Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

COURSE NAME	:	COMMUNICATION ENGINEERING
COURSE CODE	:	DAE 32603
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JANUARY / FEBRUARY 2022
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **OPEN BOOK**.

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

SECTION A (20 MARKS)

Q1 The original electrical information signal to be transmitted is called the
- A Broadband signal
- B Baseband signal
- C Multiband signal
- D Singleband signal

Q2 The process of modifying a high frequency carrier with the information to be transmitted is called
- A Multiplexing
- B Companding
- C Modulation
- D Demodulation

Q3 A power level of 50 μW could be expressed as:
- A 1.69 dBm
- B – 4.3 dBm
- C 1 dBm
- D – 13 dBm

Q4 This noise usually comes from lightning, the electric discharges that occur between clouds or between the earth and clouds. This noise refers to
- A Atmospheric Noise
- B Solar Noise
- C Thermal Noise
- D Extraterrestrial Noise

Q5 What is the noise temperature if the noise figure are 3.5 dB?
- A 649.23 Kelvin
- B 359.23 Kelvin
- C 916×10^3 Kelvin
- D 338.17 Kelvin

Q6 "The ability of the receiver to pick up a weak signals". This statement refer to
- A Selectivity
- B Fidelity
- C Sensitivity
- D Dynamic range

Q7 All these component are use in amplitude modulation superheterodyne receiver circuit except

A RF amplifier
B Local oscillator
C Demodulator
D Limiter circuit

Q8 The maximum deviation of an FM carrier is 2 kHz by a maximum modulating signal of 400 Hz. The deviation ratio is

A 0.2
B 5
C 8
D 2.5

Q9 What happen to the FM signals if the value of modulation index becomes zero?

A the sideband signals becomes lower
B only carrier signals available
C effect of noise will increased
D amplitude of information equal to amplitude of carrier

Q10 In digital communication system, which process is NOT related to data conversion process

A Sampling
B Quantization
C Encoding
D Modulation

Q11 By using Nyquist theorem, calculate are the maximum frequencies in the input signal if the telephone audio system is sampled at 8 kHz.

A 16 kHz
B 4 kHz
C 8 kHz
D 64 kHz

Q12 The information signal becomes indistinguishable to reconstruct from the discrete time samples. This effect refers to

A Aliasing effect
B Sampling effect
C Nyquist effect
D Digital conversion effect

Q13 What is an unbalanced line?

A Feed line with neither conductor connect to ground
B Feed line with both conductors connected to ground
C Feed line with one conductors connected to ground
D Feed line with both conductors connected to each others

Q14 Name the device that can be installed to feed a balanced antenna with an unbalanced feed line.

A Balun
B A loading coil
C A triaxial transformer
D A wavetrap

Q15 What happens to signal loss if the length of a feed line is changed?

A Signal loss is the same for any length of feed line.
B Signal loss increases as length increases.
C Signal loss decreases as length increases.
D Signal loss is the least when the length is the same as the signal's wavelength.

Q16 When a signal travels in a straight line from one antenna to another is called

A Line-of-sight propagation
B Straight-line propagation
C Knife-edge diffraction
D Tunnel propagation

Q17 _____ is the best terrain for ground wave propagation.

A Densely wooded
B Sandy
C City or residential
D Sea water

Q18 Which application below that use near field antenna radiation?

A Bluetooth
B Wi-Fi
C Radio frequency identification (RFID)
D Televisyen broadcasting

Q19 If an antenna has a gain of 30 dB, it increases the output of the transmitter by

A 10,000 times
B 1000 times
C 100 times
D 30 times

Q20 Which antenna radiates an omnidirectional pattern in the horizontal plane with vertical polarization?

A Marconi antenna
B Discone antenna
C Horn antenna
D Helical antenna

SECTION B (80 MARKS)

Q1 (a) Total harmonic distortion (THD), is the ratio of the quadratic sum of the root mean square (rms) values of all the higher harmonics to the rms value of the fundamental. Find the percent second-order, third-order and total harmonic distortion for a fundamental frequency with an amplitude of $9\ V_{rms}$, a second harmonic amplitude of $1.2\ V_{rms}$, and a third harmonic amplitude of $0.8\ V_{rms}$.

(6 marks)

(b) A receiver with a $50\ \Omega$ input resistance operates at a temperature of $37°C$. The received signal is at $101\ MHz$ with a bandwidth of $8\ MHz$. The received signal voltage of $6.3\ \mu V$ is applied to an amplifier with a noise figure of $4.8\ dB$. Justify

(i) The input noise power

(4 marks)

(ii) The input signal power

(2 marks)

(iii) Input SNR, in decibels

(2 marks)

(iv) The noise ratio and SNR of the amplifier (output),

(4 marks)

(v) The noise temperature of the amplifier.

(2 marks)

Q2 (a) **Figure Q2(a)** shows the Single Sideband (SSB) generation circuit using phasing method. Identify the signal output of *A*, *B*, *C*, *D* and *E* if the modulating and carrier signal are $v_m = 3 \sin 150\, t$ and $v_c = 6 \cos 500\, t$.

