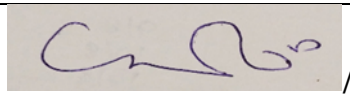
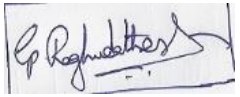
Master of Engineering - ME (Embedded Systems)

Course File

Course Name	:	**Microcontrollers and its Applications**
Course Code	:	**ESD 5103**
Academic Year	:	2024 - 25
Semester	:	I
Name of the Course Coordinator	:	Mr. RAGHUDATHESH G P
Name of the Program Coordinator	:	Dr. Dinesh Rao

 **//2025**	 **//2025**
Signature of Program Coordinator with Date	**Signature of Course Coordinator with Date**

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Program Education Objectives (PEOs)

The overall objectives of the Learning Outcomes-based Curriculum Framework (LOCF) for **ME (Embedded Systems)**, program are as follows.

PEO No	Education Objective
PEO 1	Enable to draw upon fundamental and advanced knowledge in order to apply analytical and computational approach to solve technological problems in embedded systems.
PEO 2	Introduce state of art technologies in the area of embedded system and inculcate ethical practices to make industry ready professional.
PEO 3	Promote scientific and societal advancement through research and entrepreneurship.

Program Outcomes (POs)

By the end of the postgraduate program in **ME (Embedded Systems)**, graduates will be able to:

PO1	Acquire in-depth knowledge of embedded system domain, with an ability to discriminate, evaluate, analyze, synthesize the existing and new knowledge, and integration of the same for enhancement of knowledge.
PO2	Analyze complex embedded system Eco System critically; apply independent judgement for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
PO3	Think laterally and originally, conceptualize and solve embedded system Design problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
PO4	Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.
PO5	Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.

1. Course Plan

1.1 Primary Information

Course Name	**:**	**Microcontrollers and its Applications [ESD 5103]**
L-T-P-C	**:**	3-0-0-3
Contact Hours	**:**	36 Hours
Pre-requisite	**:**	Basic Programming with C
Core/ PE/OE	**:**	Program Elective

1.2 Course Outcomes (COs), Program outcomes (POs) and Bloom's Taxonomy Mapping

CO	At the end of this course, the student should be able to:	No. of Contact Hours	Program Outcomes (PO's)	BL
CO1	Employ the knowledge of Microcontrollers to build embedded systems.	14	PO1	3
CO2	Explain the concept of Programming Microcontrollers using Assembly and Embedded C.	6	PO2	2
CO3	Demonstrate Embedded Systems by interfacing Sensors and Actuators.	16	PO3	3

1.3 Assessment Plan

Components	Internal Test 1	Flexible Assessments (2 – 3 in number)	End semester/ Makeup examination
Duration	90 minutes	To be decided by the faculty.	180 minutes
Weightage	0.3	0.2	0.5
Typology of questions	Applying; Analyzing.	Applying; Analyzing. Understanding.	Applying; Analyzing; Understanding.
Pattern	Answer all 5 questions of 10 marks each.	**Assignment:** (Programming on Embedded C.)	Answer all 10 full questions of 10 marks each.
Schedule	As per academic calendar.	**Assignment submission:** November 2024	As per academic calendar.
Topics covered	Introduction – Microprocessor, microcontroller Reset circuitry, LED inetrfacing ARM microcontroller, timers, Serial communication	Programming on Embedded C.	Comprehensive examination covering the full syllabus. Students are expected to answer all questions.

1.4 Lesson Plan

L. No.	TOPICS	Course Outcome Addressed
L0	Course delivery plan, Course assessment plan, Course outcomes, Program outcomes, CO-PO mapping, reference books	---
L1	Introduction to microprocessor and microcontroller comaparions	CO1
L2	Introduction to embedded Board , application types, single and multiple task , applications	CO1
L3	Introduction to ARM microcontroller LPC XXXX Features	CO2
L4	Details of PIN configuration	CO2
L5	ARM and Thumb information	CO2
L6	RAM, ROM details	CO2
L7	Memory Map	CO2
L8	Interrupts concepts	CO2
L9	Reset Circuitry	CO1
L10	Crystals . circruits	CO1
L11	GPIOs registers	CO1
L12	Input output configuerations	CO1
L13	Register concepts of pullup and down, intro timers	CO1
L14	Interfacing lED, buttons, relays timer programming	CO1

L15	Counter programming,configuration	CO1
L16	LCD interfacing, stepper motor inroduction	CO1
L17	Programming of LCD, stepper motors	CO1
L18	Serial communication introduction	CO3
L19	Serial vs parallel terminology	CO3
L20	Hand shaking concepts configurations	CO3
IT	Mid-test	
L21	Regsiters of serials communications etc	CO3
L22	Programming of serial communication protocols	CO3
L23	UART programming	CO3
L24	SPI and I2c protocol	CO3
L25	Details discussion of protocols	CO3
L26	Bitbanging	CO3
L27	Interfacing with SPI	CO3
L28	Interfacing with I2C devices	CO3
L29	RTC	CO3
L30	Introduction of ADC DAC	CO3
L31	Types of of ADC , DAC chips	CO3
L32	Registers , configurations	CO3
L33	Programming of ADC	CO3
L34	Programming of DAC	CO3

