ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

13

MID SEMESTER EXAMINATION
DURATION: 1 HOUR 30 MINUTES

SUMMER SEMESTER, 2022-2023
FULL MARKS: 50

CSE 4615: Wireless Networks

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer **all 3 (three)** questions. Figures in the right margin indicate full marks of questions with corresponding COs and POs in parentheses.

---

1. A microwave transmitter has an output of 0.1 W at 2 GHz. Assume that, the transmitter is used in a microwave communication system where the transmitting antenna is a parabola at a height of 81 m and the receiving antenna is a conical horn at ground level, each 1.2 m in diameter.

   a) What is the gain of each antenna in decibels? Note that, the effective area, A_e of a parabolic antenna (with a face area A) is $0.56A$ and that of a conical antenna (with a mouth area A) is $\frac{2\pi A}{\lambda^2}$. — 4 (CO2) (PO1)

   b) If the receiving antenna is located 20 km away from the transmitting antenna over a free space path, find the available signal power of the receiving antenna in dBm units. — 4 (CO2) (PO1)

   c) What is the maximum coverage of this (Line-of-sight) propagation? Which height will you set for the receiving antenna to triple the maximum coverage? — 2 + 2 (CO2) (PO1)

   d) In designing a communication system, the communication engineers need to estimate the effects of multipath fading and noise on the mobile channel. Describe the Rayleigh and Rician fading with the necessary diagrams. — 4 (CO1) (PO1)

2. a) Explain the different modes of scanning in IEEE 802.11 WLAN. Discuss the advantages and disadvantages of these scanning modes. — 4 (CO1) (PO1)

   b) One MAC Service Data Unit (MSDU) may be fragmented into multiple MAC Protocol Data Units (MPDU) to reduce the duration of channel occupancy in IEEE 802.11 WLAN. Discuss the benefits and drawbacks of the fragmentation process. — 4 (CO1) (PO1)

   c) Consider an infrastructure-based 802.11 WLAN with two stations, station A and station B, both trying to transmit data packets to the Access Point (AP) within the same Basic Service Set (BSS) using the Distributed Coordination Function (DCF). The stations are within the range of each other and can hear each other's transmissions. In the first attempt, they choose the same random number as the backoff value from the contention window, CW = 16. However, in the second attempt they choose a different random number as the backoff value. Considering this scenario, list the sequence of events along with the necessary labeled diagram. — 6 (CO1) (PO1)

   d) What is the disadvantage to the time domain backoff strategy? Describe Back2f (Backoff in frequency Domain) strategy and how it can overcome the disadvantage. — 4 (CO1) (PO1)

3. a) What are the differences between multiplexing and multiple access techniques? Explain the Space Division Multiple Access (SDMA) technique. How can we enhance the channel utilization even after using the SDMA protocol? — 4 (CO1) (PO1)

   b) Illustrate the effect of attenuation and noise on transmission power and comment on their relationship with the maximum transmission-range with a labeled bar chart. — 4 (CO1) (PO1)

c) Describe the working procedure of the Timing Synchronization Function (TSF) in the Basic Service Set (BSS) and the Independent Basic Service Set (IBSS). Why TSF is required in IEEE 802.11 WLAN? 4 (CO1) (PO1)

d) Describe the architecture of Mesh network. Discuss the advantages and disadvantages of a Mesh network over a typical infrastructure network. 4 (CO1) (PO1)