UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	ANTENNA AND PROPAGATION
COURSE CODE	:	MEP 10303
PROGRAMME CODE	:	MEE
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

Q1 (a) An antenna is well known element that acts as a transponder. Antenna converts the electrical power into electromagnetic waves. By having antennas, wireless communication can be realized such as mobile communication, TV broadcasting and many others. Knowing the antenna's properties is very important in order to appreciate its values. Discuss at least **FIVE (5)** of the antenna properties.

(5 marks)

(b) Commercial wireless routers are used for wireless access point. These routers can be accessed by many other wireless devices such as smartphones or laptops:

(i) State the frequency that has been allocated for an access point.

(1 mark)

(ii) The antenna that almost being used as a transmitter for wireless router is a Monopole Antenna. Design and discuss in details the characteristics of such antenna.

(10 marks)

(iii) Explain why monopole antenna is chosen for the transmitting antenna for wireless router.

(2 marks)

(c) Demonstrate how the gain is measured in an anechoic chamber.

(7 marks)

Q2 (a) Review the **FOUR (4)** methods to increase the gain of the microstrip patch antenna for point to point communication system.

(5 marks)

(b) Discuss **FOUR (4)** methods to eliminate the harmonic frequencies of the microstrip antenna.

(5 marks)

(c) Explain the procedure to apply the fractal curve for designing a compact printed antenna.

(5 marks)

(d) Explain the **THREE (3)** techniques to tune the frequency of the reconfigurable antenna.

(5 marks)

(e) Define the following 5G terminology;
(i) mm Wave

(1 mark)

(ii) sub 6 GHz

(1 mark)

(iii) low band

(1 mark)

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       (iv)   beam forming

(1 mark)

       (v)   massive MIMO

(1 mark)

Q3   A local telco company in Malaysia has decided to set up two base stations to improve the coverage area. The distance between the two stations is measured to be 200 km with line of sight communication link. In order to communication with each other, the requirements below must be fulfilled:

- Use an antenna with a power gain of 10 dB for each station;
- Frequency of operation for the communication link is 1.8 GHz;
- The transmitter produces 9 W of power which is fed to the transmit antenna via a 45-meter transmission line with a characteristic impedance of 50 Ω; and
- The transmission line attenuates 8 dB radio frequency (RF) signal at 1.8 GHz/100 meter.

Based on the information given, solve for the followings:

(a)   Power at the input of the antenna assuming a matched load in Watt;

(5 marks)

(b)   Effective Isotropic Radiated Power (EIRP) of the transmitter in dBW;

(5 marks)

(c)   Free space loss in dB;

(5 marks)

(d)   Power density at the received antenna; and

(5 marks)

(e)   Power received at the receiving antenna in Watt. Assume no other losses.

(5 marks)

Q4   (a)   List the **THREE (3)** modes of radio wave propagation.

(3 marks)

       (b)   There are a number of categories into which different types of RF propagation can be placed. Explain **FOUR (4)** types of radio propagation

(12 marks)

       (c)   Given the angle of incident θ is 30° and the cut off frequency is 1.2 GHz. Calculate the maximum usable frequency.

(5 marks)

       (d)   Determine the free space path loss if given the distance is 100 km and the wavelength is 20 m.

(5 marks)

-END OF QUESTIONS –

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