UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2010/2011

COURSE NAME	:	COMMUNICATION ENGINEERING
COURSE CODE	:	DEK 3233
PROGRAMME	:	3 DEE/DET/DEX
EXAMINATION DATE	:	NOVEMBER/DECEMBER 2010
DURATION	:	2 1/2 HOURS
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS IN **PART A** AND **TWO (2)** QUESTIONS IN **PART B**

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

PART A

Q1 (a) Sketch the basic transmitter block diagram and describe ONE of its functions.

(6 marks)

(b) An Amplitude Modulation (AM) radio power amplifier gain has been given at 15dB. During the transmission, the output power of the amplifier is at 20 W.

(i) Compute the input power P_i and
(ii) The possible shortest period for the transmitted signal to complete one full cycle in Medium Wave (MF) band.

(4 marks)

Q2 (a) Amplitude Modulation (AM) is defined as a change of amplitude of carrier frequency, proportion to the instantaneous value of the modulation signal. Describe TWO on each of the followings:

(i) Advantages and
(ii) Disadvantages

(4 marks)

(b) An Amplitude Modulation (AM) transmission can be in 3 different type of modulation.

(i) Calculate the modulation index with its $V_{max\ p\text{-}p} = 10\ V_{pp}$ and $V_{min\ p\text{-}p}=2\ V_{pp}$,
(ii) Sketch the AM waveform with its trapezoidal format and
(iii) Determine the type of modulation based on the previous calculation.

(6 marks)

Q3 An unshielded twisted pair (UTP) cable as shown in Figure Q3 is used to transmit 50 MHz signal in a networking system. It has a relative dielectric constant of the insulating material at 2.0 and the velocity factor of 0.7. The line is terminated with a load having impedance of $130 + j60\ \Omega$. Determine

(i) The characteristic impedance of the UTP line.
(ii) The propagation velocity of the line.
(iii) The UTP's wavelength.
(iv) Standing Wave Ratio.
(v) Return loss in dB.
(vi) Percentage of transmitted power to the load.

(10 marks)

Q4 Pulse code modulation (PCM) is one of the methods in the Pulse Modulation Scheme in order to convert the analog to digital signal. With the aid of a diagram describe the complete process of PCM generation.

(10 marks)

PART B

Q5 (a) The general expression of angle-modulated signal is given by:

$$v(t) = V_c \sin[2\pi f_c t + \theta(t)]$$

where $\theta(t)$ is prescribed as being a function of the modulating signal. In terms of modulating signal $v_m(t) = V_m \sin(\omega_m t)$ the instantaneous frequency deviations is given by:

$$\theta'(t) = k_f v_m(t) \text{ rad/s}$$

where k_f is the deviation sensitivity of the frequency modulator. Hence, variation of $d\theta/dt$ produces Frequency Modulation (FM). Illustrate that the expression of frequency modulated signal is given by:

$$v_{FM}(t) = V_c \sin\left[\omega_c t - \frac{k_f V_m}{\omega_m}\cos(\omega_m t)\right]$$

(8 marks)

(b) An FM signal, $v_{FM}(t) = 22 \sin(4\pi \times 10^8 t - 2\cos 5\pi \times 10^3 t)$, is applied to a 50 Ω antenna. Determine;

(i) Modulation index, β
(ii) Modulating frequency, f_m
(iii) Bandwidth using Bessel function table (refer Table Q5)
(iv) Bandwidth using Carson's rule
(v) Power in the largest and smallest sidebands predicted by Bessel function table
(vi) Total power using the Bessel function table.

(22 marks)

Q6 (a) Noise is divided into two categories which are correlated and uncorrelated noise. Using your own word, define uncorrelated noise. Then state TWO (2) types of extraterrestrial noise.

(4 marks)

(b) Two signals of 1 kHz and 10 kHz are mixed in a nonlinear device producing sum and difference of harmonics. Find the cross product frequencies for values of m = 1 and n = 1,2,3,4. Draw a table showing the sum and difference of the frequency values and then sketch the spectrum.

(8 marks)

(c) A 5 W, 27 MHz signal is fed through an RG-58A/U coaxial line with a terminated impedance of $160 + j70\ \Omega$. The coaxial line is made from a solid polyethylene dielectric having relative permittivity 2.3, with an inner conductor 2.1 mm in diameter and an outer conductor 7.45 mm in inside diameter. The line wavelength is 0.7λ long with velocity propagation of $2.07 \times 10^8\, m/s$. Determine the followings:

(i) Characteristic impedance,
(ii) Reflection coefficient at the load,
(iii) Coaxial length in meter,
(iv) Standing Wave Ratio (SWR) on the line,
(v) Return loss in dB,
(vi) Percentage of power reflected and
(vii) Power absorbed by the load.

(18 marks)

Q7 (a) Sky wave is the propagation of electromagnetic waves bent (refracted) back to the Earth's surface by the ionosphere. As a result of sky wave propagation, a broadcast signal from a distant AM broadcasting station at night, or from a shortwave radio station can sometimes be heard as clearly as local stations. Explain the sky wave characteristics and sketch the propagation application.

(22 marks)

(b) For a transmitting antenna with a radiation resistance R_r = 75 Ω, an effective antenna resistance R_e = 15 Ω, a directive gain D = 18 and an input power is 35 W. Determine;

(i) Percentage of antenna efficiency,
(ii) Antenna gain in dB,
(iii) Radiated power in dBm, and

(8 marks)

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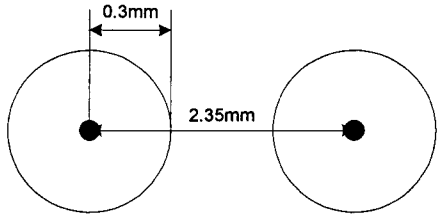

Figure Q3: UTP Wire

Modulation index	Carrier J_0	Sidebands									
		J_1	J_2	J_3	J_4	J_5	J_6	J_7	J_8	J_9	J_{10}
0.0	1.00	—	—	—	—	—	—	—	—	—	—
0.25	0.98	0.12	—	—	—	—	—	—	—	—	—
0.5	0.94	0.24	0.03	—	—	—	—	—	—	—	—
1.0	0.77	0.44	0.11	0.02	—	—	—	—	—	—	—
1.5	0.51	0.56	0.23	0.06	0.01	—	—	—	—	—	—
2.0	0.22	0.58	0.35	0.13	0.03	—	—	—	—	—	—
2.5	−0.05	0.50	0.45	0.22	0.07	0.02	—	—	—	—	—
3.0	−0.26	0.34	0.49	0.31	0.13	0.04	0.01	—	—	—	—
4.0	−0.40	−0.07	0.36	0.43	0.28	0.13	0.05	0.02	—	—	—
5.0	−0.18	−0.33	0.05	0.36	0.39	0.26	0.13	0.06	0.02	—	—
6.0	0.15	−0.28	−0.24	0.11	0.36	0.36	0.25	0.13	0.06	0.02	—
7.0	0.30	0.00	−0.30	−0.17	0.16	0.35	0.34	0.23	0.13	0.06	0.02
8.0	0.17	0.23	−0.11	−0.29	0.10	0.19	0.34	0.32	0.22	0.13	0.06

Table Q5: Bessel Function.

Constant:

Speed of light, C = 3.01 x 10^8 m/s
Boltzman, K = 1.38x10-23 J/K
Absolute temperature, T = 17°C or 290K