAN ? A sector antenna with a gain of 2·6 is used. Assume interference factor β = 0·5 to account for the interference from users in other cells and power control efficiency α = 0·9. What is the bandwidth efficiency ? 8

b) What do you mean by hidden terminal problem in adhoc network ? Suggest method to improve it. 7

4. a) Consider a 802.11 BSS with three stations (STA_1 to STA_2) all within range of each other and operating in DCF mode . Data frames of various sizes arrive for transmission at the respective MAC layers as follows :

Time	MSDU (Data bytes)	Source	Destination
t = 0	500	STA_1	STA_3
t + 120 μs	1400	STA_2	STA_1
t + 250 μs	500	STA_3	STA_2

Compute the earliest time by which all the frames can be delivered to the destinations. Assume : Slot_time = 20 μs, SIFS_time=10 μs, Fragmentation_threshold=2400 bytes, RTS_threshold=1200 bytes, RTS_size =

ACK_size=100 bytes, 200 bytes may be transmitted in one Slot Time. 8

b) What are the factors affecting TCP Performance in MANET ? Explain why TCP performance typically degrades when caches are used for route repair. 7

5. a) Consider and IEEE 802.11a WLAN system in which OFDM baseband modulation scheme is used. The OFDM system has 52 subcarriers out of which 4 subcarriers are used as pilot subcarriers and the remaining as data subcarries. OFDM symbol duration including guard interval for ISI mitigation is 4 μs. If the system uses $\frac{3}{4}$ FEC code rate and 64-QAM carrier modulation scheme, then show that the achievable transmission data rate is 54 Mbps. 8

b) Describe the main differences between the IEEE 802.11a and IEEE 802.11b wireless LANs and explain why the devices of the two standards cannot work together. 7

6. a) You have studied different models for wireless sensor networks. You are asked to model the connectivity of two different sensor networks. The first sensor network is used by a farmer in the paddy fields of Bengal to monitor his cattle; the second network is located inside and office building. Which model would you recommend and why ? 4

b) Consider the following nodes in the 2-dimensional Euclidean plane :

$V = \{v_1 = (1, 2), v_2 = (2,1), v_3 = (2,3), v_4 = (3,2), v_5 = (5, 5), v_6 = (2, 4), v_7 = (2,5)\}$. The connectivity of the nodes be as follows :

$E = \{ \{v_1, v_2\}, \{v_1, v_3\}, \{v_1, v_4\}, \{v_2, v_3\},$

$\{v_2, v_4\}, \{v_3, v_4\}, \{v_2, v_5\}, \{v_4, v_5\}, \{v_5, v_6\}, \{v_5, v_7\}, \{v_6, v_7\}$ }. Can this graph G be modeled as a Unit Disk Graph ? Prove your answer. 4

c) How does an adhoc network differ from a cellular network, like GSM ? Mention the advantages of adhoc network over GSM network. 7

7. a) Estimate the number of mobile users that can be supported by a CDMA system using an RF bandwidth of 1·25 MHz to transmit data at 9·6 kbps. Assume E_b / N_0 = 6 dB, frequency reuse efficiency is 0·45, bandwidth efficiency factor is 0·9 and efficiency of sector-antenna in cell is 1. Suppose the voice activity factor for t he talk spurts is 60% and the power control accuracy is 80%, what is the number of mobile users that can now be supported ? 8

b) "Flooding is a robust protocol to make path discovery in an adhoc network." Do you agree with this statement ? Justify your answer. 7

8. a) Given six nodes placed in a string topology $I_0 - I_1 - I_2 - I_3 - I_4 - I_5$. Node I_n has data for node I_{n+1}, n = [0 ....4]. Suppose RTS, CTS and ACK packets take 1 unit of time and DATA packets take 5 units of time. Calculate the time required to complete the data transfer. 8

b) Calculate the probability of data packet collision in the MACA protocol. Assume that T_c is the control packet transmission and propagation delay, T_w is the optimal maximum back-off time, β is the percentage of ready nodes, and R is the transmission range of each node. 7