APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M. TECH DEGREE EXAMINATION

Electronics & Communication Engineering

(Telecommunication Engineering)

04EC6805—Advanced Digital Communication

Max. Marks : 60 Duration: 3 Hours

PART A

Answer All Questions. Each question carries 3 marks

1. Represent a linear band-pass system by its impulse response.
2. Draw the signal space representation of BPSK, QPSK and PAM.
3. Enumerate the properties of a matched filter.
4. Characterize an ideal multipath channel.
5. State Nyquist pulse shaping criterion.
6. What are the challenges in multicarrier modulation? Explain briefly.
7. Explain the propagation model for mobile radio channels.
8. Find the baseband bandwidth of one chip in a spreading code $s_c(t)$ with chip time $T_c = 1\mu s$.

PART B

Each question carries 6 marks

9. Explain Gram – Schmidt procedure for orthogonal expansion of signals in detail.

OR

10. For a set of M orthogonal signal waveform $s_m(t)$, $1 \leq m \leq M$, $0 \leq t \leq T$, all of which have the same energy ε. For a new set of M waveforms $s'_m(t) = s_m(t) - \sum_{k=1}^{M} s_k(t)$; $1 \leq m \leq M$, $0 \leq t \leq T$, show that all the M waveforms in {sm'(t)} have equal energy, $\varepsilon' = \frac{(M-1)\varepsilon}{M}$ and are equally correlated, with correlation coefficient $\frac{1}{\varepsilon'}\int_{-\infty}^{\infty} s'_m(t)s'_n(t)dt = \frac{-1}{(M-1)}$.

11. Determine the metrics of an optimum MAP detector for binary PAM signals when the signal is corrupted with AWGN.

OR

12. Explain correlation demodulator in detail.

13. A wireless channel of length 1000 Km is used to transmit data by means of binary PAM. Regenerative repeaters are spaced 50 Km apart along the system. Each segment of the channel has an ideal frequency response over the frequency band $0 \leq f \leq 1200$ Hz and an attenuation of 1dB/Km. If the channel noise is AWGN,

    a) What is the highest bit rate that can be transmitted without ISI?

b) Determine the required $\mathcal{E}_b/N_o$ to achieve a bit error of $P_2 = 10^{-7}$ for each repeater.

c) Determine the transmitted power at each repeater to achieve the desired $\mathcal{E}_b/N_o$, where $N_o = 4.1 \times 10^{-21}$ W/Hz.

OR

14. Explain Maximum Likelihood optimum receiver.

15. Explain multicarrier modulation with overlapping sub channels.

OR

16. Explain discrete implementation of multicarrier modulation with necessary mathematical equations.

17. Explain Nakagami-m model for frequency non-selective slowly fading channel.

OR

18. Explain tapped delay line model of frequency selective slowly fading channel.

19. a) An SFH system with hop time $T_c = 10\mu s$ and symbol time $T_s = 1\mu s$. If the FH signal is transmitted over a multipath channel, for what range of multipath delay spreads will the received despread signal exhibit frequency selective fading? Explain Direct sequence spread spectrum in detail.

b) For a DSSS downlink with bandwidth expansion $N = \frac{B_s}{B} = 100$. If the system is interference limited and there is no multipath on any users channel, then how many users of the system can support under BPSK modulation such that each user has a BER less than 10^{-3}?

OR

20. Explain Frequency hopping spread spectrum in detail.