Semester: I / II						
INTRODUCTION TO EMBEDDED SYSTEMS **Category: Emerging Technologies** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	**EC114BT / EC124BT**		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	3 Hours

Unit-I	**08 Hrs**
Introduction: Definition of Embedded Systems, Typical examples, and Application domains (Automotive, Consumer, etc), Characteristics, Typical block diagram, Input, Core, Output, Commercial Off the Shelf Components (COTS). Processing Components, Microprocessors & Microcontrollers, Indicative Examples (Microcontrollers on Arduino boards), Development boards (Arduino boards), Concepts and brief introduction to Memory, Interrupts, Power Supply, Clocks, Reset. Case Studies: Washing Machine, Antilock Brake Systems (Block diagram & Working Principle).	
Unit – II	**08 Hrs**
Integrated Development Environment (Ide) And Programming: Basics of Embedded C Programming, Data Types, Arithmetic & Logical Operators, Loops, Functions, #define Macros, Structures (Declaration and Accessing data members). Integrated Development Environment tools: Editor, Compiler, Linker, Loader, Debugger (Definitions only). Practice: Working with Arduino IDE (Simple programs on Operators, Loops and Functions).	
Unit –III	**08 Hrs**
Serial And Parallel Interfaces: Digital Data, Analog data, Serial Vs Parallel Data Transfer, UART, I2C, SPI (only block diagram and working), Arduino board with schematics, Port pins and GPIOs, Data Sheets Practice: Interfacing Serial Modules like GSM, GPS, LEDs, Switches, Interfacing Temperature & Humidity Sensors, Interfacing LCD Module.	
Unit –IV	**08 Hrs**
Data Converters: Real world analog signals (Temperature, Bio medical signals, etc), Analog to digital conversion, Successive Approximation ADC Type, FLASH Type (Block Diagram and Explanation). Digital to Analog Conversion, R-2R DAC type, (Block Diagram and Explanation). Selection criteria of ADC and DAC for different applications. **Practice**: Programming ADC of Arduino Board, Interfacing Analog Temperature Sensor, Gas sensor, Generation of PWM Wave.	
Unit –V	**08 Hrs**
Electro Mechanical Acturators: DC motor, Principle of Operation, DC Motor Driver, Stepper Motor, Principle of Operation, Stepper Motor Driver, Servo Motor, Principle of Operation, Servo Motor Driver. (Working principles and Typical Diagrams). Planning, Design and Implementation: Smart Street Lights. **Practice**: Interfacing, Speed Control and Direction control of DC motor, Servo Motor, Stepper Motors.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyse the architecture of embedded systems, importance of different functional units and their mapping toreal-world requirements.
CO2	Interpret the embedded programming constructs, tools usage and their suitability to develop embedded applications.
CO3	Identify the data converter specifications to match with real world needs and programming with suitable configurations to achieve the same.
CO4	Demonstrate the use of serial and parallel ports for data transfer and motors for actuation.

Reference Books	
1	Embedded System Design: A Unified Hardware / Software Introduction, Tony Givargis and Frank Vahid. Wiley. ISBN-10: 812650837X.
2	Designing Embedded Systems with Arduino: A Fundamental Technology for Makers, Tianhong Pan, Yi Zhu, Springer, ISBN 978-981-10-4417-5.
3	Embedded Systems: Architecture, Programming and Design, Raj Kamal, 2nd Edition, The McGraw Hill, ISBN: 13:978-0-07-066764-8
4	Introduction to Embedded Systems, Shibu K V, 2009, Tata McGraw Hill Education Private Limited, ISBN: 10: 0070678790.
5	Embedded System Design: A Unified Hardware / Software Introduction, Tony Givargis and Frank Vahid. Wiley. ISBN-10: 812650837X.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (05), Program specific requirements (05), Video based seminar/presentation/demonstration (10), **MATLAB (20) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	16
3 & 4	Unit 2 : Question 3 or 4	16
5 & 6	Unit 3 : Question 5 or 6	16
7 & 8	Unit 4 : Question 7 or 8	16
9 & 10	Unit 5: Question 9 or 10	16
	MAXIMUM MARKS FOR THE SEE THEORY	**100**