Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	COMMUNICATION ENGINEERING
COURSE CODE	:	DAE 32603
PROGRAMME	:	3 DAE
EXAMINATION DATE	:	DECEMBER 2014/ JANUARY 2015
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	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) Explain each element of the communication system.

(4 marks)

(ii) Sketch the block diagram of a transmitter.

(2 marks)

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

(i) State both types.

(2 marks)

(ii) Gives an example of each type as in **Q1(b)(i).**

(2 marks)

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

(i) State **two (2)** applications of SHF.

(2 marks)

(ii) Calculate the SHF bandwidth.

(2 marks)

(iii) Calculate the channel capacity of the signal.

(2 marks)

(iv) From your point of view, shows what happens to the channel capacity if the SNR is increased to 30dB?

(3 marks)

(d) Signals travel in different ways. Explain with the aid of diagrams **three (3)** types of transmission modes.

(6 marks)

Q2 (a) Given an input to a conventional AM modulator is a 700 kHz carrier with amplitude of 40 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 ± 12.5 V_p. Determine;

(i) Modulation coefficient, m.

(2 marks)

(ii) Index modulation percentage, M

(1 marks)

(iii) Upper and lower side frequency amplitude, V_{USB} and V_{LSB}.

(1 marks)

(iv) Frequency limit for upper and lower sideband (f_{USB} and f_{LSB}),

(2 marks)

(v) Bandwidth, BW.

(1 marks)

(vi) The total power of the AM wave, P_T, if load resistance $R_L = 75\ \Omega$.

(4 marks)

(vii) Sketch the output spectrum for this AM DSBFC (Double Sideband Full Carrier).

(3 marks)

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

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

(5 marks)

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

(2 marks)

(iii) Calculate the bandwidth, BW of this receiver at 550 kHz and 1550 kHz.

(4 marks)

Q3 (a) Frequency modulation (FM) is considered to be superior to amplitude modulation (AM).

(i) Give **three (3)** advantages of frequency modulation (FM).

(3 marks)

(ii) Give **two (2)** disadvantages of frequency modulation (FM).

(2 marks)

(b) An FM signal, $v_{FM}(t) = 22 \sin (4\pi \times 10^8 t - 1.5 \cos 7\pi \times 10^3 t)$, is applied to a 63Ω antenna. By referring to **Table Q3(b)**, determine the following :

(i) Total power, P_T.

(1 mark)

(ii) Peak frequency deviation, Δf.

(3 marks)

(iii) Deviation sensitivity (kf), if 300 mV is require to achieved part **Q3(b)(ii).**

(2 marks)

(iv) Amplitude spectrum voltages.

(5 marks)

(v) Bandwidth using Bessel table.

(1 mark)

(vi) Approximate bandwidth by Carson's rule.

(1 mark)

(vii) Sketch the FM signal spectra.

(3 marks)

(c) List **four (4)** types of FM demodulator circuits that you know.

(4 marks)

Q4 (a) Transmission line is a medium connection between transmitter to receiver in communication system. List **four (4)** types of transmissions line.

(4 marks)

(b) In general term, noise can be defined as interference or interruption.

(i) Explain the definition of Electrical Noise

(2 marks)

(ii) Differentiate between the correlated and uncorrelated noise.

(4 marks)

(iii) Uncorrelated noise divided into two general categories, external and internal. State **two (2)** primary source of external noise and **two (2)** primary source of internal noise.

(4 marks)

(c) Determine the overall noise factor and noise figure for a three cascaded amplifiers as shown in **Figure Q4 (c).** Then, find the input Signal to Noise Ratio (SNR) in decibel (dB) at the initial stage if the output SNR to the whole system is 53 dB.

(11 marks)

Q5 (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.

(2 marks)

(ii) **Three (3)** disadvantages of ground wave propagation.

(3 marks)

(c) An antenna is to be installed to receive a LOS wave transmitted from a 150m in height antenna located at a distance of 90 km from this installation. Determine the necessary height of the receiving antenna in km.

(4 marks)

(d) A submarine under the sea level sends a signal to a mainland station with an angle of 63.5° against the water surface. If the sea water has $\mathcal{E}_{r1} = 12$, $\mu_{r1} = 0.45$ and the air has $\mathcal{E}_{r2} = 1$, $\mu_{r2} = 6.5$. Determine.

(i) Sea water refraction index.

(2 marks)

(ii) Air refraction index.

(2 marks)

(iii) Angle of refraction.

(2 marks)

(iv) The critical angle.

(2 marks)

(v) The critical angle if the ratio between $n_1 : n_2$ is 1 :20.

(2 marks)

Q6 (a) Antenna array is formed when two or more antenna elements are combined to form a single antenna. Antenna element is an individual radiator such as half or quarter wave dipole. Driven and parasitic are the **two (2)** types of element in antenna array.

(i) Explain the function and the length of driven and parasitic element.

(6 marks)

(ii) Sketch the diagram of antenna array.

(3 marks)

(b) Antenna polarization is the direction in space of electric vector of the electromagnetic wave from the antenna. List **three (3)** types of antenna polarizations.

(3 marks)

(c) In transmission line connection, a parallel wire cable has inductance of 32 nH/m and capacitance of 70 pF/m at 900MHz. The radius 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.

(2 marks)

(ii) Distance between conductors.

(3 marks)

(iii) Velocity factor.

(2 marks)

(iv) Propagation velocity of the cable.

(2 marks)

(v) Wavelength in free space.

(2 marks)

(vi) Wavelength while travelling through the coaxial cable.

(2 marks)

- END OF QUESTION -

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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

Table Q3(b): Bessel Table

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

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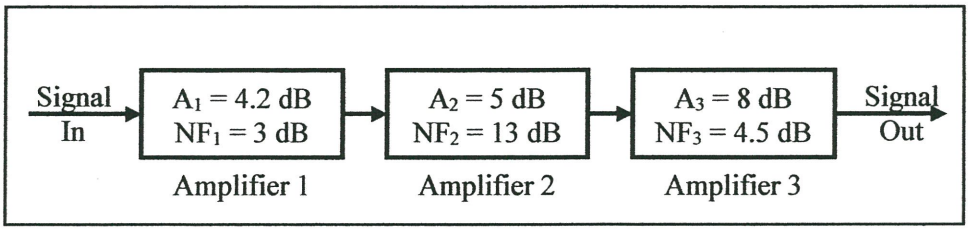

FIGURE Q4 (c)

List of formula:

1. Ganeral equation for Frequency Modulation

$$v_{FM} = V_c \cos[\omega_c t + \beta \sin(\omega_m t)]$$

2. Formula for line impedance of coaxial and parellel wire cable.

$$Z_0 = \frac{138}{\sqrt{k}} \log \frac{d_1}{d_2}$$

$$Z_0 = \frac{276}{\sqrt{k}} \log \frac{d}{r}$$