JSPM's
Bhivarabai Sawant Institute of Technology & Research, Wagholi, Pune
(Approved by AICTE, Delhi & Govt. of Maharashtra, affiliated to Savitribai Phule Pune University)
Department of Information Technology

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Class: SE (IT) **Div.:-A & B**
Course: Processor Architecture (214451)
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VIVA QUESTIONS AND ANSWERS
(Based On Practical Syllabus)

1. Study of Embedded C (Overview, Syntax, Simple Program)

1. **What is Embedded C?**
   → Embedded C is an extension of C programming to develop applications for embedded systems.
2. **Name an important feature of Embedded C.**
   → Direct access to hardware registers.
3. **Which header file is commonly included in Embedded C programs?**
   → <xc.h> for PIC microcontrollers.
4. **Give an example of an Embedded C data type.**
   → unsigned char, unsigned int.
5. **What is a microcontroller?**
   → A compact integrated circuit designed to govern a specific operation in an embedded system.
6. **Name one basic syntax rule in C.**
   → Each statement ends with a semicolon (;).
7. **Write a small Embedded C code to add two numbers.**

```
int a=5, b=10, c;
c = a + b;
```

8. **What is the extension of Embedded C files?**
   → .c
9. **What is the difference between C and Embedded C?**
   → Embedded C focuses more on direct hardware manipulation.
10. **Why do we use volatile keyword?**
    → To tell the compiler that a variable can change at any time, like hardware status registers.

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2. Adding Array of n Numbers

11. **What is an array?**
    → A collection of elements stored in contiguous memory locations.

12. **How do you declare an array in C?**
    → int arr[10];
13. **How do you calculate sum of array elements?**
    → Using a loop to add each element.
14. **What will be the initial value of an uninitialized array?**
    → Garbage value.
15. **What is the purpose of using loops for arrays?**
    → To traverse and process each element easily.

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3. Internal/External Memory Transfer

16. **What is internal memory?**
    → Memory inside the microcontroller (RAM, registers).
17. **What is external memory?**
    → Memory outside the microcontroller (external RAM, EEPROM).
18. **How to transfer data from one array to another?**
    → By copying elements using a loop.
19. **Name a function for memory copy.**
    → memcpy().
20. **What is a pointer?**
    → A variable that holds the memory address of another variable.

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4. Menu Driven Program (Multiply/Divide)

21. **What is a menu-driven program?**
    → A program that offers users a list of options to choose from.
22. **Which control structure is used in menu programs?**
    → switch-case or if-else ladder.
23. **What is multiplication of two 8-bit numbers called?**
    → Byte multiplication.
24. **How many maximum values an 8-bit number can hold?**
    → 255 (unsigned).
25. **How do you perform division in C?**
    → Using / operator.

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5. Sorting Numbers

26. **What is sorting?**
    → Arranging numbers in a specific order (ascending/descending).
27. **Name one sorting algorithm.**
    → Bubble sort.
28. **Which loop is generally used for sorting?**
    → for loop.

29. **Which method is easier for small array sorting?**
→ Bubble Sort.
30. **What is swapping?**
→ Exchanging two variables' values.

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6. LED Blinking with PIC

31. **What is LED?**
→ Light Emitting Diode.
32. **How do you turn on an LED using a microcontroller?**
→ Set the corresponding pin to high.
33. **What is the delay function?**
→ It pauses the program for a defined time.
34. **What timer function is used in C?**
→ _delay_ms(time).
35. **Why use resistors with LEDs?**
→ To limit current and prevent LED damage.

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7. Timer ISR Buzzer

36. **What is an ISR?**
→ Interrupt Service Routine.
37. **What is the purpose of using ISR for buzzer control?**
→ To automatically handle buzzer ON/OFF without blocking the main program.
38. **What is a timer in a microcontroller?**
→ A hardware peripheral that counts clock cycles.
39. **What is a buzzer?**
→ A sound-producing electronic component.
40. **How is a timer interrupt triggered?**
→ When the timer overflows or matches a value.

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8. External Interrupt and Relay

41. **What is an external interrupt?**
→ An interrupt caused by an external event like a button press.
42. **What is a relay?**
→ An electromechanical switch controlled electrically.
43. **How to detect switch press?**
→ Monitor input pin for change (high/low).
44. **What is debouncing?**
→ Eliminating multiple unwanted signals from mechanical switch press.
45. **Why use external interrupts?**
→ To respond immediately to an external event.

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9. LCD Interfacing

46. **What is LCD?**
    → Liquid Crystal Display.
47. **How many pins does a standard 16x2 LCD have?**
    → 16 pins.
48. **Which function initializes LCD?**
    → lcd_init().
49. **What is command register of LCD?**
    → Used to send instructions like clear display, cursor shift, etc.
50. **What are data pins used for in LCD?**
    → To send the characters to display.

