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

Question Paper Code : 40400

M.E./M.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

First Semester

Communication Systems

CU 5151 — ADVANCED DIGITAL COMMUNICATION TECHNIQUES

(Common to M.E. Communication and Networking/M.E. Electronics and Communication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define spectral efficiency and power efficiency.
2. Characterize the channel model of a Rician fading.
3. What is inter-symbol interference? Mention its causes.
4. Distinguish between DHSS and FHSS systems.
5. Mention the features of zero forcing equalizers.
6. Calculate the capacity of AWGN channel with a bandwidth of 10 KHz and signal to noise ratio of 30 dB.
7. Why convolutional codes are more suitable for error syndrome analysis?
8. Write the pros and cons of space time coding.
9. Does Alamouti coding optimal for MIMO systems?
10. How does wireless channel differ from its wired counterpart?

PART B — (5 × 13 = 65 marks)

11. (a) With the help of circuit diagram explain the operation of M-ary Quadrature amplitude modulation technique. Also derive its probability of error. (13)

Or

(b) Assess the performance of joint estimation of carrier phase and symbol detector in QAM and PSK based model for synchronization. (13)

12. (a) What is duo-binary signaling? Obtain the frequency response of the duo-binary conversion filter. Also explain the decision process of the pre-coded duo binary scheme with relevant block diagram. (13)

Or

(b) Derive the expression for maximum likelihood detector and prove that the ML detector reduces to minimum distance detector for the special case of White Gaussian noise vector channel. (13)

13. (a) Consider (7, 4) cyclic code with generator polynomial $g(x) = 1 + x + x^2$

(i) Draw the encoder and syndrome calculator (4)

(ii) Obtain the code-words for the message : 1010 (4)

(iii) Calculate the syndrome calculator output when the codeword of the message 1010 is applied :

(1) with no error

(2) the least significant bit LSB is in error. (5)

Or

(b) Find the bit error probability for a BPSK system with a bit rate of 1 Mbps. The received waveform $s_1(t) = A\cos w_0(t)$ and $s_2(t) = A\cos w_0(t)$ are coherently detected with a matched filter. The value of A is 10 mV. Assume that the single sided noise power spectral density is $N_0 = 10^{-11} W/Hz$ and that signal power and energy per bit are normalized relative to a 1 ohm load. (13)

14. (a) For the given random input 01010101 assess the 4 state, 4 PSK, space time trellis coding and decoding procedure. (13)

Or

(b) Consider a convolutional coder with $r = 2/3$ and constraint length $k = 2$ and generate functions defined by $g^{(1)} = [1011]$, $g^{(2)} = [1101]$, $g^{(3)} = [1010]$. Determine :

(i) Trellis diagram

(ii) State diagram

(iii) Codeword for the message [101101]

(iv) Show the error correction capability using viterbi algorithm. (13)

15. (a) (i) How does peak power problem influence OFDM system? (5)

(ii) Assess the performance of PAPR reduction using coding and scrambling. (8)

Or

(b) (i) What is called Cyclic Prefix (CP)? What is its relation with guard intervals and how the ISI is eliminated by the use of CP? (5)

(ii) Deduce the framework of OFDM system. (8)

PART C — (1 × 15 = 15 marks)

16. (a) (i) By applying the concept of cyclic prefix, explain how OFDM converts the frequency selective channel into a set of flat fading channels. (7)

(ii) Calculate the capacity of a deterministic MIMO channel defined by (8)

$$H = \begin{bmatrix} 0.5 & 0.6 \\ 0.2 & 0.3 \end{bmatrix}$$

Or

(b) (i) Analyse the performance of turbo coded BPSK systems over Gaussian channel. (8)

(ii) The polynomial of a 2-ary PN sequence generator $f(x) = x^3 + x + 1$. Draw the PN sequence generator and obtain the set of PN sequences. (7)
