COURSE MODULES OF THE SUBJECT TAUGHT FOR THE SESSION 2024-25 (EVEN SEMESTER)

Course Syllabi with CO's

Faculty Name/s : Dr. Hussana Johar R B							**Academic Year: 2024- 2025**
Department: CSE(Artificial Intelligence & Machine Learning)							
Course Code	**Course Title**	**Core/Elective**	**Prerequisite**	**Contact Hours**			**Total Hrs/ Sessions**
				L	**T**	**P**	
21CS43	Microcontroller & Embedded Systems	Core	Analog and Digital Electronics	4		0	40

Course Learning Objectives: This course (BCO601) will enable students to:

- Understand the architectural features and instruction set of 32 bit ARM microcontrollers.
- Apply instructions of assembly language for programming ARM.
- Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Explain the need of real time operating system for embedded system applications.
- Develop/test/Conduct the experiments on an ARM7TDMI/LPC2148 evaluation board using Embedded 'C' and Keil Vision tool/Compiler

Module 1	**Conta ct Hours**
Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions **Text book 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.5** **RBT: L1, L2**	08
Module 2	
Introduction to the ARM Instruction Set : Data Processing Instructions , Programme Instructions, Software Interrupt Instrurunctions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants **ARM programming using Assembly language:** Writing Assembly code, Profiling and cycle counting, instruction scheduling, Register Allocation, Conditional Execution, Looping Constructs **Text book 1: Chapter 3:Sections 3.1 to 3.6 (Excluding 3.5.2), Chapter 6(Sections 6.1 to 6.6)** **RBT: L1, L2**	08
Module 3	
Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. **Text book 2:Chapter 1(Sections 1.2 to 1.6),Chapter 2(Sections 2.1 to 2.6)** **RBT: L1, L2**	08
Module 4	
Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational quality attributes ,non-operational quality attributes, Embedded	08

Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling, embedded firmware design and development **Text book 2: Chapter-3, Chapter-4, Chapter-7 (Sections 7.1, 7.2 only), Chapter-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)** **RBT: L1, L2**	
Module 5	
RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques, target hardware debugging, boundary scan. **Text book 2: Chapter-10 (Sections 10.1, 10.2, 10.3, 10.4 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Chapter 12, Chapter-13 (block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)** **RBT: L1, L2**	08

Course Outcomes: The student will be able to :

CO1: Explain the architectural features and instructions of ARM microcontroller
CO2: Apply the knowledge gained for Programming ARM for different applications.
CO3: Demonstrate Interfacing of external devices and I/O with ARM microcontroller.
CO4: Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
CO5: Develop the hardware /software co-design and firmware design approaches

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.

Reference Books:

1. Raghunandan..G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019
2. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005.
3. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015.
4. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.

Internal Assessment Marks: 50 (CIE for theory component-25 Marks: 2 Tests, each of 15 marks and other assessments for 10 marks and CIE for Practical component-25 Marks: conduction of the experiment along with laboratory record for 15 Marks and test for 10 Marks).

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Subject with Subject Code:		Microcontroller & Embedded Systems-BC0601								Faculty Name: Dr. Hussana Johar R B								
		Program Outcomes												Program Specific Outcomes				
	RBT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Total	PSO1	PSO2	PSO3	Total
CO1	L2			1	-	-	-	-	-	-	-	-	-	1				-
CO2	L3			2	-	-	-	-	-	-	-	-	-	2				-
CO3	L3		2		-	-	-	-	-	-	-	-	-	2	1			1
CO4	L3			3	-	-	-	-	-	-	-	-	-	3	2			2
CO5	L3			3	-	-	-	-	-	-	-	-	-	3				-
Total			2	9										11	3			3

Note: 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution 0 = No Contribution