Subject	Microcontroller	**Course Code**	CT213	**Theoretical**	3 hrs / wk
Semester	4	**Prerequisite**	CT212	**Practical**	3 hrs / wk

Program Learning Component

Week 1-2

1. Appreciate the fundamental structure and function of a microcontroller

Specific Learning Outcomes	Resources	Practical
• Appreciate the differences between microprocessors and microcontrollers. • Use the number systems (this including binary, hexadecimal, and BCD numbers, binary arithmetic and logical operations and coding). • Draw a block diagram of a simple microcontroller-based system (CPU, memory, buses, Input/output). • Explain a simplified memory organization. • Appreciate the use of machine code, assembly and high level languages.	Power point slide Whiteboard Comprehensive workbook for students PIC 16F84 development board. MP lab development software. PIC Programmer or a suitable alternative.	• Perform example calculations in binary and hexadecimal and conversions between hex and binary systems. • Appreciate and use a simple to Microcontroller development system. • Use a specific microcontroller (e.g: PIC 16F84)

Week 3

2. Use a software development system for a particular microcontroller.

Specific Learning Outcomes	Resources	Practical
• Microcontroller programming languages • Binary arithmetic, use of ASCII codes • Appreciate microcontroller characteristics. • Read the data sheet of a microcontroller. • Interpret the pin diagram and functions.	Power point slide Whiteboard Comprehensive workbook for students	• Write a simple program in assembly language using an appropriate development system. • Use appropriate assembly language style, directives and pseudo ops. • Investigate assembly language instructions by writing and testing

			example programs.
Week 4-5	**3. Write, test and simulate assembly language programs.**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Define the function of some basic assembly language instructions. • Define the function of jump and branch assembly language instructions • Describe the function of a subroutine, its advantages, disadvantages and how to implement it in assembly language.	Power point slide Whiteboard Comprehensive workbook for students	• Investigate the new assembly language instructions by writing and testing example programs. • Use a simulator to test the programs.
Week 6	**4. Explain the basic principles of address decoding.**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Explain the basic principles of address decoding. • Obtain memory address ranges from a particular design.	Power point slide Whiteboard Comprehensive workbook for students	• Write and test simple programs with loops.
Week 7	**5. Program basic input/output devices and timers .**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Describe how to use Input/Outputs of the microcontroller to perform simple functions.	Power point slide Whiteboard Comprehensive workbook for students	• Implement some programs with subroutines.
Week 8	**6. Program basic input/output devices and timers**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Appreciate the issue of synchronization of I/O data transfers using polling or interrupts.	Power point slide Whiteboard Comprehensive workbook for students	• Write and test simple programs to write data to leds connected to an output port.
Week 9-10	**7. Program basic input/output devices and timers**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Appreciate the importance of hardware timers ,counters and their advantages.	Power point slide Whiteboard Comprehensive	• Write and test simple programs to read data from

	• Outline the purpose and use of ADCs and DACs.	workbook for students	switches connected to a port and using Input/output interface devices
Week 11-12	**8. Appreciate various microcontroller applications in process control.**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Appreciate various microcontroller applications such as process control , DC motor control and Stepper motor control,	Power point slide Whiteboard Comprehensive workbook for students	• Programming the speed of a stepper and the DC motor .
Week 13-14			
	Specific Learning Outcomes	**Resources**	**Practical**
	• Appreciate various microcontroller applications such as applying PWM technique ,measurements and data display.	Power point slide Whiteboard Comprehensive workbook for students	• Use a microcontroller to measure and control temperature. • Create a closed loop control system using the microcontroller