(10 marks)

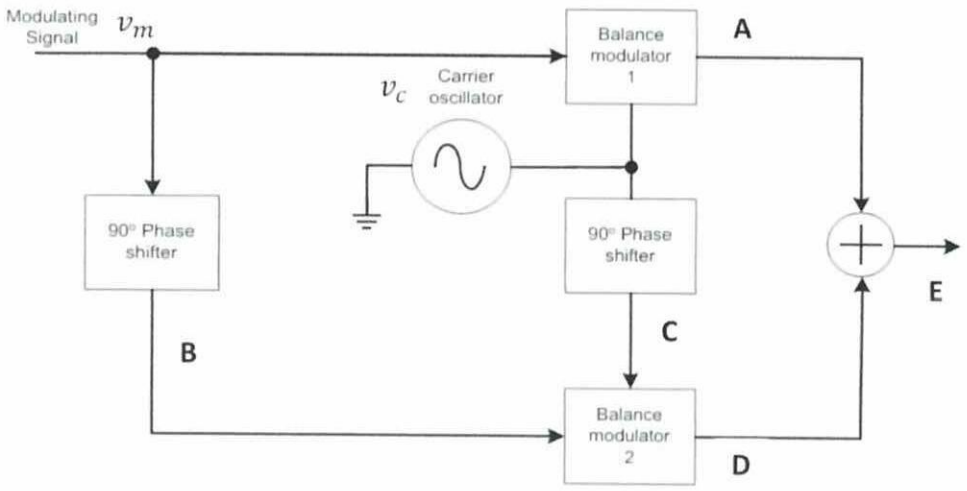

Figure Q2(a)

(b) An FM signal, $v_{FM} = 45 \cos(350\pi \times 10^6 t + 0.5 \sin 15\pi \times 10^6 t)$, is applied to a 75 Ω antenna. By referring to the Bessel Table in **Table 1,** determine :

(i) Total power, P_T.

(2 marks)

(ii) Peak frequency deviation, f_d

(2 marks)

(iii) Amplitude spectrum voltages.

(2 marks)

(iv) Bandwidth using Bessel table.

(2 marks)

(v) Approximate bandwidth by Carson's rule.

(2 marks)

Q3 (a) Amplitude shift keying (ASK) is the simplest digital modulation technique that contains digital information signal (v_m) and carrier signal (v_c) as shown in **Figure Q3(a).** If the carrier signal is $v_c = 2 \sin 1000\, t$, find the possible output for V_{ASK} signal.

(4 marks)

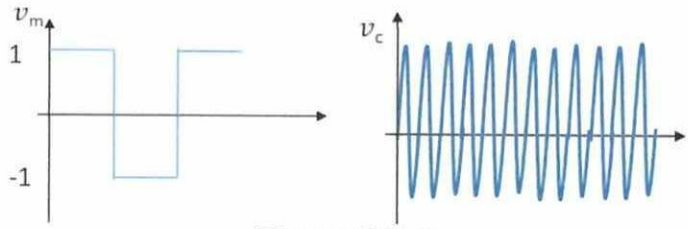

Figure Q3(a)

(b) Multiplexing is one of the most important process in digital communication transmission. Differentiate between Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM) with aid of figure.

(4 marks)

(c) The analog signal in **Figure Q3(c)** is sampled with the frequency which is *5%* higher than the Nyquist sampling rate. The bit rate of this Pulse Code Modulation (PCM) transmission is fixed at *63 kbps*.

(i) Determine the quantization level.

(5 marks)

(ii) Based on the quantization level in **Q3(c)(i),** find the corresponding voltage for each quantization level.

(5 marks)

(iii) Suggest a method to improve the quality of the recovered waveform.

(2 marks)

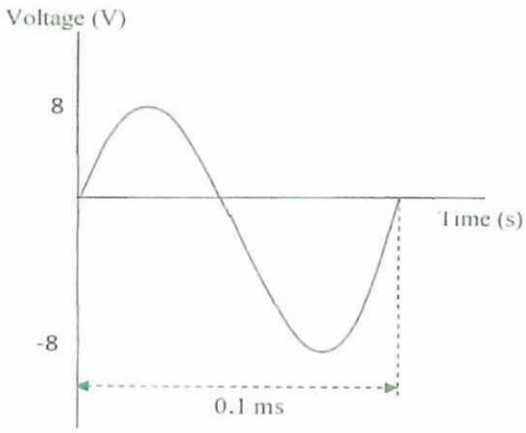

Figure Q3(c)

Q4 (a) Explain the following characteristics of radio wave with the aid of suitable diagram:

(i) Reflection

(2 marks)

(ii) Refraction

(2 marks)

(iii) Diffraction

(2 marks)

(b) A coaxial cable has inductance of *55 nH/m* and capacitance of *145pF/m* at *65 Mhz*. The diameter of the inner conductor of the cable is *0.65 mm* and relative permittivity (ε_r) of the insulation is 1.19. Solve:

(i) Characteristic impedance of the cable

(2 mark)

(ii) Outer conductor diameter

(3 marks)

(iii) Velocity factor

(2 marks)

(iv) Propagation velocity of the cable

(3 marks)

(v) Wavelength in free space

(2 marks)

(vi) Wavelength while travelling through the coaxial cable

(2 marks)

- END OF QUESTIONS –

FINAL EXAMINATION

SEM/SESSION	:	SEM I / 20212022	PROGRAMME CODE	:	DAE
COURSE NAME	:	COMMUNICATION ENGINEERING	COURSE CODE	:	DAE32603

Table 1

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