6. (a) Explain the concept of CAN bus arbitration and how it ensures message prioritization. How does the differential signaling used in CAN enhance noise immunity ? **10**

   (b) How can RFID tags and readers be used in a layered security system for access control, and what are the advantages compared to traditional keycard systems ? **5**

7. Explain how RFID tags can be used for electronic toll payment systems. How does data transfer occur during toll booths ? What are the security considerations for using RFID in electronic toll payment systems ? **15**

May 2024

B. Tech. (EEIOT) (Sixth Semester)

Microcontroller and RFID in IoT (EE-IOT-601)

Time : 3 Hours] [*Maximum Marks :* 75

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) How do barcodes incorporate redundancy to ensure accurate data reading despite potential damage ? **1.5**

   (b) How do factors like operating frequency and desired read range influence the choice of RFID tags ? **1.5**

   (c) Illustrate the oscillator circuit and execution timing of 8051 microcontroller. **1.5**

   (d) What are the advantages and disadvantages of using a CAN bus compared to other communication protocols like I2C or SPI ? **1.5**

(e) Describe the steps involved in reading data from an RFID card using an 8051 microcontroller. **1.5**

(f) Discuss the benefits of using RFID for vehicle parking compared to traditional methods like tickets. **1.5**

(g) Compare and contrast barcode ticketing systems with RFID ticketing systems for public transportation. **1.5**

(h) How does the ESP8266 module connect to 2.4 GHz Wi-Fi ? **1.5**

(i) Transfer the contents of the register A, R0 and R1, respectively of bank0 to the register B, R0 and R1 of bank1 using stack operations **1.5**

(j) Illustrate with diagram the significance of gate in TMOD register to control timer/counter module in 8051 microcontroller. **1.5**

Part B

2. (a) How do stacked symbologies encode multiple layers of data within a single barcode image ? Explain with an application. **10**

(b) How antenna designs are optimized for different RFID applications ? **5**

3. (a) Describe the role of the Program Status Word register in the 8051 microcontroller and how individual flags impact program execution. **5**

(b) Interface 4k bytes RAM and 8k bytes ROM to 8051 microcontroller in such a way that starting address of RAM is 1000H and ROM is C000H. **10**

4. Describe the role of a Message Queue Telemetry Transport (MQTT) broker in an ESP8266 controlled relay system and its advantages compared to a simple web server approach. **15**

5. (a) Explain how RFID tags can improve visibility and efficiency throughout a supply chain, from manufacturing to final delivery. How can data from RFID tags be used for inventory management and logistics optimization ? **5**

(b) Write 8051 program to generate square wave with tON = 3 ms and tOFF = 7 ms on all pins of Port 0. System Clock is 22 MHz. Use timer0 in Mode-1. **10**