ANNEXURE 3.1.2

EARLIER CO PO MAPPING

Course Name: DSP

CO 18EC52	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	K3	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	K3	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO3	K3	3	2	3	-	-	-	-	-	-	-	-	-	3	2
CO4	K3	3	2	3	-	-	-	-	-	-	-	-	-	3	2
CO5	K3	3	2	3	-	-	-	-	-	-	-	-	-	3	2
18EC52		3	2	3	-	-	-	-	-	-	-	-	-	3	2

REDEFINED CO PO MAPPING

Course Name: DSP

CO 18EC52	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
18EC52.1	K3	3	2	2	-	**2**	-	-	-	**2**	**2**	**2**	**2**	3	2
18EC52.2	K3	3	2	2	-	**2**	-	-	-	**2**	**2**	**2**	**2**	3	2

18EC 52.3	K3	3	2	3	-	**2**	-	-	-	**2**	**2**	**2**	**2**	3	2
18EC 52.4	K3	3	2	3	-	**2**	-	-	-	**2**	**2**	**2**	**2**	3	2
18EC 52.5	K3	3	2	3	-	**-**	-	-	-	-	-	-	-	3	2
18EC 52 (Before CBS)		3	2	2.6										3	2
Strength due to Activity: Mini Project Report						**2**				**2**	**2**	**2**	**2**		
18EC 52		3	2	2.6	-	**2**	-	-	-	**2**	**2**	**2**	**2**	3	2

CO PO Mapping of Course EMBEDDED SYSTEMS with Justification

K. S. INSTITUTE OF TECHNOLOGY

#14, Raghuvanahalli, Kanakapura Main Road, Bengaluru-5600109

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

CO-PO/PSO Mapping

Course: EMBEDDED SYSTEMS		Course Code:18EC62	Type: CORE
Course Incharge : Dr. B Sudarshan		Academic Year: 2022-23	
No of Hours per week			
Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total/Week	Total teaching hours
4	1	4	52
Marks			
Internal Assessment	Examination	Total	Credits
40	60	100	4

Aim/Objective of the Course:

Aim/Objective of the Course:

- Understand the architectural features and instruction set of 32 bit microcontroller ARM Cortex M3.
- Program ARM Cortex M3 using the various instructions and C language for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware software co-design and firmware design approaches.

Course Learning Outcomes: After completing the course, the students will be able to,		**Bloom's Level**
18EC62.1	**Construct** the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.	Applying (K3)
18EC62.2	**Make use of** the knowledge gained for Programming ARM Cortex M3 for different applications.	Applying (K3)
18EC62.3	**Identify** the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.	Applying (K3)
18EC62.4	**Develop** the hardware/software co-design and firmware design using ARM Cortex M3 instruction set.	Applying (K3)
18EC62.5	**Establish** the need for real time operating system in embedded system applications	Applying (K3)

Syllabus Content:	COs, POs and PSOs mapping
Module 1: Instruction list and description, Thumb and ARM instructions, Special instructions, Useful instructions, CMSIS, Assembly and C language Programming LO: At the end of this session the student will be able to, 1. Program ARM Cortex M3 using the various instructions and C language for different applications. 2. understand memory mapping concepts 3. Perform bus interfaces and understand CMSIS	CO1 10hrs PO1-3 PO2-2
Module 2: RM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Thumb and ARM instructions, Special instructions, Useful instructions, CMSIS, Assembly and C language Programming LO: At the end of this session the student will be able to, 1. Program ARM Cortex M3 using the various instructions and C language for different applications. 2. understand memory mapping concepts 3. Perform bus interfaces and understand CMSIS	CO2 10hrs. PO1-3 PO2-2
Module 3 :Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Differences between RISC and CISC, Harvard and Princeton, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only) LO: At the end of this session the student will be able to, 1. Differentiate Embedded and general computing systems. 2. Major applications of embedded systems. 3. Have a sound knowledge of all the interfaces used.	CO3 10hrs PO1-3 PO2-2
Module 4: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling (excluding UML), Embedded firmware design and development (excluding C language). LO: At the end of this session the student will be able to, 1. Analyse the characteristics and quality attributes of embedded systems. 2. Have sufficient knowledge to develop embedded system applications	CO4 10hrs PO1-3 PO2-2

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, Preemptive Task scheduling techniques, Task Communication, 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 LO: At the end of this session the student will be able to, 1. Understand the basics of operating systems, task, and process. 2. Understand how to choose an RTOS. 3. Work in embedded system environment using Keil.	CO5 10hrs PO1-3 PO2-2

Text Books:

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition

Reference Books:

1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0- 471-72180-2.
2. Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2nd E - Man Press LLC ©2015 ISBN:0982692633 9780982692639.
3. Embedded real time systems by K.V. K. K Prasad, Dreamtech publications, 2003.
4. Embedded Systems by Rajkamal, 2nd Edition, McGraw hill Publications, 2010.

Useful websites:

ARM CORTEX M3 Tutorial VIDEOs:
https://www.youtube.com/playlist?list=PLILsWEPZKv_HiKVDDDpOP0jp5grZvNn1D

Useful Journals

- https://www.eecs.umich.edu/courses/eecs373/readings/ARM_Cortex_AppNote179.pdf
- https://www.arm.gov/research/publications IEEE Journal on Robotics and Automation

Teaching and Learning Methods:

1. Lecture class: 50 hrs.
2. Self-study: 5hrs.
3. Field visits/Group Discussions/Seminars: 1hrs.
4. Practical classes: 3hrs.

