Assignment : 2

1) Elaborate different criteria for selection of microcontrollers.

→ ① Performance :
Consider clock speed, bus width (8-bit, 16-bit, 32-bit), and processing capabilities.

② Memory: Ensure enough Flash, RAM, and EEPROM for program and data storage.

③ Peripherals and Interfaces :
Look for ADC's, PWM, I/O pins, and communication protocols (I2C, SPI, UART, etc).

④ Power Consumption:
Evaluate operating voltage and power-saving modes, especially for battery-powered devices.

⑤ Size and Packaging :
Consider physical size, package type (DIP, QFN, etc), and ease of assembly.

⑥ Development Tools :
Check for IDE support, debugging tools, and libraries.

⑦ Cost:
Ensure it fits the project budget, especially for mass production.

8) Availability and longevity:
choose widely available microcontrollers with long-term support.

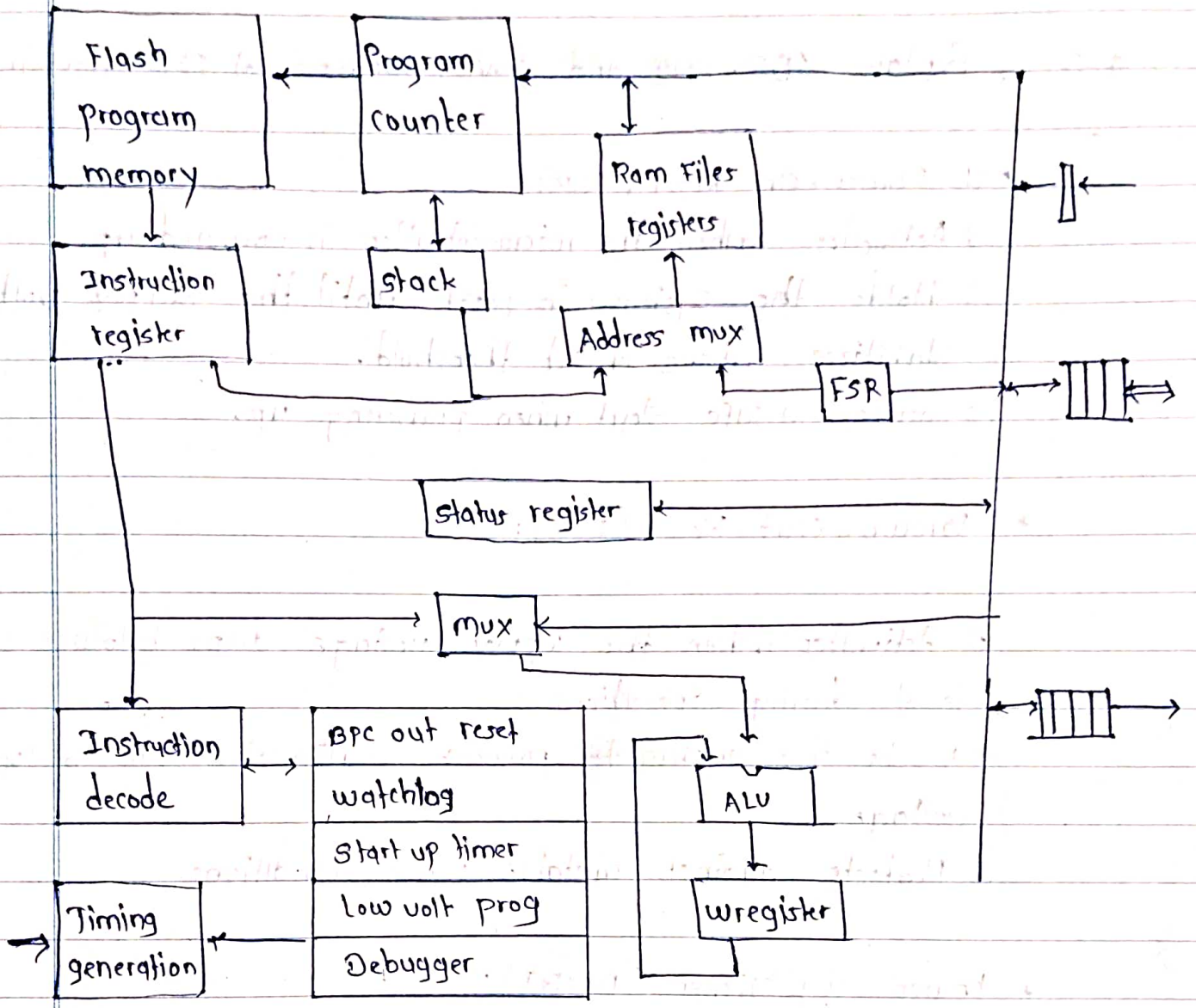
9) Environmental:
make sure it can withstand the required temperature & environmental conditions.

10) Security:
look for hardware security features if needed for secure applications.

9 - 2) State features of PIC, draw and explain the block schematic of PIC 18FXXX.

