UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESI 2008/2009

SUBJECT NAME	:	COMMUNICATION ENGINEERING
SUBJECT CODE	:	DEK 3233
COURSE	:	3 DEE / 3 DET / 3 DEX
EXAMINATION DATE	:	APRIL 2009
DURATION	:	2 ½ HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN **PART A** AND ANSWER TWO **(2)** QUESTIONS IN **PART B**.

THIS QUESTION PAPER CONSISTS OF SIX PAGES

PART A

Q1 (a) Message signal in communication can be in TWO (2) forms. Describe these forms with its applications

(5 marks)

(b) VHF and UHF are some of the widely used designation in a frequency spectrum in radio communication. Determine:

(i) the frequency range, and
(ii) common usage and application

(5 marks)

Q2 (a) Percentage modulation also known as modulation index is defined as a measure which a carrier voltage is varied by the modulating signal. In AM there are 3 different types of modulation index. Describe and sketch the modulated AM waveform for:

(i) under-modulated
(ii) ideal, and
(iii) over-modulated

(6 marks)

(b) A tuned circuit needs to be built with its component consists of 220nf capacitor, a winding coil which has a 75Ω resistance and 20μH. Find the:

(i) selectivity Q of the circuit
(ii) bandwidth of the circuit

(4 marks)

Q3 (a) Draw and label correctly the block diagram of the digital data flow in a data communication systems.

(4 marks)

(b) There are three most common techniques used in digital modulation which are called the Amplitude Shift-Keying (ASK), Frequency Shift-Keying (FSK) and Binary Phase Shift-Keying (BPSK). If a digital message 10011010 is to modulate a carrier of 10 kHz, what would be the resulting signals of these THREE (3) techniques? Sketch the signals.

(6 marks)

Q4 A Frequency Modulation (FM) broadcast system has a main carrier frequency. f_c = 1 MHz with peak amplitude of 5V. The modulating signal has an equation of 3 sin (37,500 πt). According to the FCC standards in broadcasting stated that the maximum frequency deviation allowed is ±75 kHz and maximum modulating frequency is 15 kHz. The percent modulation for the FM broadcast is assigned to be 50%. Determine,

(i) index modulation, β,
(ii) deviation sensitivity, K_f,
(iii) actual bandwidth for FM signal,
(iv) bandwidth for FM signal using Carson approximation, and
(v) the significant sideband frequencies

(10 marks)

PART B

Q5 (a) A stereo FM transmitter using the frequency division multiplexing has several sections to complete its process. Explain the following:

(i) matrix network (adder),
(ii) delay network,
(iii) balanced modulator,
(iv) multiplier, and
(v) linear combining network

(10 marks)

(b) Superheterodyne (Superhets) receiver has complex circuitry compared to the tuned radio frequency (TRF) receiver. However, superhets has excellent performance under many factors and conditions Draw the complete superheterodyne receiver block diagram and explain the function for the stages that differentiate between superhets and TRF.

(8 marks)

(c) List ONE (1) major advantage of a Ratio Detector over Foster-Seeley Discriminator in the detection of a Frequency Modulation signal.

(2 marks)

Q6 (a) Electrical noise is defined as any undesirable electrical energy that falls within the passband of the signal. Explain the different between correlated and uncorrelated noise.

(2 marks)

(b) Determine the overall noise factor and noise figure for a three cascaded amplifiers as shown in Figure Q1. Then, find the output signal to noise ratio (SNR) in decibel (dB) at the final stage if the input SNR to the whole system is 14.38 dB.

(10 marks)

(c) Two signals of 2 kHz and 9 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)

Q7 (a) A transmission line is a metallic conductor system used to transfer electrical energy from one point to another point using electrical current flow. Draw the equivalent transmission line model and state the name of the electrical constants of the transmission line model. Then list THREE (3) examples of transmission line that you know.

(8 marks)

(b) 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 2.1mm 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.

(12 marks)

Q8 (a) List the advantages and disadvantages of ground wave propagation.

(5 marks)

(b) A radio wave moves from air ($\varepsilon_r = 1$) to glass ($\varepsilon_r = 7.8$) with angle of incidence 30°. Assuming the relative permeability (μ_4) is unity, what is the angle of refraction?

(4 marks)

(c) The characteristics of radio wave are almost similar to the light waves which are the reflection, the refraction and the diffraction. Explain briefly each of the characteristics mentioned with the aid of a diagram.

(11 marks)

Q9 (a) For a transmitting antenna with a radiation resistance $R_r = 50\ \Omega$, an effective antenna resistance $R_e = 7\ \Omega$, a directive gain $D = 25$ and an input power is 115 W. Determine:

(i) antenna efficiency,
(ii) antenna gain in dB,
(iii) radiated power in dBm, and
(iv) Effective Isotropic Radiated Power (EIRP) in dBm.

(14 marks)

(b) Explain the characteristics of a basic antenna array with its elements. Sketch and label the antenna array.

(6 marks)

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TABLE Q1: Bessel Function

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

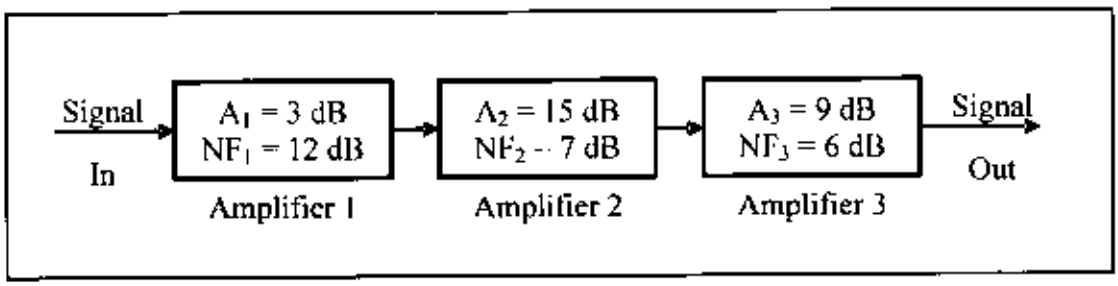

FIGURE Q1

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