POKHARA UNIVERSITY

Level: Bachelor | Internal Exam | Year : 2025
Programme: BE Computer (III/I) | Full Marks: 100
Course: Embedded Systems | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Define an embedded system. How does it differ from a general purpose computing system? Explain in brief. 7
   b) Explain the architecture of AVR microcontrollers. Highlight its key features. 8
2. a) How are I/O ports configured in AVR microcontrollers? Explain with the help of an appropriate example. 8
   b) Write a program to store and retrieve a value from the EEPROM memory of an AVR microcontroller. 7
3. a) What is an RTOS, and how does it benefit embedded system applications? 8
   b) Discuss semaphore-based and mutex-based resource sharing techniques in RTOS. 7
4. a) What are the primary differences between structural and behavioural modelling styles in VHDL? Explain briefly with some simple examples. 8
   b) Write a VHDL code to implement a full-adder. 7
5. a) Implement a Moore state machine for an elevator control system with states for up, down, and idle. 7
   b) A smart farming solution includes soil moisture sensors, weather stations, and irrigation controllers connected via an embedded system. Data should be transmitted to a central monitoring unit and accessible via mobile apps. 8
      i. Compare LoRa and Zigbee for long-range, low-power communication in an agricultural setting.
      ii. What are the trade-offs between using wired vs wireless communication in this scenario?
6. a) Write an AVR C program to interface a 16x2 LCD (in 4-bit mode) with an AVR microcontroller (e.g., ATmega16/ATmega32). The program should: 7
      i. Initialize the LCD in 4-bit mode.

ii. Display the message "AVR LCD TEST".

b) Compare the features of Arduino, ESP32, and Raspberry Pi as IoT platforms. 8

7. Write short notes **any two:** 2×5

a) Embedded system in automotive industry

b) MQTT protocol

c) Bluetooth