UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	COMMUNICATION ENGINEERING
COURSE CODE	:	DAE 32603
PROGRAMME	:	3 DAE / DAL
EXAMINATION DATE	:	MARCH 2012
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES

Q1 (a) An electromagnetic wave travels from the source to the destination in a complete system of communication.

(i) Sketch the block diagram of a communication system.
(ii) Explain each element of the block diagram.

(6 marks)

(b) There are two (2) types of medium in electronic communication system.

(i) State both types.
(ii) Gives an example of each type as in Q1(b)(i).

(4 marks)

(c) With reference to Table Q1(c), the Very High Frequency (VHF) signal is transmitted from an antenna with Signal to Noise Ratio (SNR) of 20 dB.

(i) State two (2) applications of VHF.
(ii) Calculate the VHF bandwidth.
(iii) Calculate the channel capacity of the signal.
(iv) From your point of view, what happens to the channel capacity if the SNR is reduced to 5dB?

(9 marks)

(d) Signals travel in different ways. Briefly explain the three (3) types of transmission modes.

(6 marks)

Q2 (a) State one (1) advantage and one (1) disadvantage of Amplitude Modulation (AM).

(2 marks)

(b) Briefly explain the process of amplitude modulation (AM). Sketch the modulating signal, carrier signal and AM signal.

(3 marks)

(c) For the trapezoidal pattern shown in Figure Q2(c), determine:

(i) Modulation coefficient, m.
(ii) Index modulation percentage, M.
(iii) Modulating amplitude, V_m.
(iv) Carrier amplitude, V_C.
(v) Upper and lower side frequency amplitude, V_{USB} and V_{LSB}.
(vi) Frequency limit for upper and lower sideband (f_{USB} and f_{LSB}), if the carrier frequency, f_C =100kHz and the modulating frequency, f_m =5kHz.
(vii) Bandwidth, BW.
(viii) The total power of the AM wave, P_T, if load resistance R_L = 10 Ω.
(ix) Draw the output spectrum for this AM DSBFC (Double Sideband Full Carrier).

(13 marks)

(d) *Demodulator* or *detectors*, are circuits that accept modulated signals and recover the original modulating information.

(i) With an aid of a block diagram, briefly explain the process in a receiver circuit.
(ii) Construct one of the common AM demodulator circuit.
(iii) According to answer in Q2(d)(ii), explain how it works.

(7 marks)

Q3 (a) Modulation Index is the useful parameter in both, AM and FM.

(i) Sketch AM signal
(ii) Briefly explain the Modulation Index of AM.
(iii) Sketch FM signal
(iv) Briefly explain the Modulation Index of FM.
(v) Give reason why it is useful in AM and FM.

(5 marks)

(b) An FM signal expressed as $V_{FM}(t) = 2000\cos(2\pi 10^7 t + 2\sin 2\pi(2\times 10^4)t)$ is measured in a 100 ohm antenna. By referring to TABLE Q3(b), determine the following :

(i) Total power.
(ii) Modulation index, β.
(iii) Peak frequency deviation, Δf.
(iv) Deviation sensitivity (kf), if 250mV is require to achieved Q3(b)(iii).
(v) Amplitude spectrum voltages.
(vi) Bandwidth using Bessel table.
(vii) Approximate bandwidth by Carson's rule.
(viii) Sketch the FM signal spectra.

(10 marks)

(c) Phase Locked Loop (PLL) is a type of FM discriminator circuits. All PLL have three basic elements. Sketch and briefly explain each of them.

(5 marks)

(d) With some illustration, suggest an idea on how to prove that the output from a FM modulator is using direct method technique.

(5 marks)

Q4 (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) According to Figure Q4(b):

(i) Determine the overall noise factor and noise figure for a three cascaded amplifiers.
(ii) Find the output Signal to Noise Ratio (SNR) in decibel (dB) at the final stage if the input SNR to the whole system is 36 dB.

(10 marks)

(c) A coaxial cable has inductance of 45nH/m and capacitance of 120pF/m at 20MHz. The diameter of the inner conductor of the cable is 0.842 mm and the relative permittivity (ε_r) of the insulation is 2.27.