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10. PWM Signal Generation

51. **What is PWM?**
    → Pulse Width Modulation.
52. **What is duty cycle?**
    → Percentage of time the signal remains high in one period.
53. **Which microcontroller module generates PWM?**
    → CCP (Capture/Compare/PWM) module.
54. **What does PWM control in motors?**
    → Speed or position.
55. **What is the range of PWM frequency?**
    → Depends on application; typically few Hz to kHz.

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11. UART Communication

56. **What is UART?**
    → Universal Asynchronous Receiver Transmitter.
57. **What are Tx and Rx pins?**
    → Tx: Transmit, Rx: Receive.
58. **What is baud rate?**
    → Number of bits transmitted per second.
59. **Name two devices using UART.**
    → GPS module, Bluetooth module.
60. **What protocol does UART follow?**
    → Asynchronous serial communication.

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12. Temperature Sensor with ADC and LCD

61. **What is ADC?**
    → Analog to Digital Converter.
62. **What does a temperature sensor do?**
    → Converts temperature into an electrical signal.

63. **Name one commonly used temperature sensor.**
→ LM35.
64. **Why use ADC with sensor?**
→ Sensors output analog voltage, and microcontrollers read digital values.
65. **How do you display temperature on LCD?**
→ Read ADC, convert to temperature, and send string to LCD.

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13. Study of Arduino and OS Installation on Raspberry Pi

66. **What is Arduino?**
→ An open-source hardware and software platform for prototyping.
67. **What is Raspberry Pi?**
→ A small, affordable computer used for programming and IoT projects.
68. **Name an OS used for Raspberry Pi.**
→ Raspberry Pi OS (formerly Raspbian).
69. **What is the first step in Raspberry Pi OS installation?**
→ Download the OS image.
70. **What tool is used to flash OS image to SD card?**
→ Balena Etcher.

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14. Open Source Platform Programming

71. **What is digital read in Arduino?**
→ Reading a HIGH or LOW signal on a digital pin.
72. **What is digital write in Arduino?**
→ Setting a digital pin HIGH or LOW.
73. **Which function reads analog input?**
→ analogRead().
74. **Which function writes analog output (PWM)?**
→ analogWrite().
75. **What does a sensor do?**
→ Converts physical quantity to an electrical signal.
76. **What does an actuator do?**
→ Converts electrical signal into physical movement.
77. **What is pinMode() in Arduino?**
→ Sets a pin as INPUT or OUTPUT.
78. **Which Arduino board is most commonly used?**
→ Arduino UNO.
79. **Which GPIO voltage levels are used in Raspberry Pi?**
→ 3.3V.
80. **How many GPIO pins are in Raspberry Pi 4?**
→ 40 pins.
81. **What is PWM used for in Raspberry Pi?**
→ Motor control, LED brightness.

82. **How do you control a relay with Arduino?**
→ Output HIGH signal to relay control pin.
83. **What is the use of pull-up and pull-down resistors?**
→ To define a default state for a pin.
84. **What are libraries in Arduino IDE?**
→ Pre-written code to simplify complex tasks.
85. **What programming language does Arduino use?**
→ C/C++.
86. **How do you upload a program to Arduino?**
→ Using USB cable and Arduino IDE.
87. **What is Serial Monitor in Arduino?**
→ Tool to send and receive data from board to PC.
88. **What is GPIO?**
→ General Purpose Input Output pins.
89. **Can Raspberry Pi control motors?**
→ Yes, using H-Bridge or motor drivers.
90. **How to install a library in Arduino IDE?**
→ Sketch → Include Library → Manage Libraries.
91. **What is SSH in Raspberry Pi?**
→ Secure Shell, to remotely access Pi.
92. **Name one language supported by Raspberry Pi.**
→ Python.
93. **What are actuators examples?**
→ Motors, relays, servos.
94. **What is the maximum current from Arduino UNO pin?**
→ 40mA per I/O pin.
95. **What does PWM stand for in Arduino?**
→ Pulse Width Modulation.
96. **Can Raspberry Pi use WiFi?**
→ Yes, built-in WiFi support.
97. **What is a breadboard?**
→ A tool for prototyping circuits without soldering.
98. **Which command is used to update Raspberry Pi OS?**
→ sudo apt update.
99. **What is difference between Arduino and Raspberry Pi?**
→ Arduino is a microcontroller, Raspberry Pi is a microprocessor.
100. **Can you use C language to program Raspberry Pi?**
→ Yes, C/C++ and Python are common.

