M.Sc. Engg.(EE) / Ph.D. (EE) Date: 17 February, 2023 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 6411
Course Title: Wireless Ad Hoc and Sensor Networks

Summer Semester, A. Y. 2021-2022
Time: 90 Minutes
Full Marks: 75

There are **3 (three)** questions. Answer **all 3 (three)** questions. Programmable calculators are not allowed. Do not write on this question paper.

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1. a) In wireless networking, performance metrics are: i) throughput, ii) delay, iii) fairness, iv) stability, v) channel fading, vi) energy consumption, and vii) power management. As a wireless network designer, explain how you consider each of them for efficient wireless connectivity. Justify your answer by briefly explaining each of them. **8**

   b) Explain four IEEE 802.11 Management Operations: **8**
      i) Scanning,
      ii) Association/Reassociation,
      iii) Time synchronization,
      iv) Power management and/or energy-efficient routing.

2. a) For personal area networking (PAN), IR and Bluetooth technologies have advantages and disadvantages. Justify your choice of technology between IR and Bluetooth technologies by mentioning appropriate applications. **6**

   b) You and your friend want to share data between two wireless enable devices with the help of Bluetooth. Write down the basic characteristics and parameters of Bluetooth communication. **8**
   What is the spread-spectrum frequency hopping of Bluetooth? Briefly explain with examples.

3. a) During the COVID-19 pandemic situation, Bangladesh Government hires you as the network expert. Your task is to build a sustainable network solution among all the intensive care units (ICUs) and the hospitals inside Dhaka city so that the Institute of Epidemiology, Disease Control and Research (*IEDCR*) can stay connected and receive real-time data of the patients. **15**

   Suppose in a day, on average 100 patients are affected. Among them, on average 10 patients (10%) are admitted to ICU and stay there for around 14 days. As a network designer, your task is to develop Intra-Networks among the devices within the Hospitals and Inter-Networks among the hospitals using basic network components. Your designed networks should handle the upcoming patients for the next 6 months to 1 year. Explain your network solution and justify your preferred basic network components based on your design (i.e., end devices, routers, switches, hubs, bridges, cables, etc.

While designing your network and answering the following connected questions, use suitable illustrations, diagrams, tables, and flowcharts as much as possible for better clarification.

b) While designing your above network solution - **15**

i) What are the four layers in the Internet protocol stack (TCP/IP model) that you prefer to use?

ii) What are the principal responsibilities of each of these layers for your designed network?

iii) What are protocol data units (PDU), header, and trailer in data encapsulation in TCP/IP that handle the intra and inter-network data transmission?

iv) Briefly explain how the following responsibilities inside the layer are performed- i) application-layer message, ii) transport-layer segment, iii) network layer datagram, and iv) link-layer frame.

v) Which layer/s in the Internet protocol stack does the routing process of your overall network solution?

vi) Why is the Transport layer called the heart of the OSI model of your design?

c) While designing your above network solution - **15**

i) Which routing algorithms (or combinations) do you use among - Shortest-Path, Flooding, Flow-based, Distance-Vector, Link-State, Hierarchical, Broadcast, and Multicast? Briefly explain and justify your answer.

ii) How do you handle congestion control by defining CSMA/CD and CSMA/CA? Briefly explain.