

METCE EXAMINATION, 2017

(1st Semester)

Advanced Digital Communication

Time: Three hours

Full Marks: 100

Write all the parts of a question in the same place

Answer any five questions

All the questions carry equal marks

1. a) Diversity is a powerful communication receiver technique which can provide significant link improvement-explain. (4)
 - b) Explain that space diversity can be used at either the mobile or base station, or both. (4)
 - c) Discuss the principles of operation of the following types of diversity with necessary diagrams: (3x4)
 - i) Selection diversity
 - ii) Scanning diversity
 - iii) Equal gain combining
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2. a) Draw the structures of Linear Transversal Equalizer (LTE) using (4+4)
 - i) only feed forward taps
 - ii) both feed forward and feedback taps

Also compare the performances of the above equalizers.
 - b) Discuss the principle of operation of Decision Feedback Equalizer (DFE) with necessary diagram. Under which condition does DFE perform better than LTE? How can you make this equalizer predictive in nature? (6+2+4)
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3. a) State the advantages of OFDM over conventional FDM. (4)
 - b) Describe the OFDM transceiver system with proper diagrams. (10)

- c) How can you handle the problem of Inter Symbol Interference (ISI) in OFDM system using the concept of cyclic prefix? (6)
4. a) Discuss clearly the need for Adaptive Modulation and Coding (AMC) in modern communication systems? (6)
- b) Design an AMC system model for WiMAX system considering atleast three modulation orders and two code rates. You can use either Moore or Mealy state machine approach. (8)
- c) Describe the Target Block Error Rate (TBER) and Maximum Throughput (MT) adaptation techniques for WiMAX systems. (6)
5. a) Explain with necessary examples that design of a digital communication system requires a proper trade-off between power efficiency and bandwidth efficiency. (8)
- b) State and explain Nyquist's Vestigial Symmetry theorem. (5)
- c) Draw and explain the amplitude characteristic of any function that satisfies the above theorem. (4)
- d) How can the overall filtering between the transmitter and receiver can be apportioned over a data link? (3)
6. Explain the advantages of i) over ii) as stated below: (4x5)
- a) i) Lattice equalizer ii) LTE
- b) i) OQPSK ii) QPSK
- c) i) 16-QAM ii) 16-PSK
- d) i) Multi-carrier modulation ii) Single carrier modulation
7. a) Draw the base band equivalent models of band pass modulated signals using (4+4)
- i) Modulator having a pre-modulation low-pass filter only.
- ii) Modulator having a post-modulation band-pass filter only.

Hence derive the equivalence condition between the above models.

- b) Explain that $\pi/4$ QPSK offers a compromise between OQPSK and QPSK in terms of the allowed maximum phase transitions. Hence draw the constellation diagram of $\pi/4$ QPSK (4+2)
 - c) Describe the operation of $\pi/4$ QPSK transmitter with necessary diagram and mathematical description. (6)
8. Write short notes on the following: (2x10)
- a) Gaussian pulse-shaping filter
 - b) Base band differential $\pi/4$ QPSK detector