VIVA QUESTIONS AND ANSWERS (BASED ON THEORY SYLLABUS)

Unit I: PIC Microcontroller Architecture

1. **Q:** What is a microcontroller?
   A: A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system [Source: *Mazidi et al., PIC Microcontroller and Embedded Systems*].
2. **Q:** How does a microcontroller differ from a microprocessor?
   A: Microcontrollers have CPU, RAM, ROM, and I/O ports on a single chip, while microprocessors need external components [Source: *Mazidi et al.*].
3. **Q:** Name one key advantage of microcontrollers over microprocessors.
   A: Compactness and lower cost.
4. **Q:** What is one important selection criterion for a microcontroller?
   A: Required memory size, number of I/O ports, and power consumption.
5. **Q:** What does PIC stand for?
   A: Peripheral Interface Controller [Source: *Microchip Technology*].
6. **Q:** List two features of the PIC18FXXX series.
   A: High-speed RISC architecture, built-in EEPROM.
7. **Q:** What is the program counter used for in PIC?
   A: To keep track of the address of the next instruction to execute.
8. **Q:** What memory types are present in a PIC18F microcontroller?
   A: Program memory (Flash) and data memory (RAM).
9. **Q:** What is bank switching?
   A: It is the method to access more memory by switching between memory banks.
10. **Q:** Name any one register in PIC18F microcontroller.
    A: STATUS register.
11. **Q:** What is the Access Bank?
    A: A region of memory that allows faster access to commonly used registers without bank switching.
12. **Q:** Define addressing mode.
    A: The method to access data in instructions.
13. **Q:** Give one example of indirect addressing mode.
    A: Using FSR (File Select Register).
14. **Q:** What is a Watchdog Timer (WDT)?
    A: A timer that resets the microcontroller if the program hangs.
15. **Q:** What causes a brownout reset?
    A: Drop in supply voltage below a threshold.
16. **Q:** What is the purpose of configuration registers?
    A: To set up device operating parameters before running the program.
17. **Q:** What does an oscillator configuration determine?
    A: The clock source for the PIC microcontroller.

18. **Q:** What happens during a reset operation?
    A: The microcontroller initializes and starts execution from the reset vector.
19. **Q:** Name two types of PIC reset.
    A: Power-on reset and brown-out reset.
20. **Q:** What is the maximum program memory size for PIC18F458?
    A: 32 KB [Source: *Microchip PIC18F458 Datasheet*].

Unit II: PIC I/O Ports and Timer

21. **Q:** How many I/O ports are there in PIC18F458?
    A: Five (PORTA to PORTE).
22. **Q:** What is TRIS register used for?
    A: To configure a pin as input or output.
23. **Q:** How to make a pin an output?
    A: Set corresponding TRIS bit to '0'.
24. **Q:** How to make a pin an input?
    A: Set corresponding TRIS bit to '1'.
25. **Q:** What is bit manipulation?
    A: Modifying individual bits of a port.
26. **Q:** What is a Timer in microcontrollers?
    A: A module that counts pulses from a clock or external source.
27. **Q:** Which register controls Timer0 in PIC18F458?
    A: T0CON register.
28. **Q:** What is prescaler in timers?
    A: A divider that slows down the timer clock.
29. **Q:** How to calculate delay using a timer?
    A: Delay = (Timer ticks × Prescaler) / Clock frequency.
30. **Q:** Why are timers important?
    A: For generating precise delays and time measurements.
31. **Q:** How to start Timer0?
    A: Set TMR0ON bit in T0CON register.
32. **Q:** What is an 8-bit timer?
    A: Timer capable of counting from 0 to 255.
33. **Q:** What is the role of TMR0H and TMR0L registers?
    A: They store the high and low byte of 16-bit Timer0.
34. **Q:** Which register is used for delay calculation?
    A: TMRx register (Timer Register).
35. **Q:** Can timers work in counter mode?
    A: Yes, they can count external pulses.

Unit III: PIC Interrupts & Interfacing-I

36. **Q:** What is an interrupt?
    A: An event that temporarily halts the main program to execute a specific function.

37. **Q:** Difference between interrupt and polling?
    A: Interrupts are automatic, polling requires continuous checking.
38. **Q:** What is IVT?
    A: Interrupt Vector Table – stores addresses of ISRs.
39. **Q:** How many interrupt priority levels does PIC18F458 support?
    A: Two (high and low).
40. **Q:** Name one interrupt source.
    A: External interrupt INT0.
41. **Q:** What is INTCON register?
    A: Interrupt control register.
42. **Q:** What are the steps in interrupt execution?
    A: Save context, jump to ISR, execute, restore context.
43. **Q:** How to enable global interrupts?
    A: Set GIE bit in INTCON register.
44. **Q:** What is external interrupt?
    A: Interrupt generated by external signal.
45. **Q:** Example of external hardware interrupt.
    A: Switch press.
46. **Q:** What happens if two interrupts occur simultaneously?
    A: Higher priority interrupt executes first.
47. **Q:** How is serial communication interrupt triggered?
    A: On transmission or reception of a byte.
48. **Q:** What is interfacing?
    A: Connecting microcontroller with external devices.
49. **Q:** How is LED interfaced with PIC?
    A: Connect LED to a port pin via a resistor.
50. **Q:** How many pins are needed to interface 16×2 LCD in 8-bit mode?
    A: 8 data + 3 control = 11 pins.

