UNIVERSITY COLLEGE TATI (UCTATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BMT 4033
COURSE TITLE	: EMBEDDED SYSTEM DESIGN
SEMESTER/SESSION	: 2-20232024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **all questions**.
2. All theory and calculation answers should be written in the answer booklet.
3. All software answers should be in a folder labeled with matric number. Specify the question number in filename.
4. Write legibly and draw sketches wherever required.
5. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 7 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) Describe the difference between python language with c language in developing embedded applications by giving **five (5)** comparisons.

(5 marks)

b) Outline a flow chart based on the program below.

```
from machine import ADC,Pin
from utime import sleep

pot = ADC(Pin(27))      # create ADC object on ADC pin
led1 = Pin(3, Pin.OUT)  #create led output at pin 3
led2 = Pin(12, Pin.OUT)  #create led output at pin 12
while 1:
      value=pot.read_u16()   # read adc put in value
      print("raw value:",value)
      volt=value/65535*3.300;
      print("voltage",volt)
      if volt<1:
            led1.value(0) # led is off
            led2.value(0)
      elif volt<2:
            led1.value(1) # led is off
            led2.value(0)
      else:
            led1.value(1) # led is on
            led2.value(1)
      sleep(0.5)
```

(15 marks)

QUESTION 2

a) Figure 1 shows the pin out of the 16x2 LCD. Describe the function of **VSS, VDD, VEE, RS, RW, E** and **data bus (D0-D7)** at LCD.

(7 marks)

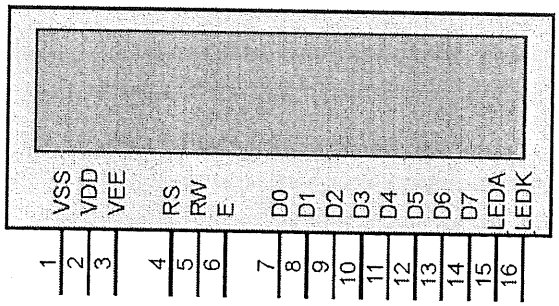

Figure 1: LCD pin out

b) The Raspberry Pi Pico has 3 analog input pins, which convert an analog input (between 0-3.3V by default) into a digital value with 16 bits of resolution. Create an application which **flashing LED change** based on the **setting of the potentiometer**. Use a bank of 4 LEDs and potentiometer reading as ADC input. Connect each LEDs to an output of the Raspberry Pi Pico. Make your code to make all the LEDs flash together

i. Produce schematic diagram for LED connection. Refer to figure 2 for the raspberry pi Pico pin out.

(4 marks)

ii. Outline a program for this application.

(6 marks)

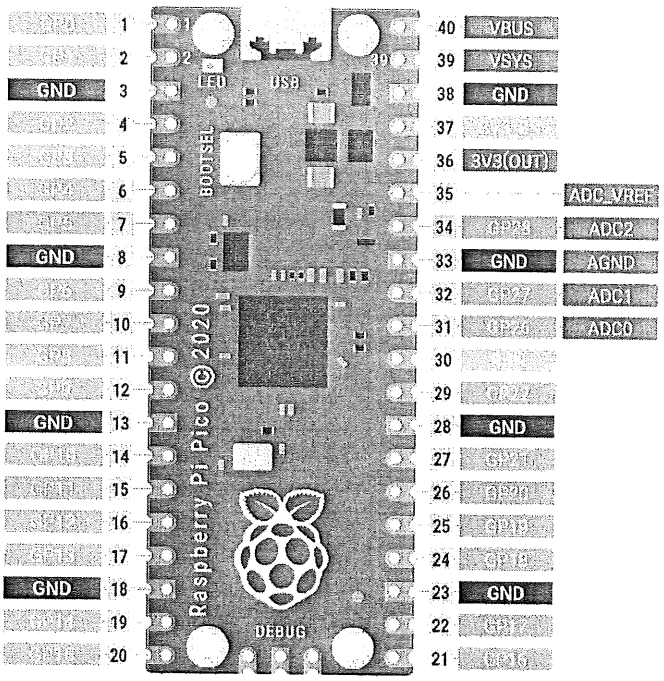

Figure 2: Pi Pico pin out

QUESTION 3

a) Draw the internal construction of the 4x4 matrix keypad.

