Roll Number:_____

Thapar Institute of Engineering & Technology, Patiala
Computer Science & Engineering Department
END SEMESTER EXAMINATION (Dec 2022)

B.E. (IV Year): Semester-VII	Course Code: UCS704
	Course Name: Embedded Systems Design
December 12, 2022	Monday, 16:30 – 19:30 PM
Time: 3 Hours, M. Marks: 40	Faculty: Dr. Anju Bala, Dr. Deepshikha Tiwari, Dr. Anil Singh, Dr. Ankit Jaiswal, Dr. Ranjeet K. Ranjan

Note: Attempt all questions. Assume missing data, if any, suitably.

1(a) LED display is a popular choice to show alphanumeric information in many embedded system applications. Twelve segments LED is one such display device which uses 12 LEDs to represent various alphabet and numbers as shown in Fig.1. Assume common anode connection to connect all 12 LEDs, "a" as the LSB bit, "l" as MSB bit and refer remaining bits in alphabetic order. Find the 12 segment codes (in binary) to display following characters.   **(4)**

Fig.1: 12 segment LED display

i)   Y (capital)
ii)   a (small)
iii)   S (capital)
iv)   R (capital)

1(b) Describe Stepper Motors and its working mechanism. Also explain how rotation of the motor is related to the sequence of the input pulses.   **(4)**

2(a) Design Finite State Machine for seat belt alarming system using three states like: IDLE, READY and RUNNING. The FSM should do the following: **(4)**
   i.   Alarm is on if the vehicle is started moving and seat belt is not in use.
   ii.   Alarm is on if the vehicle is in motion but seat belt is not in use.

2(b) Design a smart Drip irrigation system for agriculture. List the IoT devices used to develop the system and explain its working. **(4)**

3(a) A float type variable Y is assigned the decimal value of −14.25. Represent the number in Hexadecimal after converting through single-precision 32-bit floating point format IEEE-754 standard. **(4)**

3(b) Describe the working of RFID (Radio Frequency Identification) and explain its Architecture. **(4)**

4(a) Considering the given process table (Table 1).

Table 1

Process	Burst Time	Arrival Time	Period
P1	2	0	10
P2	1	0	5
P3	5	0	30
P4	2	0	15

(i) Write the necessary condition for RMA (Rate Monotonic Algorithm). Justify your answer with the above values mentioned in the Table 1. **(2)**
(ii) Draw the Gantt chart illustrating the execution of these four processes with RMA. **(3)**

4(b) An operating system uses Shortest Remaining Time first (SRT) process scheduling algorithm. Consider the arrival times and execution times for the following processes. Find the total waiting time for Process P2 shown in Table 2. **(3)**

Table 2

Process	Execution time	Arrival time
P1	20	0
P2	25	15
P3	10	30
P4	15	45

5. Differentiate between followings: **(3, 3, 2)**
 (a) FPGA and CPLD
 (b) Harvard and Super Harvard
 (c) Hard Real Time and Firm Real Time