QUIZ I, ELNG 307, LEVEL 300 - EEE & COMP ENG [Answer ALL]

1. a) The capacity in bits per second of an additive white Gaussian noise channel is given by

$$C = Blog_2\left(1 + \frac{P}{N_0 B}\right)$$

Where P is the received signal power, B is the signal bandwidth and N_0 is the noise power spectral density.

The total noise power is given by, $N_0 B$. Consider a wireless channel where received signal power decreases with distance (d) according to the expression below,

$$P_r(d) = P_t\left(\frac{d_0}{d}\right)^3$$

Given d_0 =2500 cm, $P_t = 10^{-3}$ mW; noise power spectral density (PSD), $N_0 = 10^{-9}$ W/Hz; channel bandwidth, $B = 35$ kHz. Find the capacities of the channel with the following distance of separation between transmitter and receiver (a) $d = 15000\ cm$ and (b) $d = 1.5\ km$. **[Marks: 5/2 = 2.5]**

b) What is the key function of the National Communication Authority (NCA)? Distinguish difference between NCA and National Media Commission (NMC)? **[Marks: 10/2 = 5]**

2. a) A terrestrial microwave system is being designed. The transmitting and receiving antennas are to be placed at the top of equal-height towers, with one tower at the transmitter site and one at the receiving site. The distance between the transmitting and receiving sites is 30 miles. Calculate the minimum height required for LOS transmission path. **[Marks: 5/2 = 2.5]**

b) The spectral component of a complex exponential Fourier series of $x(t)$ is given by $C_x(nf_o)$. What is the name given to $C_x(nf_o)$ for $n \geq 2$? **[Marks: 5/2 = 2.5]**

$P_r(15000)$

$P_r(5\,cm) = P_0^{-3}\left(\frac{2500}{1500}\right)^3$

$P_r(15000) = 4.639 \times 10^{-3}$

$P_r = 32\,49000$

$C = 35kHz\left(1 + \frac{5,24900}{10^{-9} + 35}\right)$