(i) Calculate the line impedance of the cable.
(ii) Calculate the outer conductor diameter.
(iii) Find the velocity factor and propagation velocity of the cable.
(Speed of light: $c = 3 \times 10^8$ m/s)

(6 marks)

(d) There are two types of commonly used transmission line.

(i) Briefly explain each type of them.
(ii) From Q4(d)(i), gives an examples for each type.
(iii) State three (3) types of losses in transmission line.

(7 marks)

Q5 (a) The characteristics of radio wave are almost similar to the light waves which are the reflection, the refraction and the diffraction. Briefly explain each of the characteristics mentioned.

(6 marks)

(b) An antenna is to be installed to receive a LOS wave transmitted from a 0.15 km in height antenna located at a distance of 70,000m from this installation. Determine the necessary height of the receiving antenna in km.

(4 marks)

(c) All of the most common types of antennas used in communications industry are based on a basic dipole. Sketch and label the components of dipole antenna.

(4 marks)

(d) A radio wave moves from air (ε_r = 1) to glass (ε_r = 5.8) with angle of incidence 25°. Assuming the relative permeability (μ_r) is unity,

(i) Determine the angle of refraction.
(ii) Find the critical angle.

(6 marks)

(e) Sketch the diagrams of the normal propagation modes, ground wave, sky wave and space wave.

(5 marks)

Q6 (a) (i) Explain the usage of a 'limiter' in the FM (Frequency Modulation) discriminator.
(ii) Sketch the limiter input signal.
(iii) Sketch the limiter output signal.

(4 marks)

(b) List the one (1) advantage and one (1) disadvantage of ground wave propagation.

(2 marks)

(c) List three (3) types of AM demodulator circuits.

(3 marks)

(d) Tuned RF Receiver (TRF) is the earliest and simplest receiver design. TRF consist of RF amplifiers stages, detector and audio amplifier stages.

(i) Give two (2) disadvantages of Tuned Radio Frequency (TRF) receiver.
(ii) Suggest the receiver that designed to overcome the problems in TRF receiver.
(iii) Explain three (3) stages of the suggested receiver according to Q3(d)(ii) answer.

(6 marks)

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

(6 marks)

(f) Electronic communication engineering moving forward in a very fast phase.

(i) Give two (2) suggestions what will be happen to the future communication system.
(ii) According to your answer in Q6(f)(i), briefly explain how it helps in our daily life.

(4 marks)

- END OF QUESTION -

Table Q1(c): Frequency Allocations

Designation	Frequency. Range (Hz)
ELF	30 – 300
VF	300 – 3 K
VLF	3 K – 30 K
LF	30 K – 300 K
MF	300 K – 3 M
HF	3 M – 30 M
VHF	30 M -300 M
UHF	300 M – 3 G
SHF	3 G – 30 G
EHF	30 G – 300 G

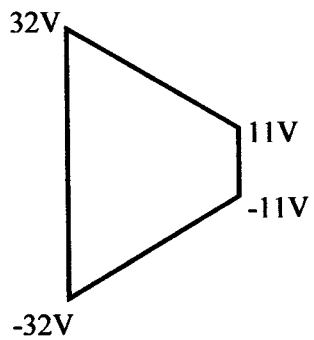

FIGURE Q2(c)

TABLE Q3(b): 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

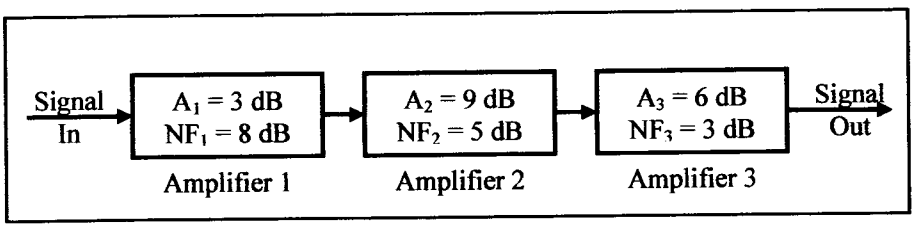

FIGURE Q4(b)