Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	COMMUNICATION ENGINEERING
COURSE CODE	:	DAE 32603
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JUNE/JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	**SECTION A** : ANSWER **ALL** QUESTIONS **SECTION B**: ANSWER **THREE (3)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **TWELVE (12)** PAGES

SECTION A (25 MARKS)

Q1 A portion in a communications system, which processes the information so that it will become suitable to the characteristic of the transmission medium

A Encoder
B Modulation
C Transmitter
D Multiplexer

Q2 Signal whose physical quantity varies continuously with time

A Digital
B Analog
C Discrete
D Information

Q3 What is the frequency range for ultra high frequency (UHF) band?

A 3 MHz – 30 MHz
B 30 MHz – 300 MHz
C 300 MHz – 3000 MHz
D 3 GHz – 30 GHz

Q4 A device operates at frequency of 2.4 GHz. What is the wavelength of that frequency?

A 0.125 meter
B 0.725 meter
C 1. 25 meter
D 7.25 meter

Q5 A power level of 50 μW could be expressed as:

A 1.69 dBm
B – 4.3 dBm
C 1 dBm
D – 13 dBm

Q6 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

Q7 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

Q8 Which of the following is not true about AM?

A The carrier amplitude varies.
B The carrier frequency remains constant.
C The carrier frequency changes.
D The information signal amplitude changes the carrier amplitude.

Q9 What is the characteristics for a Single Side Band?

i. The bandwidth signals becomes wider
ii. The signal can travel more longer
iii. The frequency is combination from carrier and information signals
iv. About 66% power will reduced compared to Full AM

A ii and iii
B i and ii
C ii and iv
D iii and iv

Q10 "The ability of the receiver to pick up a weak signals". This statement refer to

A Selectivity
B Fidelity
C Sensitivity
D Dynamic range

Q11 All these component are use in amplitude modulation superheterodyne receiver circuit except

A RF amplifier
B Local oscillator
C Demodulator
D Limiter circuit

Q12 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

Q13 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

Q14 In digital communication system, which process is NOT related to data conversion process

A Sampling
B Quantization
C Encoding
D Modulation

Q15 By using Nyquist theorem, what 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

Q16 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

Q17 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

Q18 What device 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

Q19 As the length of a feed line is changed, what happens to signal loss ?

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.

Q20 When a signal travels in a straight line from one antenna to another, what is this called ?

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

Q21 How does the range of sky-wave propagation compare to ground-wave propagation?

A It is much shorter
B It is much longer
C 1t is about the same
D It depends on the weather

Q22 Over which of the following types of terrain will the ground wave component propagate best?

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

Q23 Which application below that use near field antenna radiation

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

Q24 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

Q25 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 (75 MARKS)

Q1 (a) Communication is the process of exchanging information from one point to another.

(i) Sketch the basic block diagram of communication system.

(3 marks)

(ii) Explain each of block diagram in **Q1(a)(i)**

(4 marks)

(b) Noise in communication system can be divided into two types which are correlated and uncorrelated. Explain and give **two (2)** example for each types.

(6 marks)

(c) A radio amplifier manufactured by a company Z has a bandwidth of 10 MHz. The internal resistance is 50 Ω and operates at temperature of 17°C determine:

(i) thermal noise power in watts.

(2 marks)

(ii) thermal noise power in dBm.

(2 marks)

(iii) the noise voltage.

(2 marks)

(d) For a nonlinear amplifier with the following parameter,

Input signal power = $2x10^{-10}$ W
Input noise power = $2x10^{-18}$ W
Output signal power = $5x10^{-6}$ W
Output noise power = $10x10^{-15}$ W

Determine ;

(i) Input SNR (dB)

(2 marks)

(ii) Output SNR (dB)

(2 marks)

(iii) Noise figure

(2 marks)

Q2 (a) A good radio receiver requires some parameters to be considered. List **four (4)** parameters that you know to evaluate the ability of FM radio receiver.

(4 marks)

(b) Frequency modulation signals, v_{FM} is generated by imposing the information signals, $v_m = 15\ \cos 5\pi \times 10^3 t\ V$ into a carrier signals $v_c = 75\ \cos 350\pi \times 10^3 t\ V$ with internal resistance of 50 Ω. If the frequency deviation is 5.0 kHz,

(i) Determine the total power, P_T.

(2 marks)

(ii) Determine the modulation index, β.

(2 marks)

(iii) State the full FM equation

(2 marks)

(iv) Determine the amplitude voltages for each spectrums.

(3 marks)

(v) Determine the bandwidth using Bessel table.

