



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024**

COURSE NAME : ANTENNA THEORY AND APPLICATIONS

COURSE CODE : BEJ 41603

PROGRAMME CODE : BEJ

EXAMINATION DATE : JULY 2024

DURATION : 3 HOURS

INSTRUCTION :

1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 - Open book
 - Closed book**
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

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

- Q1**
- (a) Define the importance of antennas in the field of wireless communication. (3 marks)

 - (b) Four of the antenna's characteristics stated below are the major of requirement to be fulfilled by the antenna engineer. Describe the importance and practicality each of the characteristics in details:
 - (i) Reflection Coefficient Magnitude. (4 marks)
 - (ii) Vertical dan Horizontal Polarization. (3 marks)
 - (iii) Operating Bandwidth. (3 marks)
 - (iv) Beamwidth. (3 marks)

 - (c) Express your understanding on the situations as the following:
 - (i) The method to covert a dipole antenna to have a directional feature (3 marks)
 - (ii) The form of the radiated wave in near-field region. (3 marks)
 - (iii) The energy radiated from an isotropic radiator (3 marks)
- Q2**
- (a) Distinguish between wire-type and aperture-type antennas and highlight the specific application of each of them. (5 marks)

 - (b) A monopole antenna is one of the main antennas that famously employed in many wireless applications such as Wi-Fi routers.
 - (i) Design a Wi-Fi monopole antenna that can be used to support the internet speed up to 2Gbps for Unifi packages. For the chosen router, please state the IEEE Standard, maximum data rate, frequencies of operating, and antenna elements. (12 marks)
 - (ii) State **TWO (2)** advantages of deploying a monopole antenna. (2 marks)

 - (c) If the antenna in Q2(b) is designed for the Base Station GSM900 with the gain of 10 dBi, EIRP of 52dBm and 3dB of the cable loss, determine the amplitude of electric field (signal strength) at distance of 1km.

- (6 marks)
- Q3** (a) Rectangular Microstrip Patch Antenna (RMPA) is one of a resonant antenna that widely used in many applications, due its low profile, robustness, and ease of fabrication. Identify and explain the challenges of RMPA for millimetre wave (mmWave) applications in term of substrate materials, frequency bands, patch sizes, connectors and cables and fabrication types.
- (10 marks)
- (b) The antenna in **Q3(a)** has an antenna radiation pattern of broadside that is perpendicular to the plane of the patch.
- (i) Sketch both the 2-Dimensiona radiation pattern of patch antenna for E-Plane and H-Plane.
- (4 marks)
- (ii) Describe the measurement steps required to measure these two planes in **Q3(b)(i)**.
- (8 marks)
- (iii) State **ONE (1)** drawback and **TWO (2)** advantages of RMPA.
- (3 marks)
- Q4** (a) The utilisation of internet at present is very crucial and important particularly in accessing and steaming 4K video or high-resolution online gaming. One of the internet sources is from the mobile cellular system. 5G mobile communication technology has enabled new applications that require high speed. From your understanding and knowledge,
- (i) State the frequency spectrum of 5G in Malaysia and the average speed of the data.
- (6 marks)
- (ii) Identify the required data rate for HD and 4K YouTube applications, online-gaming, HD Netflix streaming and online meeting.
- (6 marks)
- (iii) Propose any type of antenna that can support 5G applications with the aid of diagram, details specification and limitations.
- (10 marks)
- (b) Discuss the advantages of 5G Mobile Communications system.
- (3 marks)

-END OF QUESTIONS-

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