16

Name of the Program: B.Sc. in EEE
Semester: 5th

Date: 11 October, 2023 (Morning)
Time: 10:30 am – 12:00 pm

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No: EEE 4551
Course Title: Data Communication and Networking I

Winter Semester, A. Y. 2022-2023
Time: 90 Minutes
Full Marks: 75

There are **03 (three)** questions. Answer all **03 (three)** questions. The symbols have their usual meanings. Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are written in the brackets.

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1. a) Briefly explain the role of the electron as the primary medium for electronic data communication. Briefly discuss using suitable illustrations the low-level mechanisms and technologies used to send information across the physical communication medium. **7 (CO1, PO1)**

2. a) Define the Internet of Things (IoT) and explain how it differs from the traditional Internet in terms of its purpose and connectivity. **7 × 2 = 14 (CO1, PO1)**

b) Explain the key abilities and functionalities that Things (sensors and devices) acquire in the IoT. Explain how these abilities enable them to interact and collaborate with other devices in an IoT ecosystem.

3. Imagine you are part of a team responsible for improving waste management in the densely populated Dhaka North City Corporation (DNCC) areas. The title of the project is - *Utilizing Internet of Things for Sustainable Waste Management in Urban Communities*. **9 × 6 = 54 (CO2, CO3, PO2)**

Problem Statement and Background: In urban areas, efficient waste management is a critical challenge that affects both the environment and the quality of life of residents. Traditional waste collection methods can be inefficient, leading to overflowing bins, improper disposal, and increased environmental pollution. The Internet of Things (IoT) offers the potential to revolutionize waste management by enabling real-time monitoring and data-driven decision-making.

Scenario: The local authorities are interested in adopting IoT solutions to address waste-related issues. Your team has been given the responsibility to design an innovative IoT-based system that optimizes waste collection and encourages responsible waste disposal behavior among residents. The solution will monitor waste bins, analytics to optimize collection routes, and a mobile app to engage residents.

As a 3rd-year undergraduate student specializing in Network Engineering, your expertise in IoT can contribute significantly to this project. Develop a comprehensive IoT-based solution for efficient and sustainable waste management in DNCC. Your solution should address the following key points.

a) *IoT Infrastructure:* Describe the network architecture and components required for the IoT system, including sensors, communication protocols, and data aggregation mechanisms.

b) *Real-time Monitoring:* Explain how IoT sensors can be strategically placed to monitor waste levels in bins or containers. Discuss how these sensors collect and transmit data in real time.

c) *Data Analytics:* Discuss the role of data analytics in processing the collected waste data. Explain how this data can be used to optimize waste collection schedules, route planning, and resource allocation.

d) *User Engagement:* Propose ways to engage and educate the community about responsible waste disposal using IoT. Explain how IoT can be used to provide feedback to residents and incentivize them to participate actively in waste reduction efforts.

e) *Scalability and Sustainability:* Consider the long-term viability of your IoT solution. Explain how it can be scaled to accommodate growth in the community. Discuss what measures will ensure the sustainability of the system in terms of maintenance, energy efficiency, and technology updates.

f) *Challenges and Mitigation:* Identify potential challenges, such as privacy concerns, technical failures, or resistance from residents. Suggest strategies to address these challenges and ensure the successful implementation of the IoT-based waste management system in DNCC.

Your solution should demonstrate a strong understanding of network engineering principles, IoT technologies, and their practical application in solving real-world social and community problems. Provide diagrams, examples, and references to support your ideas.