KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF ELECTRICAL ENGINEERING

EE 418 INTRODUCTION TO SATELLITE COMMUNICATIONS EXAMINATION II
December 14, 2005

NAME :		
I.D. # :		**Section: 01 (Semester 051)**

Q.1 Answer the following questions.

1) The maximum directivity of an isotropic source (which radiates equally in all directions) is:
   a. 0.5 **b.** 1.0 **c.** 10 **d.** Any value in the range $0.0 \le D_o \le \infty$
2) The gain, expressed in dB, of an antenna with a maximum directivity of 1000 and antenna efficiency of 85% is:
   a. 10.5 **b.** 29.29 **c.** 58.59 **d.** 999.3
3) 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. 9.54 dB b. 12 dB c. 15.75 dB d. 16.26 dB e. 24 dB
   (*Hint:S/N*=1.5β^2 *C/N*)
4) The preferred modulation scheme for FSS digital data is:
   a. BPSK b. FM c. QAM d. QPSK e. ACSSB
5) 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 The radiation intensity of an antenna is given by: $U(\theta,\phi) = \cos^6\theta$ for $0^\circ \le \theta \le \frac{\pi}{2}$ & $0^\circ \le \phi \le 2\pi$ (i.e. in the upper hemisphere). It is zero in the lower hemisphere. Find the maximum directivity and the half-power beam-widths in two perpendicular planes including the direction of maximum radiation (HP_1 and HP_2). Find the approximate directivity and percentage error in using the approximate formula $D_0 = 4\pi/(HP_1 \cdot HP_2)$.

Q.4 A satellite carrying an 11.7 GHz CW beacon transmitter is located in geosynchronous orbit 38000 km from an earth station. The beacon's output power is 200 mW, and it feeds an antenna with 18.9 dB gain toward the earth station. The receiving antenna is 4 m in diameter and has aperture efficiency of 50%. If the overall system noise temperature of the earth station is 1250 K, determine: a)satellite EIRP b) receiving antenna gain (dB) c)the path loss (dB) d)received signal power in W, mW, dBm, e)earth station G/T in dBK-1, f)receiver noise power in 100-Hz noise bandwidth in W and dBm, g) receiver C/N in dB in a 100Hz noise 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	35	30	35	100