B. Sc. in EEE
Semester: 6th

Date: 17 February 2023
Time: 10.00 AM – 11:30 AM

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

Mid-Semester Examination
Course Number: EEE 4651
Course Title: Data Communication and Networking II

Summer Semester: 2021 - 2022
Full Marks: 75
Time: 90 minutes

There are **3 (three)** questions. Answer **all 3 (three)** questions. Marks of each question and the corresponding CO and PO are written in brackets.

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1. You want to design a universal remote control for controlling home electronic appliances. You are given WiFi, IR, Zigbee, and Bluetooth technologies for wireless connectivity. Explain your technology of preference. Justify your answer by mentioning the comparison among technologies with suitable illustrations and example. **8 (CO1) (PO1)**

2. a) Explain Zigbee technology. Explain why Zigbee is suitable for remotely located sensor networks. Explain why Zigbee is not suitable for LAN design. Explain with suitable illustrations: Zigbee Star network and Zigbee Mesh Network. **8 (CO1) (PO1)**

   b) Explain the functions with the suitable illustration of the following three special frames: i) Acknowledgement (ACK), ii) Request To Send (RTS), and iii) Clear To Send (CTS). **4 (CO1) (PO1)**

3. a) Design an Energy Networking (EN) Solution among the appliances and electrical equipment in your classrooms in IUT. Currently, electricity management and controlling appliances (e.g., ACs, Fans, Lights, etc.) are maintained manually. Therefore, huge amounts of energy are wasted, and the IUT authority has to pay an enormous amount of money for monthly bills. **15 (CO3) (PO2)**

   As an expert in *Intelligent Energy Networks (IEN)*, your task is to assist IUT authority in providing *Energy Networking (EN) Solutions* among appliances (e.g., ACs, Fans, Lights, etc.) and energy equipment (e.g., meters, sub-stations, etc.). All the equipment and devices can communicate with each other with the help of wireless sensor network and intelligently consume energy. Explain your network solution and justify your preferred basic network components based on your design i.e., end devices, routers, switches, hubs, bridges, etc.

   b) While designing your network as mentioned above solution, explain the following choices for network designs- **20 (CO3) (PO2)**
      i) Explain which Physical Layer is preferable: diffused Infrared (IR) or Radio Frequency (RF).
      ii) Explain which Radio Technology is preferable: Direct-Sequence or Frequency-Hopping.
      iii) Explain which frequency range and Bandwidth are preferable.
      iv) Explain which MAC (medium access control) Protocol is preferable.
      v) Explain which Network Architecture is preferable: Peer-Peer architecture or Base-Station approach.

c) If you are asked to use Bluetooth technology, explain the following choices for network designs- **20 (CO3) (PO2)**

i) Justify the use of Bluetooth technology for your *Intelligent Energy Network (IEN)* solution.
ii) Briefly explain the *PicoNet* architecture for your solution.
iii) Briefly explain the *Spread-spectrum frequency hopping* used in the Bluetooth technique for your solution.
iv) Briefly explain each action of Bluetooth technology: *Disconnected, Connecting, Active, and Low power,* as shown in the figure.
v) Briefly explain each state of Bluetooth technology: *Standby, Inquiry, Page, Connected, Transmit, Hold, Sniff, and Park,* as shown in the figure.

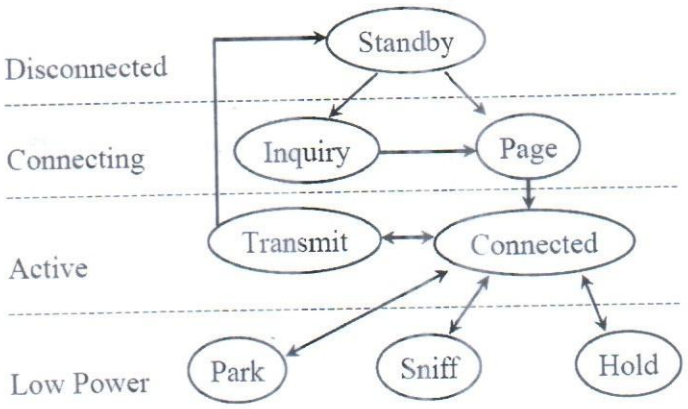

Figure: 3 (c).

Justify all of your answers using suitable illustrations, diagrams, tables, and flowcharts as much as possible for better understanding.