→ Features of PIC microcontroller:

① RISC Architecture: Efficient with fewer instructions.
② High Performance: Up to 16 MIPS processing speed.
③ Memory: Flash for program storage, SRAM for runtime, EEPROM for non-volatile storage.
④ Peripheral Support: ADC, PWM, multiple I/O pins, timers, UART, I2C, SPI
⑤ Power-saving modes: Includes sleep modes for batten operated devices.
⑥ Interrupt Handling: Supports multiple, prioritized interrupt
⑦ In-Circuit Serial programming (ICSP): programmable without removing from the circuit.
⑧ watchdog Timer: Resets in case of software failure.
⑨ Wide operating voltage: 2V to 5.5 V
⑩ Enhanced features: USB and Ethernet support in som models.


Flash Program memory
Program counter
Ram Files registers
Instruction register
Stack
Address mux
FSR
Status register
mux
Instruction decode
Bpc out reset
watchdog
Start up timer
Low volt prog
Debugger
Timing generation
ALU
wregister

9-3. Explain POR, BOR, and PWRT modes of PIC reset in de

→

* ① Power-On Reset (POR):
① Activates when the microcontroller is powered up.
② Holds the system in reset until the supply voltage stabilizes above a set threshold.
③ Ensures a safe start when powering up.

* Brown-Out Reset (BOR):

① Activates when the supply voltage drops below a safe level during operation.
② Resets the system to prevent malfunction due to low voltage.
③ Protects against unstable power conditions.

* Power-Up Timer (PWRT):

① Adds a delay (64 ms - 1/2 ms) after a reset (e.g., POR
② Ensures the supply voltage and internal circuits ar fully stable before starting normal operations.

Q-4) What are different peripheral support used in PIC? Elaborate

→ ① Timers / Counters:
Used for time-based operations, PWM generation, & event counting. Timers can operate in various modes such as timer, counter, and watchdog timer.

② USART:
Enables communication with serial devices like computers or other microcontrollers using protocols like RS232.

③ ~~I2C~~ - SPI
A high-speed synchronous serial communication protocol used for interfacing with devices like ADCs, DACs, memory, or displays.

④ I2C:
A two-wire communication protocol used for connecting low-speed peripherals like sensors, EEPROMs, or other controllers.

⑤ ADC:
Converts analog input signals (e.g., from sensors) into digital data that the microcontroller can process.

que-5 Draw and Explain functional diagram of Timer0 of PIC. A differentiate between operating function timer 0, 1 and or PIC.

→ ① TMR0 Register:
This is where the timer value is stored. It can be read or written to by the CPU.

② Prescalar:
A pre-scalar can divide the clock frequency by a factor allowing slower counting in the timer.

③ Clock Source Select:
Timer 0 can either use an internal clock or an external clock source.

④ TMR0 interrupts:
When the timer overflows, an interrupts is generated enabled, allowing for interrupt-driven tasks.

⑤ T0CS:
This bit selects whether the clock source is internal external.

⑥ T0SE:
This bit determines on which clock edge the exter

clock should increment the timer.

① 8-bit / 16 bit - Operation:
Timer 0 can work in both 8-bit and 16-bit modes depending on the configuration.

Feature	Timer 0	Timer 1	Timer 2
width	8-bit / 16-bit	16-bit	8-bit
prestscaler	No	No	Yes (1:1 to 1:16)
clock source	Internal / External	Internal / External	Internal only
Interrupt on Overflow	Yes	Yes	Yes
User	General purpose timer / counter	RTC timer	PWM, time delay generation
Reset mode	Does not reset automatically	Can reset with external signal	Resets when a portscaler Overflow occurs.

Que-6 Explain the capture and compare mode of PIC in details.

→ 1) Capture mode:

In capture mode, the microcontroller captures the value of the timer at the exact moment an event occurs, such as an edge on an input pin. This is used to measure time between events like edges of a pulse.

Key Features:

- Timer Capture Register (CCPRx): The value of the timer is saved in this register when a specific edge is detected on the capture pin (CCPx).
- Triggering on Edge: Capture mode can be configured to trigger on rising edges, falling edges, or both. This allows for the measurement of pulse width or time between pulses.
- Input Pin (CCPx Pin): The pin is connected to the external signal, and when a transition occurs, the current value of the timer is captured.
- Timer Interval measurement:

By recording the timer value on two consecutive edges, the time difference can be calculated, allowing measurement of signal frequency or period.

2) Compare Mode:

In compare mode, the timer's value is continuously compared against a preset value in the compare register (CCPRx). When the timer matches this value, an action such as toggling an output pin, generating an interrupt, or resetting the timer can be triggered.

Key Features:

- Comparison with Preset Value:
The timer's value is compared with the value in the compare register (CCPRx).

- Event Trigger:
when a match occurs, the PIC can trigger various actions like:
  - Generating an interrupt.
  - Toggling a specific output pin
  - Resetting the timer.

- Pwm Generation:
This mode is often used in pulse-width modulation (pwm) where the duty cycle of a signal is controlled by the compare value.