DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE & Affiliated to Anna University, Chennai)
Re-Accredited by NAAC with 'A' Grade
Accredited by NBA for AERO, BME, CSE, ECE, EEE, IT & MECH.
PERAMBALUR-621212, TAMILNADU, INDIA.
Website: www.dsengg.ac.in

M.E COMPUTER SCIENCE AND ENGINEERING REGULATIONS – 2023

Name of the Faculty				
Designation/Department	AP/CSE			
Course Code/Name	**P23CST21-EMBEDDED SYSTEMS WITH IoT**			
Year/Section/Department	I/A/CSE			
Credits Details	L: 3	T: 1	P: 0	C:3
Total Contact Hours Required	45			

Syllabus:

UNIT I - EMBEDDED SYSTEMS ARCHITECTURE	**No. of Periods: 9**
CISC Architecture:- Introduction to MCS51 Family - 8051 Microcontroller - Architecture - Timers - Interrupts - Serial Data Communication - RISC Architecture:- overview of PIC 16F87x family - PIC16F877A - Architecture - Timers - Interrupts - Serial ports - Introduction to ARM - LPC4088 Architecture	
UNIT II - INTRODUCTION TO IOT	**No. of Periods: 9**
Introduction to IoT - Current technological trends and future prospects - Evolution of IoT- Business Scope - Relation with embedded system - Basic Architecture of an IoT - From M2M to IoT - M2M towards IoT - IoT Value Chains - An emerging industrial structure for IoT.	
UNIT III - ELEMENTS OF IOT	**No. of Periods: 9**
Application Sensors and Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN and LPWA - Overview of IoT supported Hardware platforms such as: Raspberry pi - ARM Cortex Processors - Arduino and Intel Galileo boards - Wearable Development Boards..	
UNIT IV - COMMUNICATION AND CONNECTIVE TECHNOLOGIES	**No. of Periods: 9**
IoT Communication Model - Cloud computing in IoT - IoT in cloud architecture - Logging on to cloud - Selecting and Creating cloud service - cloud based IoT platforms - IBM Watson - Google cloud.	
UNIT V - DATA ANALYTICS AND IOT PLATFORM	**No. of Periods: 9**
Big Data Analytics - Apache Hadoop - Using Hadoop Map Reduce for Batch Data Analysis - Apache Storm - Data Visualization - Visualization tools for IoT.	

TOTAL: 45 PERIODS

Objectives:

1. To get familiarized with the embedded hardware architecture
2. To understand the basics of RTOS and the attributes of various communication protocols.
3. To build knowledge on Embedded C programming and realize the concept of peripheral interfacing.
4. To get introduced with the concept of IoT and architecture of IoT systems
5. To acquire knowledge over IoT implementation tools and thecore elements of IIoT

Text Book:

T1- ***Raj Kamal***, Embedded Systems: Architecture, Programming and Design, *McGraw-Hill Education, 2nd Edition.*
T2 - ***Arshdeep Bahga, Vijay Madisetti***, Internet of Things: A Hands-On Approach, *Universities Press*, 1st Edition.
T3- ***Peter Waher***, Learning Internet of Things, *Packt Publishing, 2015.*

Reference Book:

R1. Andrew S. Tanenbaum & David J. Wetherall, *Computer Networks*
R2. Douglas E. Comer, Internetworking *with TCP/IP*.
R3.Charlie Kaufman, Radia Perlman, Mike Speciner**,** *Network Security: Private Communication **in** a Public World*

Website:

W1: https://www.statlect.com/probability-distributions
W2: https://www.khanacademy.org/math/statistics-probability
W3: https://stattrek.org/probability/probability-rules.aspx
W4: https://www.geeksforgeeks.org/probability-in-maths//

Online Mode of Study:

W1: https://onlinecourses.nptel.ac.in/noc24_ma23/preview
W2: https://www.coursera.org/courses?query=probability%20and%20statistics
W3: https://www.khanacademy.org/math/statistics-probability
W4: https://stattrek.org/statistics/tutorials.aspx
W5: https://www.statlect.com/

Course Plan:

Topic Number	Topic	Reference Detail	Page Number	Mode of teaching	Number of Periods Required	Cumulative Period
UNIT I -INTRODUCTION AND TCP/IP						
1	CISC Architecture & MCS51 Family	T1	1-5	BB	1	1
2	8051 Microcontroller – Architecture	T1	6-10	BB	1	2
3	Timers in 8051	T1	11-15	BB	1	3

4	Interrupts in 8051	T1	16-20	BB	1	4
5	Serial Data Communication	T1	21-25	BB	1	5
6	RISC Architecture & PIC16F87x Family	T1	26-30	BB	1	6
7	PIC16F877A – Timers, Interrupts, Serial Ports	T1	31-35	BB	1	7
8	ARM Introduction	T1	36-40	BB	1	8
9	LPC4088 Architecture	T1	41-45	BB	1	9

Outcome of Unit I:

At the end of unit, Students should be able to

- Understand the concept of embedded system and its architectural features.

UNIT II - INTRODUCTION TO IOT

10	Introduction to IoT	T1	46-50	BB	1	10
11	Technological trends & future prospects	T1	51-55	BB	1	11
12	Evolution of IoT	T1	56-60	BB	1	12
13	Business scope of IoT	T1	61-65	BB	1	13
14	Relation with embedded systems	T1	66-70	BB	1	14
15	Basic IoT architecture	R1	71-75	BB	1	15
16	M2M vs IoT	T1	76-80	PPT	1	16
17	IoT value chain	T1	81-85	BB	1	17
18	Industrial structure of IoT	T1	86-90	BB	1	18

Outcome of Unit II:

At the end of this unit, students should be able to:

- Develop embedded software using Embedded C and Python.

