Electronics-Paper I
Microcontroller Architecture and Programming
[CORE COURSE]

Semester: III	Credits: 2	Subject Code: BS32105	Lectures: 36

Course Outcomes

At the end of this course, the learner will be able to:

- Summarize the basics of PIC microcontroller architecture
- Make use of instruction set to write programs in Assembly Language and C for arithmetic and code conversions, I/O port programming
- Solve delay problems and illustrate programs for Timers, Serial communication, and relate to Interrupts
- Explain how to interface I/O peripherals to PIC microcontroller and develop programs using C, demonstrate advanced microcontrollers

Unit 1: Basics of Microcontroller & PIC architecture	8

- Introduction to microcontrollers
  - Difference in microcontroller and microprocessor
  - Architecture of PIC and features
- WREG register, PIC file register, SFRs, GPR, GP RAM vs EEPROM.
- File register and access bank in the PIC18, Bank switching.
- PIC status register.
- Pin diagram (18F458), Program Counter, stack and stack pointer in PIC18, Configuration registers.

Unit 2: Programming model of PIC	10

- Addressing modes, Assembler directive, Instruction set, basic arithmatic programs in Assembly Language
- ROM width in the PIC18, PIC18 time delay and delay calculations, pipelining, instruction cycle time, branch penalty.
- I/O ports programming, I/O bit manipulation programming, program for square wave generation at port pin and port, reading and monitoring single bit.
- Introduction to 'C' programming.

Unit 3: Timer / Counter, Serial Communication, Interrupts	10

- Programming timers 0 and 1: T0CON, INTCON, T1CON, PIR1 register. (C Programming)
    Steps to programming timer 0 in 16-bit mode and 8-bit mode, delay calculation (Timer count calculation),
  - T2CON, T3CON register
  - Counters

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- PIC18 serial communication, serial port programming (C Programming)
  - SPBRG, TXREG, RCREG, TXSTA, RCSTA register
  - programming PIC18 to transfer and receive data serially,
  - importance of TXIF and RCIF flag,
  - quadrupling baud rate.
- PIC18 Interrupts: Interrupt vector table in PIC18,
  - sources of interrupts, interrupts enabling,
  - timer interrupts
  - external hardware interrupts,
  - port B change interrupts,
  - setting interrupt priority.

Unit 4: ADC, DAC and Peripheral Interfacing	8

- ADC programming in the PIC18: ADC features programming, ADCON0, ADCON1 register, conversion time, steps for programming the ADC
- Interfacing DAC, LCD. Stepper Motor
- Introduction to Arduino, Raspberry Pi.

 # 12 hours for Library work, practical or field work or research purposes

Recommended Text Books:

- Muhammad Ali Mazadi et al., "*PIC microcontroller and Embedded Systems using assembly and C for PIC 18,*" Pearson Education publication, 1st Edition, Fourth Impression 2011(Indian Edition).
- Peatman, John B, "*Design with PIC microcontrollers*", Simon & Schuster Trade, 1997
- PIC micro 18C MCU reference manual, ww1.microchip.com/downloads/en/DeviceDoc/39500a.pdf
- PIC18FXX8 data sheet, ww1.microchip.com/downloads/en/devicedoc/41159d.pdf

Reference Books:

- Dogan Ibrahim, "*Advanced PIC microcontroller projects in C*", Newnes (Elsevier), 26th March 2008
- John Iovine, "*PIC Robotics*", McGraw-Hill, 16th February 2004
- John Morton, "*The PIC Microcontroller- Your Personal Introductory Course*", third edition, Newnes (Elsevier),2005
- Julio Sanchez, Maria P. Canton, "*Microcontroller Programming- The Microchip PIC*", CRC Press (Taylor & Francis Group),2007
- Lucio Di Jasio, "*PIC Microcontrollers*", Newnes (Elsevier),7th November 2011
- Myke Predko, "*Programming and Customizing the PIC Microcontroller*", Third Edition, Tata McGraw-Hill Edition,2008
- R.Barnett, L O'Cull and S.Fox,Thomsun, "*Embedded C Programming and the Microchip PIC*" (2004)

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Websites:
• NPTEL https://www.youtube.com/watch?v=VEAYB1A9SiA&feature=emb_logo PIC 18 instruction set • NPTEL PIC Micro-controller Architecture • https://www.youtube.com/watch?v=sUkgUQ9mpcg&feature=emb_logo

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