Birla Institute of Technology & Science, Pilani, Rajasthan

Second Semester 2017-2018

Comprehensive Exam. **Course no: EEE G 592**
Date: 03-05- 2018 **M.M.: 80**
Course title: Mobile & Personal Communication **Weightage: 40%**

(Part A+ PartB)

Part A (Closed Book) **Marks: 40** **Weightage: 20%** **Duration: 80 minutes (Tentative)**

Q.1: In a hexagonal cellular planning co-channel antenna location is set by i=j=2 with a cell radius of 4 km. Total spectrum bandwidth available is 24MHz in 900 MHz band including 2% for the control channels and allowed S/I as 16 dB. Mobile operator uses FDD for single channel BW as 30 KHz with 1% GOS assuming average individual load as 0.01 Erlang with each base station having P_0 as 1 W at d_0 of 10m.Find

(i) mobile users / cell and average user call duration if average call / hour is 0.2.

(ii) total number of users in the city having area 2000 km^2 .

(iii) co- channel antenna separation and average path loss exponent in the coverage region.

(iv) Minimum acceptable power at the cell boundary and also threshold power to initiate hand off if a mobile user moving with 72 km/hr speed radially away from BS to cross the cell and needs 20 seconds for handoff processing time.

(v) Average fade duration and zero level crossing rate due to small scale fading if measured voltage envelope is 8 dB below to rms voltage received at a point for the mover in case (iv).

(5x3)

Q.2: Explain frequency and time diversity scheme with one specific example for each case. How does space antenna diversity at BS get affected by decreasing the antenna height without changing antenna separation, discuss in brief?

(6)

Q.3: Compare TDMA and CDMA system capacity with a specific example assuming available bandwidth is 1.23 MHz and also comment on a statement that CDMA system is interference limited while FDMA and TDMA are bandwidth limited with justification. Discuss in brief some techniques to enhance capacity of a CDMA system and comment on the capacity in case of multiple cells CDMA system.

(6)

Q.4 Explain in brief GSM architecture with their salient features. How this has developed to a third Generation cellular system, discuss in brief? Discuss IS-95 standard and also its evolution to third Generation.

(6)

Q.5 Compare FDMA and TDMA schemes on the basis of at least four distinct points. Predict the overhead bits per slot for a 200 kbps using 0.5 ms time slot with frame efficiency of 80%. In this system mobile user may move radially away at 144kmph and may hold the talk for 3 minutes, find the number of guard bits required between two time slots and also the distance travelled to ensure channel time invariant.

(7)

Capacity of an Erlang B System

Number of channels	GOS .01	GOS 0.1
5	1.36	1.80
10	4.46	7.82
20	12.00	16.80
24	15.3	19.42
30	20.4	25.2
40	29.0	36.46

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Date: 03-05- 2018 **M.M.: 80**
Course title: Mobile Personal Communication **Weightage: 40%**

Name: **ID No:**

Part B (Open Book) **Marks: 40** **Weightage: 20%** **Duration: 90 minutes (Tentative)**

Note: Fill in the blank or strike out the wrong words as per the case. Q.1 and 2 carries 2 marks and other are of 3 marks each.

Q1: A mobile receiver finds an obstruction in the middle of a base station 4 km away and observes 6 dB diffraction losses at 900 MHz. The receiver moves 1 km towards BS (h_t = 40m) and now finds diffraction parameter (v) and diffraction loss would be ----------and ----------respectively.

Q2: In concentric CDMA cellular model one has to estimate the frequency reuse factor contribution from the interferers kept around 6R. The weight factor for inner and outer subsection of that layer would be ----------and ----------respectively so that the number of customers in those region would be same.

Q3: A wireless LAN 802.11 DS packet with dwell duration of 5 ms interferes Bluetooth packet having packet duration of 625 μs. If WLAN contains 4000bytes of data working at 4Mbps, then packet error rate would be ------. ----------This PER would become ----------if one more similar WLAN device also starts interfering.

Q4: Bluetooth devices separated by 3m on ground are communicating each radiating at 10mW. A nearby WLAN(10mW) FH device at 4 m away is interfering, then SIR under two ray approximations would be ----------. This would become ----------if the WLAN device uses WLAN DS scheme with a process gain of 10.

Q5: In a frequency hopped jamming environment the SNR without jammer is 4 and in presence of jammer this becomes 1. In the presence of 10 jammers when 1000 chips are used, the BER in the presence and absence of jammer would be ----------and ----------respectively.

Q6: In a WLL a CDMA system is applied with a process gain of 128 when path loss exponent is 2 and E_b/N_0 is 6dB. The number of served customers for 6 sectored antenna system would be ----------and this would be ----------when path loss is kept 3.

Q7**:** A BSC has 100 channels and ensure a 1% GOS for erlang B model. If individual user calls twice in 12 hrs with average call duration of 4 minutes, the BSC can serve ----------customers.

Q.8: In WLL system C/I for one interferer case is kept 3 dB lower than the case of six interferer WLL case. The ratio of served customers would be ----------. Now a six interferer normal two ray model cellular system serves 500 customers with C/I of 10dB, the WLL with similar interferer having C/I as 6 dB would serve----------customers.

Q.9: Space antenna diversity is implemented on a cellular tower with a maximum antenna separation of 10feet to provide a co-relation factor as 0.6. The suitable antenna height for broad side case would be ----------. The co-relation increases /decreases as the diversity angle changes from broadside to 60^0.

Q.10: An analog signal m(t)= 5Cos $2\pi 5x10^3t$ V is to be amplitude modulated, the required bandwidth would be ----------KHz and if it is frequency modulated with a frequency deviation constant gain of 4KHz/V, the bandwidth requirement would be ----------KHz.

Q.11: In a cellular system the user location with respect to BS changes from closest to farthest by a factor of 25 having path loss exponent as 3. In case to avoid adjacent channel interference the used filter should attenuate the adjacent channel power by ---------dB and if filter slope is 10dB/octave then the minimum channel spacing required would be ------.

Q.12: In a cellular system at the boundary the received signal has 75% probability above threshold value for σ/n value of 5. The total usable fraction area of the cell would be ----------. If the path loss exponent increases the usable area would increase/decreases keeping the same probability above threshold at boundary.

Q.13: In a GMSK system at 270kbps the 3dB bandwidth for BT=0.2 would be --------and the required bandwidth to contain 90 % power the required would be --------.

Q.14: In a CDMA system if antenna with directivity of 5.1 dB is used and BER is kept at 10^{-3} then for path loss exponent 4 and 3 the number of served customers would be ----------and ----------respectively. These numbers would increase/decrease if the directivity in increased.