L35	Interfacing of and programming and executions	CO3
L36	Embedded devise applications	CO3

1.5 References

William Hohl, Christopher Hinds,"ARM Assembly Language: Fundamentals and Techniques",2nd Edition, ISBN-13: 978-1482229851, ISBN-10: 1482229854

Andrew Sloss, Dominic Symes, Chris Wright,"ARM System Developer's Guide: Designing and Optimizing System Software",1st Edition,The Morgan Kaufmann Series in Computer Architecture and Design, ISBN13: 978-1558608740, ISBN-10: 1558608745

David Seal, "ARM Architecture Reference Manual", 2nd Edition, Addison-Wesley Professional.

Steve Furber,"ARM System-on-Chip Architecture",2nd Edition,Addison-Wesley Professional, ISBN-13: 078- 5342675191,ISBN-10: 0201675196

Douglas V. Hall,"Microprocessors and Interfacing",Mcgraw Hill Education ,ISBN-10 1259006158,ISBN-13 9781259006159,2012.

Websites & Transaction Papers

MOOC: https://www.coursera.org/learn/armv8-m-architecture-fundamentals#syllabus

1.6 Other Resources (Online, Text, Multimedia, etc.)

1. Web Resources: Blog, Online tools and cloud resources.
2. Journal Articles.

1.7 Course Timetable

1st Semester Embedded **Room: LG1 LH10** **Lab: ES Lab**

	8- 9	9 - 10	10 - 11	11 – 12	12 – 1	1-2	2 – 3	3 – 4	4 - 5
MON		DS	DS LAB				SEM	ACA	
TUE		RTOS	**MCA**	ELE			ELE LAB*		
WED		DS	RTOS LAB				SEM	ACA	
THU		RTOS	**MCA**	ELE			ACA LAB		
FRI		DS	**MCA LAB**				SEM	ACA	
SAT		RTOS	**MCA**	ELE			Mini Project		

Advanced Computer Architecture – Ravikala, Data Structures and Algorithms – Dinesh Rao, Microcontrollers and its Applications – Raghudathesh G P
Real Time Operating Systems – Keerthana Prasad, ELE - Internet of Things – Samar, ELE - Database Programming in Java – Sathyendranath Malli

1.8 Assessment Plan

COs		Marks & Weightage			
CO No.	CO Name	Mid semester (Max. 50)	Assignment (Max. 20)	End Semester (Max. 100)	CO wise Weightage
CO1	Employ the knowledge of Microcontrollers to build embedded systems.	30	-	50	**0.47**
CO2	Explain the concept of Programming Microcontrollers using Assembly and Embedded C.	20	10	20	**0.29**
CO3	Demonstrate Embedded Systems by interfacing Sensors and Actuators.	-	10	30	**0.23**
	Marks (weightage)	**0.29**	**0.11**	**0.588**	**1.0**

Note:

- In-semester Assessment is considered as Midterm Assessment (IA) in this course for 50 marks which includes the performances in class participation, assignment work, mid-term tests, quizzes etc.
- End-semester examination (ESE) for this course is conducted for a maximum of 100 and the same will be scaled down to 50.
- End-semester marks for a maximum of 50 and IA marks for a maximum of 50 are added for a maximum of 100 marks to decide upon the grade in this course.

Weightage for CO1 = (IT1 marks for CO1 / 2.5 + IT2 marks for CO1 / 2.5 + Assignment marks for CO1 + ESE marks for CO1 / 2)/100

= (25/2.5 + 0 + 0 + 20/ 2)/100 = 0.2

1.9 Assessment Details

The assessment tools to be used for the Current Academic Year (CAY) are as follows:

SI. No.	Tools	Weightage	Frequency	Details of Measurement (Weightage/Rubrics/Duration, etc.)
1	Internal Test	0.3	1	• Performance is measured using internal test attainment level. • Reference: question paper and answer scheme. • Each internal test is assessed for a maximum of 50 marks and scaled down to 30 marks.
2	Assignments	0.2	2	• Performance is measured using assignments/quiz attainment level. • Assignments/quiz are evaluated for a maximum of 20 marks.
3	ESE	0.5	1	• Performance is measured using ESE attainment level. • Reference: question paper and answer scheme. • ESE is assessed for a maximum of 100 marks and scaled down to 50 marks.

1.10 Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5
CO1	**Y**				
CO2		**Y**			
CO3			**Y**		
Average Articulation Level	*	*	*		