UNIT-III - ELEMENTS OF IOT

19	Sensors and actuators	T1	91-95	BB	1	19
20	Edge networking – WSN	T1	96-100	BB	1	20
21	Gateways	T1	101-105	BB	1	21
22	IoT communication model	T1	106-110	BB	1	22
23	WPAN & LPWA	T1	111-115	BB	1	23
24	Raspberry Pi platform	T1	116-120	BB	1	24
25	ARM Cortex processors	T1	121-125	BB	1	25
26	Arduino & Intel Galileo	T1	126-130	BB	1	26
27	Wearable development boards	T1	131-135	BB	1	27

. Outcome of Unit III:

At the end of this unit, students should be able to:

- Implement the various IoT Protocols

UNIT-IV- COMMUNICATION AND CONNECTIVE TECHNOLOGIES						
28	IoT communication model	T2	136-140	BB	1	28
29	Cloud computing basics	T2	141-145	BB	1	29
30	IoT in cloud architecture	T2	146-150	BB	1	30
31	Logging onto cloud	T2	151-155	BB	1	31
32	Selecting cloud services	T2	156-160	BB	1	32
33	Cloud-based IoT platforms	T2	161-165	BB	1	33
34	IBM Watson IoT platform	T2	166-170	BB	1	34
35	Google Cloud IoT Core	T2	171-175	BB	1	35
36	Case studies	T2	176-180	BB	1	36

Outcome of Unit IV:

At the end of this unit, students should be able to:

- Acquire real world signals and perform remote process monitoring utilizing the concept of IoT.

UNIT-V - DATA ANALYTICS AND IOT PLATFORM						
37	Introduction to Big Data analytics	T2	181-185	**BB**	**1**	37
38	Apache Hadoop overview	T2	186-190	BB	1	38
39	Using Hadoop MapReduce	T2	191-195	BB	1	39
40	Hadoop programming model	T2	196-200	BB	1	40
41	Apache Storm	T2	201-205	BB	1	41
42	IoT data visualization	T2	206-210	BB	1	42
43	Visualization tools for IoT	T2	211-215	BB	1	43
44	Integrating analytics with IoT	T2	216-220	BB	1	44
45	Case studies & applications	T2	221-225	BB	1	45

Outcome of Unit V:

At the end of this unit, students should be able to:

- Design and implement IoT enabled embedded control strategy for a given application.
- Apply IoT concepts in big data analytics.

Course Outcome:

At the end of the course the students would be able to

CO1: Understand the concept of embedded system and its architectural features.
CO2: Develop embedded software using Embedded C and Python.
CO3: Implement the various IoT Protocols
CO4: Acquire real world signals and perform remote process monitoring utilizing the concept of IoT.
CO5: Design and implement IoT enabled embedded control strategy for a given application.
CO6: Apply IoT concepts in big data analytics.

Course Outcome Vs Program Outcome Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	-	-	-	-	-	-	-	1	-	-	2	1
CO 2	3	2	1	1	1	-	-	-	-	1	-	2	2	1
CO 3	2	1	-	-	-	-	-	-	-	1	-	-	2	1
CO 4	2	1	-	-	-	-	-	-	-	1	-	-	2	1
CO 5	2	1	-	-	-	-	-	-	-	1	1	-	2	1
CO 6	2	1	-	-	1	-	-	-	2	1	1	2	2	1
AVG	**2**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**2**	**1**	**1**	**2**	**2**	**1**

Internal Evaluation Components:

Webportal	Assignment	Components	Topic Number with Topic / Unit Details	Relevance to CO
Webportal 1	--	**Assessment – I (60)**	**Unit I and II**	**CO 1 & CO2**
	1	**Assignment – Handwritten (20)**	1 Explain 8051 microcontroller architecture with a diagram. 2. Describe timers and interrupt handling in PIC16F877A.	CO1
	2	**Assignment – Poster Presentation / PPT (20)**	1. Explain the basic architecture of an IoT system. 2 Explain industrial applications of IoT with examples.	CO2
Webportal 2	--	**Assessment – II (60)**	**Unit III and IV**	**CO3 & CO4**

	3	**Seminar (20)**	1**.** Explain edge networking and WSN in IoT. 2. Discuss sensors and actuators for IoT applications.	CO3
	4	**Case Study Report (20)**	1 Explain IoT integration with cloud architecture.. 2. Compare IBM Watson and Google Cloud IoT platforms.	CO4
Webportal 3	**--**	**Model Exam (75)**	**Unit I to V**	**CO1 to CO6**
	5	**MCQ (15)**	**Unit I to V**	**CO1 to CO6**
	-	**Course Attendance (10)**	**--**	**--**

Submission Details:

Phase 1(Before AT 1)	**Phase 2 (Before AT 2)**	**Phase 3(Before Model Exam)**
Assignment 1	**Assignment 2**	**Assignment 3**

PLAN OF ASSESSMENT TEST –DISTRIBUTION OF MARKS:

TEST	**CO- MARK WISE DISTRIBUTION**						**BLOOM'S LEVEL MARK WISE DISTRIBUTION**					
AT-1	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**	**BTL1**	**BTL2**	**BTL3**	**BTL4**	**BTL5**	**BTL6**
	37	**23**	**-**	**-**	**-**	**-**						
AT-2	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**	**BTL1**	**BTL2**	**BTL3**	**BTL4**	**BTL5**	**BTL6**
	-	**-**	**37**	**23**	**-**	**-**						
MODEL	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**	**BTL1**	**BTL2**	**BTL3**	**BTL4**	**BTL5**	**BTL6**
	20	**20**	**20**	**20**	**10**	**10**						

Prepared By **Verified By**

Approved By