Fomenky's

UNIVERSITY OF BUEA
COLLEGE OF TECHNOLOGY
FIRST SEMESTER EXAMINATION 2019/2020

MONTH: FEBRUARY
YEAR: 2020
DATE: 02/2020
TIME ALLOWED: 2 HOURS
TIME:
INSTRUCTIONS: Answer all questions

COURSE INSTRUCTOR: Tsona Kouti Gaetan F.
COURSE CODE & NUMBER: EEC319
COURSE TITLE: Radio Communications
CREDIT VALUE: 4

Part I Multiple Choice Questions (20pts)

1. Which of the following accurately describe the goal of RF engineering?
   a) To capture electromagnetic waves
   b) To propagate electromagnetic waves
   c) To send small amounts of data periodically
   d) To send data and voice short distances using encryption

2. Which of the following is an accurate description of analog signals?
   a) Infection prone
   b) Continuously variable
   c) Difficult policing
   d) Interference

3. Which two of the following statements are true concerning power conversion from mW to dBm?
   a) If a power in milliwatts is halved, the corresponding power in dBm is reduced by 3
   b) 1 dBm corresponds to 0 mW
   c) If a power in milliwatts is multiplied by 10, 10dBm is added to the equivalent power in dBm
   d) The conversion is done because the power in mW is easier to manipulate than in dBm.

4. Which of the following constitute the essential elements of any radio system?
   a) A transmitter
   b) A receiver
   c) A baseband signal
   d) A transmitting antenna

5. Which of the following accurately describe the characteristics of radio receivers?
   a) Sensitivity: minimum RF signal level that can be detected and produce usable information
   b) Selectivity: ability to differentiate desired signals from unwanted signals
   c) Fidelity: unfaithfulness to the original
   d) Fidelity: ability to produce an exact replica of the original source information

6. What direction is the electrical field in a properly mounted vertically polarized antenna?
   a) Horizontal
   b) Vertical
   c) Elliptical

7. Electromagnetic fields can be divided in:
   a) Storage fields
   b) Radiating fields
   c) Closed fields
   d) Scintillating fields

Part II Open questions (50pts)

8. What is multiplexing? What is the aim of multiplexing techniques in wireless access networks? (3pts)

9. Radio transmitters (15pts)

   a) Draw a bloc diagram of a super heterodyne transmitter

   b) If the modulator and up converter have losses of 1dB each and all the transmission lines put together 0,5dB loss; consider that each amplifier has a gain of 5dB; what would be the level of an information signal that entered the transmitter at 3dBm when it reaches the antenna?

10. If a transmitter operates at power 0.4W, frequency 100MHz, Calculate: (10pts)

   a) The transmit power in dBm
   b) The wave length
   c) Compute the power measured 500m away if the transmit antenna gain is G=4 dBi (consider only free space loss. No reception antenna)
   d) What is the maximum distance at which this transmitter can be received with a receiver sensitivity of -67dBm and the same type of antenna at the receiving end?
   e) Calculate the free space loss, 27 km away from the transmitter.

11. Consider two Wi-Fi transceivers (APs) operating at power 10mW, sensitivity -62dBm, frequency 2.4GHz, with transmitter and receiver antenna gains equal 10dBi and 6dBi respectively. Antenna coupling and cable losses amount to 1dB at each end; any other loss is negligible (15pts)

   a) Compute The wave length at that frequency
   b) Compute the maximum theoretical distance (D) at which the transceivers can be installed in order to operate successfully, using the general formula for link budget.
   c) For maximum reception quality of the link, the first and second Fresnel zones are free of ground obstacles at distance D. What is the required minimum height of the antennas above the ground? Illustrate your answer with a sketch after calculations.

12. Consider a transmitter and a receiver D meters apart, operating at frequency f=5 Ghz (7pts)

   a) Give the radius of the first Fresnel zone as a function of D.
   b) What would happen if there is any obstacle in that zone?
   c) Assume the link is between 2 points in a flat and entirely deserted area, with the first and second Fresnel zones free of obstacles:

      What is the minimum height of the antennas necessary to achieve that link for D=250m?

Good luck