



Name :

Roll No. :

Invigilator's Signature :

**CS/M.Tech(ECE)/SEM-1/MEC-902/2009-10
2009**

MODERN DIGITAL COMMUNICATION

Time Allotted : 3 Hours

Full Marks : 70

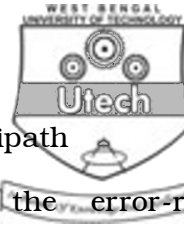
The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Answer any *five* questions.

5 × 14 = 70

1. What is OFDM ? How does it help in easing out the complexity of equalization ? Explain how an OFDM transmitter works. How is the OFDM receiver capable of maintaining zero ISI during reception ?
2 + 2 + 5 + 5
2. Derive the relationship between coherence bandwidth and multipath spread of the channel. Also derive the relationship between coherence time and Doppler spread.
7 + 7



3. What are diversity techniques for fading multipath channels ? Derive an expression for the error-rate performance of BPSK with L-th order diversity and when it is passed through a maximal ratio combiner. Compare the performance of BPSK with BFSK under the same circumstances. Assume the channel to be Rayleigh fading in nature. 4 + 7 + 3
4. What is a "RAKE" receiver ? Derive the performance of a "RAKE" receiver, when the binary signals are antipodal in nature. 5 + 9
5. Explain how Maximum Shift Keying (MSK) transmitter and receiver work. Derive an expression for the probability of error with MSK. 4 + 4 + 6
6. What is an Optimum detector ? Obtain an expression for the likelihood function $P(\hat{r}, \hat{S}_m)$ in terms of the Euclidean distance $D(\hat{r}, \hat{S}_m)$. For a maximum likelihood Sequence Detector with any given transmitted sequence, obtain an expression for the joint PDF of the received signal. 4 + 5 + 5
7. Develop an algorithm for the recursive least square technique for adaptive equalization. 14



8. Show that the time-variant frequency selective channel can be modelled as a tapped-delay line with tap-spacing T and tap weight coefficient $\{ C_n(t) \}$. Derive an expression for the error rate of BPSK as a function of the received SNR γ_b when the channel is said to be Rayleigh fading.

7 + 7

9. Write short notes on any *two* of the following :

7 + 7

- a) Trellis code modulation
- b) Decision feedback equalization
- c) MAP detector
- d) Coded waveforms for fading channels.

=====