KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF ELECTRICAL ENGINEERING

EE 418 INTRODUCTION TO SATELLITE COMMUNICATIONS EXAMINATION II
December 19 , 2006

NAME :	
I.D. # :	

Q.1 Answer the following questions:

1) The preferred modulation scheme for MSS digital data is:
   a. BPSK b. FM c. QAM d. QPSK e. ACSSB

2) The S/N at the output of an FM demodulator for an input C/N of 12 dB, when the frequency deviation is 6 MHz and the maximum modulating frequency is 4.5 MHz, is given by:
   a. 7.74 dB b. 12 dB c. 15.75 dB d. 16.26 dB e. 24 dB

3) Two cascaded receiver subsystems with noise figures F_1=3dB, and F_2=6.5 dB, and gains G_1= 30 dB and G_2= 5 dB. The system noise temperature at the input of the system is:
   a. 100 K b. 250 K c. 291 K d. 2910 K e. 0.192 K

Q.2 a. Derive the transmission equation, which gives the received power (P_r) as a function of the transmitting and receiving antenna gains (G_t and G_r), the separation (R) between the antennas, the transmitted power (P_t) and the wavelength (λ).

b. A 150 MHz VHF transmitter delivers 20 W into an antenna with 10 dB gain. Calculate the power available from a 3 dB receiving antenna separated by 20 km.

c. A low earth orbit (LEO) satellite system transmits 1 W at 1.62 GHz using a 29 dB gain antenna with spot beam directed towards users on the earth that are a maximum of 1500 Km away. Calculate:
   1. The received power, if the user antenna has a 1 dB gain when directed towards the satellite.
   2. The required satellite EIRP (Effective Isotropically Radiated Power) in dBm, in order for the received power to be at least –100dBm.

Q.3 An earth station receiving antenna delivers –119 dBm carrier power at the antennas output terminals. The antenna noise temperature is 68 K. The antenna feeds a waveguide which has 1 dB of loss and physical temperature of 295 K. The output of the waveguide is connected to an amplifier with noise figure of 4 dB and gain of 25 dB. Following the amplifier is a mixer with noise figure of 12 dB. Calculate the following: The amplifier and mixer noise temperatures, the waveguide effective noise temperature, the system noise temperature referred to the antenna terminals, and the receiver carrier to noise ratio for a 200 Hz bandwidth.
(Boltzmann's constant k = 1.38 x 10^{-23} J/K → -228.6 dBW/K/Hz)

PROBLEM #	Q. 1	Q.2	Q.3	TOTAL
Marks				
Maximum	25	40	35	100