



Reg. No. :

**Question Paper Code : 40974**

23/04/2018

(FN)

**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  $B_c = \frac{1}{5\sigma_r}$ . Show that a flat fading channel occurs when  $T_s \geq 10\sigma_r$ . (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  $B = 1\text{MHz}$ . The frequency response associated with each channel is  $H_1 = 1$ ,  $H_2 = 2$ ,  $H_3 = 3$ . The transmit power constraint is  $P = 10\text{mw}$  and noise power spectral density is  $N_0 = 10^{-9}\text{W/Hz}$ . 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.,  $H^H H = \eta I_{M_R}$ , where  $\eta$  is a constant. What is the per-stream SNR ?



15. a) Prove that  $2 \times 2$  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.