(2 marks)

(vi) Determine the approximate bandwidth by Carson's rule.

(2 marks)

(vii) Sketch the full FM frequency spectrum

(3 marks)

(d) Single Side Band (SSB) is widely used as amplitude modulation (AM) transmission because it uses less power than full AM. Prove that the power used in SSB is 83% less compared to full AM.

(5 marks)

Q3 (a) Channel capacity is one of the parameter of information theory for data communications.

(i) Describe the meaning of channel capacity.

(2 marks)

(ii) The bandwidth of a communication channel is 12.5 kHz. The S/N ratio is 25 dB. Calculate the maximum channel capacity

(5 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.

(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)

Q4 (a) List **six (6)** types of antennas.

(3 marks)

(b) With the aid of suitable diagram, explain the basic operation of the transmitting antenna and receiving antenna.

(7 marks)

(c) A dipole transmitting antenna transmit 100 W signal to a receiving antenna with a distance of 100 km. If the gain of the transmitting antenna is 2, find the power density.

(3 marks)

(d) A citizen's band transmitter operating at 27 MHz with 4-W output is connected via 10m of RG-8A/U cable to an antenna that has an input resistance of 300 Ω. Find:
(Assume the velocity of propagation, $v = 2.07 \times 10^8$ m/s)

(i) The reflection coefficient.

(3 marks)

(ii) The electrical length of the cable in wavelengths (λ).

(3 marks)

(iii) The standing wave ratio (SWR)

(3 marks)

(iv) The amount of the transmitter's 4-W output absorbed by the antenna.

(3 marks)

Q5 (a) Draw and label completely the radio wave propagation modes between transmitting and receiving antennas.

(5 marks)

(b) With the aid of suitable diagram, explain the following characteristics of radio wave:

(i) Reflection

(3 marks)

(ii) Refraction

(3 marks)

(iii) Diffraction

(3 marks)

(c) Give **three (3)** advantages and **three (3)** disadvantages of ground wave propagation.

(6 marks)

(d) An antenna is to be installed to receive a line of sight (LOS) wave transmitted from a 68m in height antenna located at a distance of 340 km from this installation. Determine the necessary height of the receiving antenna in km.

(5 marks)

- END OF QUESTION –

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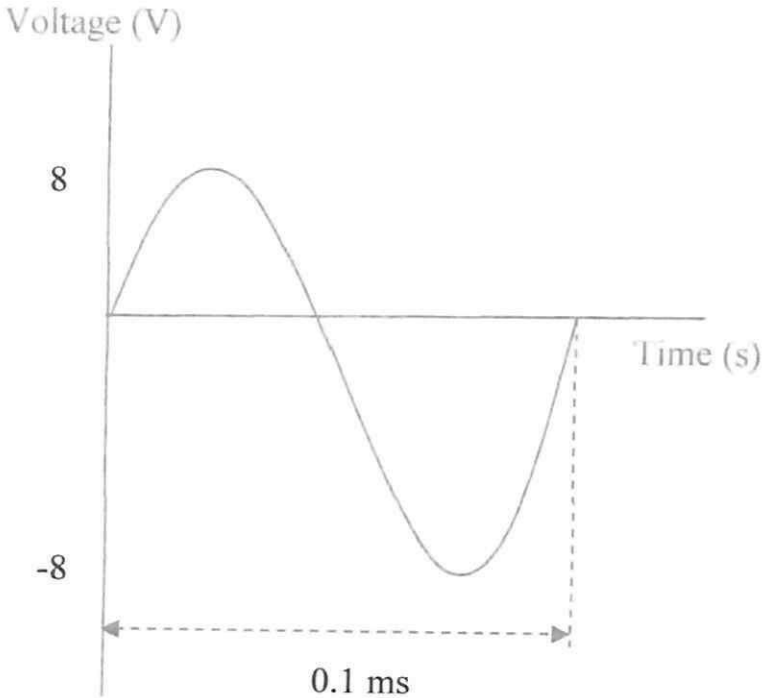

FIGURE Q3 (c)

TABLE 1: 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. Trigonometric Identities

$$\sin A \cdot \sin B = \frac{1}{2}[\cos(A - B) - \cos A + B]$$

$$\cos A \cdot \cos B = \frac{1}{2}[\cos(A + B) + \cos A - B]$$

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

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

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

3. Frequency Modulation equation

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

4. Friss Equation

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

5. Channel capacity

$$C = 3.32\, BW\, log_{10}\left(1 + {}^{S}/_{N}\right)$$