Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	COMMUNICATION SYSTEM
COURSE CODE	:	DAR 31703
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 (a) 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 are 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)

(iv) An amplifier for a receiver circuit is operating at 4 MHz bandwidth with a 100 Ω source resistance and 27 °C temperature. Determine the thermal noise power, N. Given Boltzmann's constant is $1.38 \times 10^{-23} J/K$.

(3 marks)

(b) Determine the overall noise factor and noise figure for a three cascaded amplifiers as shown in **Figure Q1 (b).** 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 40 dB.

(12 marks)

Q2 (a) An electromagnetic wave travels from the source to the destination in a complete system of communication.

(i) Sketch the block diagram of communication system.

(2 marks)

(ii) Explain each element in **Q2(a)(i).**

(4 marks)

(b) Modulation is a process of changing some characteristics of a carrier wave in accordance with the intensity of the information signal. Explain **two (2)** reasons the important of modulation.

(4 marks)

(c) Amplitude modulation signals, v_{AM} is generated by imposing the information signals, $v_m(t) = 15\ \sin(6\pi \times 10^3)t\ V$ into a carrier signals $v_c(t) = 20\ \sin(300\pi \times 10^3)t\ V$. Determine;

(i) Modulation coefficient, m.

(2 marks)

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

(2 marks)

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

(2 marks)

(iv) Bandwidth, BW.

(2 marks)

(v) The total power of the AM wave, P_T if R=50 Ohm.

(3 marks)

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

(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) Amplitude spectrum voltages.

(5 marks)

(iv) Bandwidth using Bessel table.

(2 marks)

(v) Approximate bandwidth by Carson's rule.

(2 marks)

(vi) Sketch the FM signal spectra.

(3 marks)

(c) List **four (4)** parameters that used to evaluate the ability of a radio receiver.

(4 marks)

Q4 (a) Draw and label correctly the block diagram of the digital data flow in data communication system.

(6 marks)

(b) Multiplexing is one of the most important process in digital communication transmission.

(i) Define the term of multiplexing process.

(2 marks)

(ii) Differentiate between Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM) with aid of figure.

(6 marks)

(iii) Explain how does increasing the number of signals to be multiplexed affect the bandwidth of the transmitted signal.

(4 marks)

(c) An audio frequency signal, $f_a = 3400\ Hz$ is band limited to a voice frequency limit, find:

(i) The minimum frequency required to sample the audio signal in order to be transmitted without aliasing.

(2 marks)

(ii) The Nyquist interval and the bit rate if the voice signal is being sampled at 8 bit per sample.

(2 marks)

(iii) Calculate the time required to send one bit of data.

(3 marks)

Q5 (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 900 MHz. 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)

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.

(2 marks)

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

(3 marks)

(c) As telecommunication engineer, you are assigned by your company to set up receiver tower at certain location. An antenna is to be installed to receive a LOS wave transmitted from a 150 m 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) 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.

(i) Briefly describe **three (3)** types of losses in transmission line.

(6 marks)

(ii) Suggest a solution to reduce transmission line conductor losses.

(4 marks)

- END OF QUESTION –

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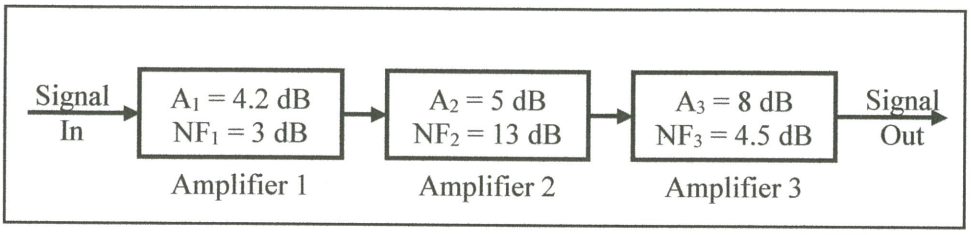

Figure Q1 (b)

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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List of formula:

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

2. Friss formula
   $$F_T = F_1 + \frac{F_2 - 1}{A_1} + \frac{F_3 - 1}{A_1 A_2} + \frac{F_n - 1}{A_1 A_2 \ldots A_n}$$

3. Total power
   $$P_T = P_c\left(1 + \frac{m^2}{2}\right)$$

4. Characteristic impedance for coaxial cable
   $$Z_0 = \frac{138}{\sqrt{\varepsilon_r}} \log \frac{d_1}{d_2}$$

5. Characteristic impedance for parallel wire
   $$Z_0 = \frac{276}{\sqrt{\varepsilon_r}} \log \frac{d}{r}$$

6. Velocity factor
   $$v_f = \frac{1}{\sqrt{\varepsilon}}$$

7. Propagation factor
   $$v_p = v_f \cdot c$$