UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER III
SESSION 2012/2013

COURSE NAME	:	RADIO COMMUNICATION
COURSE CODE	:	DAE 18003
PROGRAMME	:	3 DAL
EXAMINATION DATE	:	MAY 2013
DURATION	:	2 ½ HOURS
INSTRUCTIONS	:	ANSWER **FOUR (4)** QUESTIONS ONLY

Q1 (a) For most of today's radio telecommunication, the carrier alternating current in given of frequencies. Illustrates three common modulation used for analog communication systems.

(6 marks)

(b) The fundamental purpose of an electronic communications system is to transfer information from one place to another place. The most important in communication are transmission, reception and processing of information between two or more location using electronic circuit.

(i) Illustrate the block diagram of typical Amplitude Modulation (AM) receiver.

(6 marks)

(ii) Explain the operation of every function for the system state at Q1(b)(i).

(7 marks)

(c) From your knowledge of the Amplitude Modulation, explain the meaning of

(i) sideband

(2 marks)

(ii) single sideband

(2 marks)

(iii) double sideband suppressed carrier

(2 marks)

Q2 (a) Angle modulation is used extensively for commercial radio broadcasting, television sound transmission and two way mobile radios. If one system build for a Frequency Modulation (FM) with a peak frequency deviation $\Delta f = 50$ kHz, a modulating signal Vm (t) = Vm sin ($2\pi25$kt), and an unmodulated carrier Vc= 16 sin ($2\pi500$kt), determine

(i) the number of sets of significant side frequencies

(5 marks)

(ii) their amplitude and draw the frequency spectrum showing their relative amplitudes

(5 marks)

(iii)   actual minimum bandwidth from the Bessel function table

(3 marks)

(iv)   approximate minimum bandwidth using Carson's rule

(3 marks)

(v)   draw the output frequency spectrum and showing the sideband frequencies and relative amplitudes approximately using Bessel function.

(9 marks)

Q3   (a)   The Federal Communications Commission (FCC) issues licenses for certain bands, such as AM/FM radio and ham radio frequencies, while other bands, such as Family Radio Services, can be used without license on approved devices. International Telecommunication Union (ITU) divided the operation frequency to several band,

(i)   list two of the operation frequency

(2 marks)

(ii)   explain the applications of the frequency at Q3(a)(i)

(6 marks)

(b)   For a Double Sideband Full Carrier of Amplitude Modulation wave with a peak unmodulated carrier voltage Vc = 15 Vp , a load resistance R_L = 12 Ω, and a modulation coefficient m = 0.5, determine

(i)   power of the carrier and the upper and lower sidebands

(6 marks)

(ii)   total sideband power

(3 marks)

(iii)   total power of the modulated wave

(4 marks)

(iv)   draw the power spectrum

(4 marks)

Q4 (a) There are two basic types of radio receiver in an Amplitude Modulation. Explain each of them.

(4 marks)

(b) Tuned Radio Frequency (TRF) receiver was one of the earliest types of Amplitude Modulation receiver. Illustrate the block diagram of TRF radio receiver.

(8 marks)

(c) TRF receivers are simple and have problem that limit their usage Describe these three disadvantages of its.

(6 marks)

(d) Consider a standard Amplitude Modulation broadcast band receiver that spans the frequency range from 550 to 1550 kHz. If the approximate centre of 1000 kHz is considered, for desired bandwidth of 10 kHz, calculate

(i) the Q factor

(3 marks)

(ii) bandwidth suitable for TRF receiver.

(4 marks)

Q5 (a) There are several parameters commonly used to evaluate the ability of the receiver to successfully demodulate a radio signal. The common parameters are selectivity and sensitivity;

(i) define those two parameters

(6 marks)

(ii) explain the importance of these parameters

(4 marks)

(iii) identify the unit that they are usually expressed

(2 marks)

(b) A superheterodyne receiver using high side injection having Radio Frequency (RF) carrier of 27 MHz and an Intermediate Frequency (IF) center frequency of 455 kHz, determine

(i) local oscillator frequency

(4 marks)

(ii)   image frequency

(3 marks)

(iii)   image frequency rejection ratio (IFRR) for a preselector Q of 100

(6 marks)

Q6 (a)   JKL Communication Company want to produce system for Amplitude Modulation Double Sideband Full Carrier (AM-DSBFC) transmitter with an unmodulated carrier power, Pc = 100W which is modulated simultaneously by three modulating signals with coefficient of modulation, m1 = 0.2, m2 = 0.4, m3 = 0.5; As assistance engineer in research and development unit determine,

i)   total coefficient of modulation

(3 marks)

ii)   upper and lower sideband power

(2 marks)

iii)   total transmitted power

(2 marks)

(b)   Modulation is simplifying the process of changing one or more properties of the analog carrier in proportion with the information signal. Explain modulated spectrum and list the main components.

(5 marks)

(c)   A Tune Radio Frequency (TRF) receiver is to be designed with a single tuned circuit using 10 μH inductor.

(i)   Calculate the capacitance range of the variable capacitor required to tune from 550 to 1550 kHz

(6 marks)

(ii)   The ideal 10 kHz BW is to occur at 1100 kHz. Determine the required Q.

(3 marks)

(iii)   Calculate the Bandwidth of this receiver at 550 kHz and 1550 kHz

(4 marks)

- END OF QUESTION -

Bessel Function Table

Modulation Index m	Carrier J$_0$	J$_1$	J$_2$	J$_3$	J$_4$	J$_5$	J$_6$	J$_7$	J$_8$	J$_9$	J$_{10}$	J$_{11}$	J$_{12}$	J$_{13}$	J$_{14}$
0.00	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	—	—	—	—	—	—	—	—	—	—
2.4	0	0.52	0.43	0.20	0.06	0.02	—	—	—	—	—	—	—	—	—
2.5	−0.05	0.50	0.45	0.22	0.07	0.02	0.01	—	—	—	—	—	—	—	—
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	0.05	0.02	—	—	—	—	—	—
5.45	0	−0.34	−0.12	0.26	0.40	0.32	0.19	0.09	0.03	0.01	—	—	—	—	—
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	0.03	—	—	—
8.65	0	0.27	0.06	−0.24	−0.23	0.03	0.26	0.34	0.28	0.18	0.10	0.05	0.02	—	—
9.0	−0.09	0.25	0.14	−0.18	−0.27	−0.06	0.20	0.33	0.31	0.21	0.12	0.06	0.03	0.01	—
10.0	−0.25	0.05	0.25	0.06	−0.22	−0.23	−0.01	0.22	0.32	0.29	0.21	0.12	0.06	0.03	0.01

Side Frequency Pairs