

Quiz 3:
 Dr. Ali Muqaibel

Name: **KEY**

This quiz is based on an article published by (P.S. Mundra, T.L. Singal, and R. Kapur) entitled "The Choice of a Digital Modulation Scheme in a Mobile Radio System". Please answer the following questions. Answer in your own words and according to the article.

1. State True or False. Please fill in the table (F or T) (4 points)

- a. The bandwidth of QPSK is $\frac{1}{2}$ the BW of BPSK (for the same transmission rate).
- b. GSM standard uses $\pi/4$ QPSK as the main digital modulation scheme.
- c. Continuous phase modulation schemes avoid the linearity requirement. However, they increase the cost of amplification.
- d. When using the same power, QPSK results in less BER (bit error rate) as compared to BPSK.

Q	a	b	c	d
A	T	F	F	F

2. Circle the correct answer/answers: *hint: you should choose all correct answers* (2 points)

- a. Which of the following modulation techniques does not result in 180° abrupt phase shift between adjacent symbols?

QPSK, OK-QPSK, $\pi/4$ QPSK, MSK

- b. The Mobile Radio Channel is

Band-limited Power-limited

3. The authors excluded ASK from the candidates modulation techniques for the Mobile Radio Channel. What is their justification? (1 point)

The large amplitude variations in signal amplitude due to Rayleigh fading encountered in Mobile Radio Channel, render ASK almost inoperative *p2. sec II. line 4.*

4. MSK (4 levels) has spectral efficiency of 2 b/s/Hz while MSK (2-levels) has spectral efficiency 1 b/s/Hz. Compared with MSK (4-levels), what would make somebody use MSK (2-levels)? (1 point)

5. From frequency domain point of view, what happen when a band limited linearly modulated carrier undergoes non-linear amplifications? (1 point)

If the signal is transmitted through a nonlinear power amplifier, the amplitude variation results in the regrowth of the side lobes (BW expansion) *p3. sec VI, line 6.*

6. Based on Figure 2, which modulation requires more bandwidth MSK or QPSK? (1 point)

MSK requires more BW in terms of Main lobe. However, when out of Band emission is considered, the relation might reverse.