Type of test/examination: Written examination
Continuous Internal Evaluation(CIE) : 30 marks (Average of best two of total three tests will be considered)
Test duration: 1 :30 hr
Semester End Exam (SEE) : 60 marks (students have to answer all main questions)
Examination duration: 3 hrs

CO - PO MAPPING

PO1: Science and engineering Knowledge **PO2:** Problem Analysis **PO3:** Design & Development **PO4:**Investigations of Complex Problems **PO5:** Modern Tool Usage **PO6:** Engineer & Society	**PO7:**Environment and Sustainability **PO8:**Ethics **PO9:**Individual & Team Work **PO10:** Communication **PO11:**Project Management & Finance **PO12:**Life long Learning

PSO1: Graduate should be able to understand the fundamentals in the field of Electronics Communication and apply the same to various areas like Signal processing, embedded system Communication & Semiconductor technology.

PSO2: Graduate will demonstrate the ability to design, develop solutions for Problems in Electronics Communication Engineering using hardware and software tools with social concerns.

CO 18EC62	Bloom's Level	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
18EC62.1	K3	1	-	_	1	1	1	1	1	1	1	1	1	-	-
18EC62.2	K3	3	2	_	2	2	2	2	2	2	2	2	2	3	2
18EC62.3	K3	3	2	2	3	3	3	3	2	3	3	3	3	3	3
18EC62.4	K3	3	2	2	3	3	3	3	2	3	3	3	3	3	3
18EC62.5	K3	3	2	2	3	3	3	3	2	3	3	3	3	3	3
18EC62 before CBS		3	2	2	_	_	_	_	_	_	_	_	_	3	2.6
CBS		_	_	_	2.4	2.4	2.4	2.4	1.8	2.4	2.4	2.4	2.4	_	_
18EC62 after CBS		3	2	2	2.4	2.4	2.4	2.4	1.8	2.4	2.4	2.4	2.4	3	2.6

Justification for CO-PO, PSO mapping

CO-PO MAPPING Justification Table		
PO	**CO1: Construct** the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.	Mapping strength
1	The students will be able to apply the Knowledge Of • Mathematics	1
PO	**CO2: Make use of** the knowledge gained for Programming ARM Cortex M3 for different applications.	Mapping strength
1	The students will be able to apply the Knowledge Of • Mathematics • engineering fundamentals • engineering specialization	3
2	The students will be able to • Identify • Formulate Engineering problems	2

PSO1	The students will be able to understand the fundamentals of ECE in • Embedded systems • Communication • Semiconductor Technology And develop assembly/embedded C code for designs in these areas.	3
PSO2	The students will be able to gain the knowledge to • Develop solutions using cARM ortex M3 and design them using software tools	2
PO	CO3 **Identify** the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. CO4 **Develop** the hardware/software co-design and firmware design using ARM Cortex M3 instruction set. CO5 **Establish** the need for real time operating system in embedded system applications	Mapping strength
1	The students will be able to apply the Knowledge Of • Mathematics • engineering fundamentals • engineering specialization	3
2	The students will be able to • Identify • Formulate Engineering problems	3
3	The students will be able to • Design solutions to problems • Develop digital systems to meet the specifications..	2
PSO1	The students will be able to understand the fundamentals of ECE in • Embedded systems • Communication • Semiconductor Technology And develop assembly/embedded C code for designs in these areas.	3
PSO2	The students will be able to gain the knowledge to • Develop solutions using ARM Cortex M3 and design them using software tools	3
PO	**Content Beyond Syllabus Activity: Mini Project**	Mapping strength
4	The students will able to • Design Of Solution for Complex Problems • Analysis Of Problems.	2
5	The students will be able to • Select & Apply KiEL Micro Vision tool to model embedded systems • Use ARM CortexM3 Simulator to model embedded systems.. Use ARM Cortex M3 to prototype the designs	3
6	The students will be able to Apply reasoning during the project work and • assess Societal, health, safety and legal issues • Understand the responsibly as an engineer • Understand thee cultural issues	3
7	The students will be able to • Understand the Impact of the work on society • Understand the Impact of the work on environment • Demonstrate the knowledge acquitted	3

8	The students will be able to • Follow ethical principles while writing Assembly/Embedded-C code. • Follow ethical principles while working in project team and writing the project report.	2
9	The students will be able to Work effectively in the project team as • An Individual • A Team member • A a leader of the team	3
10	The students will be able to • Receive and understand clear instructions about the project. • Communicate within the team • Comprehend & write Effective Reports • Effective Presentations	3
11	The students will be able to • Make project plan and follow the same. • Identify the team leader • Divide the work for individuals in the team • Manage the project and complete its activities on time.	3
12	The students will be able to • Develop individual and independent learning abilities by getting involved in projects.	3

CO PO mapping for the events conducted after gap identification

Sl. No.	Gap Identification	Activity Planned to fill the gap	CO	Relevant PO Mapping
1	PO4 to PO12	Mini Project	CO1, CO2, CO3, CO4, CO5	PO4, PO5, PO8,PO9, PO10, PO11, PO12,

Justification - Number Of Key Elements of PO Mapped To CO's

Number of elements getting mapped is less for 1st and 2nd CO's as students are learning basics of embedded systems these CO's. All other CO's involve using embedded systems approach for design and development of the project.

PO2,PO5,PO7, PO9 to PO12, PSO2
CO1 maps slightly to these PO's as it imparts basic knowledge of CORTEX-M3.
CO2 maps moderately to these PO's as it imparts knowledge o usage of Instructions.
CO3 to CO5 map strongly to these PO's as these CO's impart knowledge at application level.
PO8 moderately maps to CO's due to moderate application of ethical prnciples during the conduction of mini project.

Course in-Charge Module Coordinator HOD