Ref. No.: Ex/PG/ETCE/T/129B/2019

M.E.T.C.E First Year 2019
Second semester
Wireless and Mobile Communication Systems

Full marks: 100 **Time: 3 hours**

Answer **Q. No 1** and **any four from the** rest
Answer must be written at one place for each attempted question

Q1. Justify the followings: 5x4=20

a. In cellular communication hexagonal cell is more suitable and common than square shaped cell
b. Sectored antenna at the base station enhances capacity of the system than using omnidirectional antenna
c. D/R (adjacent co-channel distance/cell radius) ratio is the key design issues for maintaining transmission quality in cellular communication
d. Fixed channel assignment scheme works better under heavy traffic condition whereas hybrid channel provides optimum performance
e. Location area in a cellular system influences cost of mobility management

Q2.

a. With pictorial illustration explain the effect of multipath in mobile communication. 04
b. Explain the cause for frequency selective and time selective fading. Explain the terms coherence time and coherence bandwidth. 05
c. When is fading called small scale and large scale? Explain how is small scale fading represented by Rayleigh distribution? 06
d. Given time coherence $T_c = 9/16\pi f_m$, where f_m is a Doppler frequency spread for a wireless transmission at f_c =5.8 GHz with a speed of mobile v= 30 miles/hour, what type of fading will occur (fast or slow). Justify your answer. 05

Q3.

a. What are the four channel characteristics for a wireless time varying LTV channel. Establish the relationship between them and explain the significance of each type. 06

b. Explain the significance for K factor in Rician distribution and show that stronger the LOS component, lesser the chance of deep fade. 06

c. The wireless channel impulse response $h(t,\tau)$ is Wide Sense Stationary process and the impulse responses at two different time are uncorrelated. Find the autocorrelation function of $h(t,\tau)$ as $\varphi_h(\tau; \Delta t)$. From this define the scattering function of the random channel. 04

d. How is power delay profile defined in wireless propagation? How are average delay and rms delay spread derived from PDP? 04

Q4. Write short notes on: 4x5=20

a. GPRS PDP context and session management

b. Goal, key features and simplified architecture of LTE and LTE-A

c. Spectral efficiency of CDMA system

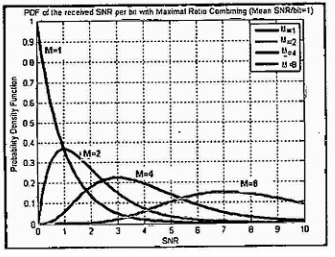
d. Multiple access techniques for 2G, GPRS, 3G and LTE

Q5. a. What are the 3 most important receiver techniques used in wireless communication and why? 05

b. What is the constraint for zero forcing equalizer? How does this constraint overcome? Explain the basic principle of adaptive equalizer design. 08

c. Draw the circuit diagram for maximal ratio combining diversity technique and find the expression for SNR_{max}. 05

d. Explain the significance of the curve shown below. 02



Q6. a. Within a wireless propagation in indoor environment the average received signal power is decreased logarithmically with distance d between transmitter and receiver. What will be the loss in dB at a distance 8 m for path loss exponent 3, and if the loss at reference distance of 1 m is 0dB. If a large obstacle is placed in the propagation media what will be the expected change in the propagation loss? 05

b. A CDMA system is defined with the parameters as follows:
Frequency reuse efficiency =0.55, E_b/N_0 = 12 dB, the information bit transmission rate = 16.2 kbps, system BW =12.5 MHz, neglecting all other sources of interference, determine the system capacity (N_m) and spectral efficiency in (bits/s/Hz). 05

c. Consider a cellular system with N-cell frequency reuse and path loss exponent k=3. Determine the minimum frequency reuse factors for no sectoring, 120^0 sectoring and 60^0 sectoring, respectively, taking into consideration that S/I value of 19 dB or better is satisfactory when the mobile is residing at the cell corner. 05

d. Show that if k = 4, a cell can be split into four smaller cells, each with half the radius and 1/16 of the transmitter power of the original cell.
If extensive measurements show that the path loss exponent is 3, how should the transmitter power be changed in order to split a cell into four smaller cells? 05

Q7. a. Differentiate WLAN variety 802.11 a, b and g in terms of throughput, range, frequency and multiplexing techniques. 05
b. Highlights some advantages and dis-advantages of WLAN. 05
c. What are the different transmission technologies for WLAN? 03
d. The two most common problem of WLAN are hidden terminal and exposed station problems, with illustrations explain how these two problems can be overcome in WLAN. 07

Q8. Write the working principles of the followings: 10x2=20

a. RAKE receiver in CDMA system
b. Bluetooth technology