Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	COMMUNICATION ENGINEERING
COURSE CODE	:	DAE 32603
PROGRAMME	:	3 DAE
EXAMINATION DATE	:	DECEMBER 2013/JANUARY 2014
DURATION	:	2 ½ HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) All electronic communication systems have the basic components that allow an electromagnetic wave travels from the source to the destination in a complete system. Using an appropriate block diagram, briefly explain four (4) primary components of an electronic communications.

(8 marks)

(b) A communication system link using a transmitter power transmitted from an antenna with Signal to Noise Ratio (SNR) of 30 dB. The transmitted signal use Super High Frequency (SHF) band which is ranged from 3 GHz to 30 GHz.

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

(12 marks)

(c) Electronic communications are classified according to whether they are:

(i) Simplex or duplex transmissions.
(ii) Analog or digital signals.

Explain each of the term above.

(5 marks)

Q2 (a) Amplitude modulation (AM) is defined as amplitude of carrier frequency change proportionately to the value of the modulation signal.

(i) List two (2) advantages of AM.
(ii) List two (2) disadvantages of AM.

(4 marks)

(b) Given an input to a conventional AM modulator is a 700 kHz carrier with amplitude of 30 V_p. The second input is a 25 kHz modulating signal that is of sufficient amplitude to cause a change in the output wave of $\pm$ 6.5 V_p. Determine;

(i) Upper and lower side frequencies.
(ii) Modulation coefficient and percent modulation.
(iii) Peak amplitudes in volts of the frequency spectrum.
(iv) Sketch the output spectrum.
(v) The carrier power if R = 75Ω.
(vi) Total transmitted power.

(15 marks)

(c) List three (3) parameters used to evaluate the ability of a receiver to successfully demodulates radio signals.

(3 marks)

(d) TRF (Tuned Radio Frequency) receiver is the earliest and simplest receiver design. However there are some disadvantages of TRF receiver.

(i) State the receiver that can overcome problems in TRF receiver.
(ii) Give two (2) advantages of the receiver as in Q2(d)(i).

(3 marks)

Q3 (a) An FM signal expressed as $V_{FM}(t) = 55\cos(2\pi 10^7 t + 2.5\sin 2\pi(2\times 10^4)t)$ is measured in a 72 ohm antenna. By referring to **Table Q3(a)** , determine the following :

(i) Total power, P_T.
(ii) Modulation index, β.
(iii) Peak frequency deviation, Δf.
(iv) Deviation sensitivity (kf), if 320mV is require to achieved part Q3(c)(iii).
(v) Amplitude spectrum voltages.
(vi) Bandwidth using Bessel table.
(vii) Approximate bandwidth by Carson's rule.
(viii) Sketch the FM signal spectra.

(20 marks)

(b) "PLL" is a type of FM demodulator circuits. All "PLL" have three basic elements.

(i) Give the meaning of "PLL" acronym.
(ii) Sketch the block diagram of "PLL" elements.

(5 marks)

Q4 (a) Electrical noise is defined as any undesirable electrical energy that falls within the pass band of the signal. Explain the correlated and uncorrelated noise.

(4 marks)

(b) Uncorrelated noise is divided into two general categories, external and internal. State:

(i) Three (3) primary source of external noise.
(ii) Two (2) primary source of internal noise.

(5 marks)

(c) An amplifier operating over a 4 MHz bandwidth has 100 Ω source resistance. It is operating at 27 °C, has a voltage gain 200 and has an input signal of 5 μV rms. Determine :

(i) Thermal noise power, N.
(ii) Noise voltage, V_N.

(5 marks)

(d) Determine the overall noise factor and noise figure for a three cascaded amplifiers as shown in **Figure Q4(d)**. 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 35dB.

(11 marks)

Q5 (a) Transmission line connects between a transmitter to the antenna or the antenna to the receiver. A perfect transmission line does not radiate any energy and does not have any losses. There are two types of commonly used transmission line.

(i) Briefly explain each type of them.
(ii) From Q5(a)(i), give two (2) examples for each type.
(iii) Briefly describe three (3) types of losses in transmission line.

(12 marks)

(b) A coaxial cable has inductance of 27nH/m and capacitance of 90pF/m at 100MHz. The diameter of the inner conductor of the cable is 0.584 mm and the relative permittivity, ε_r of the insulation is 2.23. Solve :

(i) Line impedance of the cable.
(ii) Outer conductor diameter.
(iii) Velocity factor.
(iv) Propagation velocity of the cable.
(v) Wavelength while travelling through the coaxial cable.

(13 marks)

Q6 (a) 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.

(6 marks)

(b) A ground wave is a radio wave that travels along earth's surface. Give :

(i) Two (2) advantages of ground wave propagation.
(ii) Three (3) disadvantages of ground wave propagation.

(5 marks)

(c) 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.
(iv) Effective Isotropic Radiated Power (EIRP) in dBm.

(14 marks)

- END OF QUESTIONS -

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2013/2014
COURSE : COMMUNICATION ENGINEERING
PROGRAMME : 3 DAE
COURSE CODE : DAE 32603

TABLE Q3(a): Bessel Function

Modulation index	Carrier	Sidebands									
	J_0	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

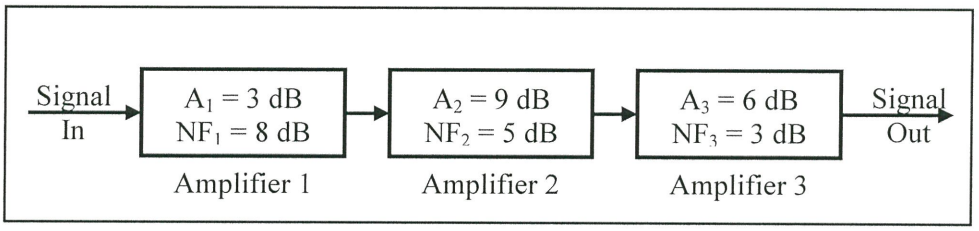

FIGURE Q4(d)

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2013/2014 PROGRAMME : 3 DAE
COURSE : COMMUNICATION ENGINEERING COURSE CODE : DAE 32603

CONSTANT

1. Speed of light , $C = 3 \times 10^8\ m/s$
2. Boltzmann's constant , $K = 1.38 \times 10^{-23}\ J/K$

FORMULA

1. FM Modulated wave , $m(t) = V_c \cos[\omega_c t + \beta \sin(\omega_m)t]$
2. Characteristic impedance of a two wire line , $Z_o \cong \frac{276}{\sqrt{k}} \log_{10} \frac{D}{r}$
3. Characteristic impedance of coaxial cable, $Z_o \cong \frac{138}{\sqrt{k}} \log_{10} \frac{D}{d}$