Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 40974

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Fifth/Eighth Semester
Electronics and Communication Engineering
EC 6801 – WIRELESS COMMUNICATION
(Common to Robotics and Automation Engineering/Information Technology)
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Compare fast and slow fading.
2. Give the differences between frequency flat and frequency selective fading.
3. Define frequency re-use.
4. Differentiate between FDMA, TDMA and CDMA technologies.
5. What do you mean by cyclic prefix ?
6. Draw the constellation diagram for offset QPSK modulation scheme.
7. Design a three tap zero forcing linear equalizer so that the output is

$$q_m = \begin{cases} 1 & m = 0 \\ 0 & m = \pm 1 \end{cases} \text{ and for the input } x_m = \begin{cases} 0.3 & m = 1 \\ 0.9 & m = 0 \\ 0.3 & m = -1 \\ 0 & \text{elsewhere} \end{cases}$$

8. Distinguish between diversity gain versus array gain.
9. State true or false : Justify your answer :
   - Channel knowledge at the transmitter is not required in MIMO channels to extract multiplexing gain.
   - Channel knowledge at the transmitter is required in MIMO channels to extract diversity gain.
10. List different types of diversity schemes.

PART – B (5×13=65 Marks)

11. a) i) Describe briefly about Free space propagation model. (3)

ii) Consider a transmitter which radiates a sinusoidal carrier frequency of 1850MHz. For a vehicle moving 60 mph, compute the received carrier Frequency if the mobile is moving directly toward the transmitter. (4)

iii) Given that the coherence bandwidth is approximated by equation $B_c = \frac{1}{5\sigma_\tau}$. Show that a flat fading channel occurs when $T_S \geq 10\sigma_\tau$. (6)

(OR)

b) Explain briefly about Two Ray Ground reflection model.

12. a) Consider a time invariant frequency selective block fading channel consisting of 3 subchannels of B =1MHz. The frequency response associated with each channel is $H_1 = 1$, $H_2 = 2$, $H_3 = 3$. The transmit power constraint is P = 10mw and noise power spectral density is $N_0 = 10^{-9}$W/Hz. Find the Shannon capacity of the channel and optimal power allocation that achieves this capacity.

(OR)

b) Explain channel assignment and handoff strategies in detail.

13. a) Prove that the OFDM system converts the delay spread channel into a set of parallel fading channels, using the concept of cyclic prefix.

(OR)

b) Derive the bit error rate for binary phase shift keying modulation for frequency flat fading channels.

14. a) Explain the principles of RAKE receiver in detail.

(OR)

b) Consider uncoded spatial multiplexing over a MIMO channel with $M_R \geq M_T$. Show that the ML, MMSE and ZF receivers perform equally well if the channel is orthogonal, i.e., $H^H H = \eta I_{MR}$, where η is a constant. What is the per-stream SNR ?

15. a) Prove that 2×2 MIMO system (without channel state information) at the transmitter provides the diversity gain of 4 and array gain of 2 using Alamouti Scheme.

(OR)

b) Derive an expression for the capacity of the following systems.

a) SIMO system assuming that the channel is known at Receiver. (4)

b) MISO system assuming that the channel is known at transmitter. (4)

c) MIMO system assuming that channel is unknown at the transmitter. (5)

PART – C (1×15=15 Marks)

16. a) Determine the error probability for different fading channels with diversity reception.

(OR)

b) With neat diagrams, explain the modulation and demodulation of $\frac{\pi}{4}$DQPSK modulation technique.