

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- December 2017

MTech 1st / B.Tech 7th

COURSE CODE: 10M11EC111

MAX. MARKS: 35

COURSE NAME: Advanced Communication System

COURSE CREDITS: 3

MAX. TIME: 2Hrs

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

WRITE IN SHORT TO SAVE YOUR TIME TO ANSWER ALL THE QUESTIONS

1. (20 marks) Short answers type questions.
 - a. Draw the transmitter and receiver structure of the OFDM system.
 - b. Why cyclic prefix is used in the OFDM system?
 - c. Draw the block diagram of RAKE receiver.
 - d. Mention the names of four multiple accessing techniques.
 - e. Write the benefits of Spread Spectrum technique and its types.
 - f. Explain in short the significance of coherence bandwidth, coherence time, delay spread, and doppler's frequency, and explain their dependencies.
 - g. Sketch phase trajectory of MSK for input sequence 11000110111.
 - h. In a regenerative binary baseband transmission system with $m=10$ repeaters, single hop error probability is 10^{-5} . Find the end-to-end error probability at the receiver.
 - i. Let P_{eI} and P_{eQ} denote the probabilities of symbol error for the in-phase and quadrature channels of a narrowband digital communication system. Find the average probability of symbol error for the overall system.
 - j. Plot signal space diagram of BPSK, QPSK, Octal PSK, and 8-QAM.

2. (15 marks) Develop the Adaptive modulation scheme for spectral efficiency maximization without power adaptation using MQAM with 7-modes: $M=2^n$, $n=0, 1, 2, \dots, 6$. If average SNR is $\bar{\gamma}$ and average spectral efficiency $\bar{\epsilon}_s$. Design for the following constraints: **NOTE: Use the expressions and figures given in the appendix.**

- For target BER= 10^{-5} , find SNR thresholds γ_i for all the modes. 5
- For constraint Outage probability $P_{\text{out}}=0.2$, find $\bar{\gamma}$ and $\bar{\epsilon}_s$. 4
- For average spectral efficiency $\bar{\epsilon}_s$ constraint $\bar{\epsilon}_s = 2.8$ bps/Hz, find $\bar{\gamma}$ and P_{out} . 4
- Find the % of energy saved in no transmission mode in above parts b. and c. assuming that in each mode same energy would have been spent. 2

Appendix

$$\text{erfc}^{-1}(2 \cdot 10^{-5}) = 3.0157$$