(5 marks)

b) Create an application that will give output at LCD 16x2 using **4-bit mode** connection based on the keypad input value as follows:

- When the numbering value is pressed, the value is displayed on the first line at the center of the LCD.
- When * is press, it will clear the LCD screen.
- When either A, B, C, D or # is pressed, it will display a different message at the LCD screen at the second line of LCD.
  Example: if A is pressed, it will display "welcome".
  if B is pressed, it will display "thank you".

i. Referring to the LCD and keypad in figure 3, produce the wiring diagram between these devices and the Pi Pico microcontroller. For Pi Pico pin out, refer to figure 2 in question 2.

(10 marks)

ii. Outline a program for this application. Refer attachment section for the LCD and keypad basic program as reference.

(15 marks)

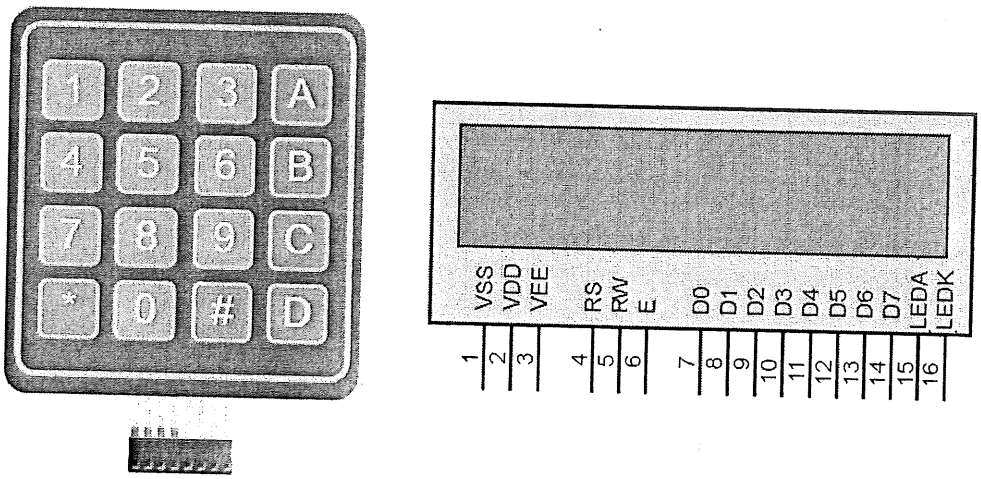

Figure 3: keypad and LCD

QUESTION 4

a) State the function of a 7-segment display unit and identify types of 7 segment display unit by describing the difference of these display types.

(5 marks)

b) Using four (4) 7-segment displays in **TM1637 module**, design a counter that counts from 0 to 9999 with an increment of 3 when a button is pushed.

i) Produce the schematic diagram for the connection between Pi Pico, push button and TM1637 module. Refer figure 4 for Tm1637 module.

(15 marks)

ii) Outline a program for this application.

(13 marks)

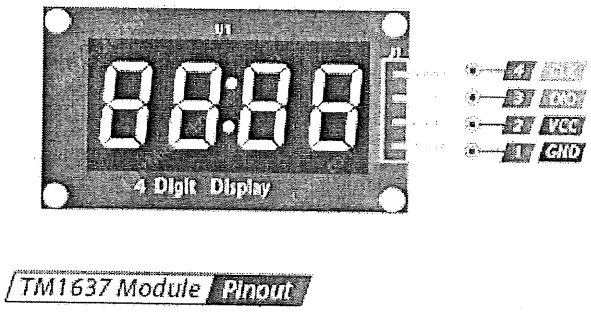

Figure 4: TM1637 module

----------End of question----------

Attachment:

Code (Hex)	Command to LCD Instruction Register
1	Clear display screen
2	Return home
4	Decrement cursor (shift cursor to left)
6	Increment cursor (shift cursor to right)
5	Shift display right
7	Shift display left
8	Display off, cursor off
A	Display off, cursor on
C	Display on, cursor off
E	Display on, cursor blinking
F	Display on, cursor blinking
10	Shift cursor position to left
14	Shift cursor position to right
18	Shift the entire display to the left
1C	Shift the entire display to the right
80	Force cursor to beginning to 1st line
C0	Force cursor to beginning to 2nd line
38	2 lines and 5x7 matrix

LCD command code