Unit IV: PIC Interfacing-II

51. **Q:** What does CCP stand for?
    A: Capture/Compare/PWM.
52. **Q:** What is capture mode?
    A: Records timer value when an event occurs.
53. **Q:** What is compare mode?
    A: Generates event when timer matches a set value.
54. **Q:** What is PWM mode?
    A: Generates a pulse-width modulated signal.
55. **Q:** Which register is used for PWM in PIC?
    A: CCPR1L and CCP1CON.
56. **Q:** How to control DC motor speed using PIC?
    A: By varying PWM duty cycle.

57. **Q:** Which motor needs stepwise pulses?
    A: Stepper motor.
58. **Q:** What is RS232?
    A: Standard for serial communication.
59. **Q:** What is SPI?
    A: Serial Peripheral Interface – synchronous communication protocol.
60. **Q:** What is I2C?
    A: Inter-Integrated Circuit – two-wire serial protocol.
61. **Q:** What is UART?
    A: Universal Asynchronous Receiver Transmitter.
62. **Q:** Which bus uses clock line?
    A: I2C.
63. **Q:** What is master-slave configuration in SPI?
    A: Master controls the clock, slave responds.
64. **Q:** What is baud rate?
    A: Data transmission rate in bits per second.
65. **Q:** What is TX pin?
    A: Transmit pin in UART.

Unit V: PIC Interfacing-III

66. **Q:** What is ADC?
    A: Analog to Digital Converter.
67. **Q:** Which ADC is commonly interfaced with PIC?
    A: ADC0808.
68. **Q:** What is DAC?
    A: Digital to Analog Converter.
69. **Q:** Which DAC is commonly used with PIC?
    A: DAC0808.
70. **Q:** How many channels are there in ADC0808?
    A: 8 channels.
71. **Q:** What is the use of temperature sensor interfacing?
    A: To measure and display temperature values.
72. **Q:** Name a temperature sensor.
    A: LM35.
73. **Q:** What is RTC?
    A: Real Time Clock.
74. **Q:** Which RTC IC is used with PIC?
    A: DS1306.
75. **Q:** How is EEPROM interfaced with PIC?
    A: Using SPI protocol.
76. **Q:** What is non-volatile memory?
    A: Memory that retains data after power off.

77. **Q:** Example of non-volatile memory.
    A: EEPROM.
78. **Q:** Which bus is used for EEPROM interfacing?
    A: SPI bus.
79. **Q:** What is the use of I2C in temperature sensor interfacing?
    A: For data transfer between sensor and controller.
80. **Q:** What is SPI Clock (SCK)?
    A: Synchronizes data transmission.

Unit VI: Current Trends in Processor Architecture

81. **Q:** What is ARM?
    A: Advanced RISC Machine.
82. **Q:** What is RISC?
    A: Reduced Instruction Set Computer.
83. **Q:** Name one feature of ARM processors.
    A: High performance with low power.
84. **Q:** What is the design philosophy of RISC?
    A: Simple instructions executed in one clock cycle.
85. **Q:** What is ARM7?
    A: Early version of ARM processor family.
86. **Q:** What is ARM9?
    A: Improved version with better speed and features.
87. **Q:** What is ARM11 used for?
    A: Advanced mobile and multimedia applications.
88. **Q:** Name one advantage of ARM processors.
    A: Energy-efficient.
89. **Q:** What is CPSR?
    A: Current Program Status Register.
90. **Q:** What is SPSR?
    A: Saved Program Status Register.
91. **Q:** What are ARM operating modes?
    A: User, FIQ, IRQ, Supervisor, Abort, Undefined, System.
92. **Q:** Which register stores processor flags?
    A: CPSR.
93. **Q:** What is FIQ mode?
    A: Fast interrupt request mode.
94. **Q:** What is IRQ mode?
    A: Standard interrupt request mode.
95. **Q:** What is Supervisor mode?
    A: Protected mode for OS operations.
96. **Q:** What makes ARM suitable for embedded systems?
    A: Low power, high speed, compact size.

97. **Q:** What is Thumb mode in ARM?
    A: Compressed 16-bit instruction set.
98. **Q:** Is ARM a Harvard or Von-Neumann architecture?
    A: Modified Harvard architecture.
99. **Q:** Difference between PIC and ARM?
    A: PIC is simpler and used in basic embedded systems; ARM is for complex high-performance applications.
100. **Q:** What is the main feature of ARM7 data flow model?
    A: Single-cycle execution for most instructions.
