



MANIPAL SCHOOL OF INFORMATION SCIENCES

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Master of Engineering - ME (Embedded Systems)

Course File

Course Name	:	Microcontroller and its Applications
Course Code	:	ESD 5103
Academic Year	:	2023 – 24
Semester	:	I
Name of the Course Coordinator	:	Ravikala Kamath
Name of the Program Coordinator	:	Dr. Dinesh Rao

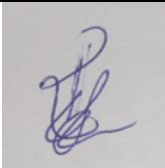
	
Signature of Program Coordinator with Date	Signature of Course Coordinator with Date 5.8.23



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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 to apply analytical and computational approaches to solve technological problems in embedded systems.
PEO 2	Introduce state of art technologies in the area of embedded systems and inculcate ethical practices to make industry-ready professionals.
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	Independently carry out research /investigation and development work to solve practical problems.
PO2	Write and present a substantial technical report/document.
PO3	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	Develop and implement embedded systems requirements based on theoretical principles and practical knowledge.
PO5	Demonstrate knowledge of the underlying principles and evaluation methods for analyzing data for decision-making.



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1. Course Plan

1.1 Primary Information

Course Name	:	Microcontrollers and Its Applications [ESD 5101]
L-T-P-C	:	3-0-0-3
Contact Hours	:	36 Hours
Pre-requisite	:	Basic Programming with C
Core/ PE/OE	:	Core



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	Apply and understand the various type of controllers , kind of applications types executables.	5	PO3	3
CO2	Analyze the various components of LPCxxxx processors	9	PO4	4
CO3	Analyze the I/O configurations and functionalities of GPIO – registers- timers	9	PO4	4
CO4	Apply and understand the terminology of communication protocol	7	PO3	3
CO5	Analyze and Evaluate the design of embedded systems by interfacing sensors and actuators	6	PO5	5



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1.3 Assessment Plan

Components	Internal Test 1	Internal Test 2	Flexible Assessments (2 – 3 in number)	End semester/ Makeup examination
Duration	90 minutes	90 minutes	To be decided by the faculty.	180 minutes
Weightage	0.2	0.2	0.1	0.5
Typology of questions	Applying; Analyzing.	Applying; Evaluating.	Applying; Analyzing. Evaluating.	Applying; Analyzing; Evaluating.
Pattern	Answer all 5 questions of 10 marks each. Each question may have 2 to 3 parts of 3/4/5/6/7 marks.	Answer all 5 questions of 10 marks each. Each question may have 2 to 3 parts of 3/4/5/6/7 marks.	Assignment: [To be decided by the faculty. May be Assignments, Problem solving, etc.]	Answer all 10 full questions of 10 marks each. Each question may have 2 to 3 parts of 3/4/5/6/7 marks.
Schedule	As per academic calendar.	As per academic calendar.	Assignment submission: Decided by faculty	As per academic calendar.



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Topics covered	Introduction – Microprocessor, microcontroller Reset circuitry, LED interfacing ARM microcontroller, timers	Serial communication SPI I2C Communication Protocols etc	ADC DAC	Comprehensive examination covering the full syllabus. Students are expected to answer all questions.
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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 comparisons	CO1
L2	Introduction to embedded Board , application types, single and multiple task , applications	CO1
L3	Introduction to ARM microcontroller LPC XXXX Features	CO1
L4	Details of PIN configuration	CO4
L5	ARM and Thumb information	CO3
L6	RAM, ROM details	CO3
L7	Memory Map	CO5
L8	Interrupts concepts	CO2
L9	Reset Circuitry	CO2
L10	Crystals . circuits	CO2
L11	GPIOs registers	CO5
L12	Input output configurations	CO5



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L13	Register concepts of pullup and down, intro timers	CO2
L14	Interfacing IED, buttons, relays timer programming	CO2
IT1	Internal test 1	CO1 & CO2
L15	Counter programming, configuration	CO3
L16	LCD interfacing, stepper motor introduction	CO2
L17	Programming of LCD, stepper motors	CO4
L18	Serial communication introduction	CO3
L19	Serial vs parallel terminology	CO5
L20	Hand shaking concepts configurations	CO5
L21	Registers of serial communications etc	CO4
L22	Programming of serial communication protocols	CO3
L23	UART programming	CO2
L24	SPI and I2c protocol	CO2
L25	Details discussion of protocols	CO2
L26	Bitbanging	CO3
L27	Interfacing with SPI	CO2
L28	Interfacing with I2C devices	CO3
L29	RTC	CO3
L30	Introduction of ADC DAC	CO3
IT2	Internal test 2	CO3 & CO4



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L31	Types of of ADC , DAC chips	CO2
L32	Registers , configurations	CO2
L33	Programming of ADC	CO3
L34	Programming of DAC	CO2
L35	Interfacing of and programming and executions	CO2
L36	Embedded devise applications	CO3

1.5 References

1. William Hohl, Christopher Hinds,"ARM Assembly Language: Fundamentals and Techniques",2nd Edition, ISBN-13: 978-1482229851, ISBN-10: 1482229854
2. 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
3. David Seal, "ARM Architecture Reference Manual", 2nd Edition, Addison-Wesley Professional.
4. Steve Furber,"ARM System-on-Chip Architecture",2nd Edition,Addison-Wesley Professional, ISBN-13: 078- 5342675191,ISBN-10: 0201675196
5. Douglas V. Hall,"Microprocessors and Interfacing",Mcgraw Hill Education ,ISBN-10 1259006158,ISBN-13 9781259006159,2012.
6. Websites & Transaction Papers
7. 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.



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1.7 Course Timetable

1 st Semester Embedded Systems				Room: LG1 LH				
	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
MON		MCA LAB						
TUE		MCA						
WED								
THU		MCA						
FRI								
SAT		MCA						



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1.8 Assessment Plan

COs		Marks & Weightage				
CO No.	CO Name	IT-1 (Max. 50)	IT-2 (Max. 50)	Assignment (Max. 10)	End Semester (Max. 100)	CO wise Weightage
CO1	Apply and understand the various type of controllers , kind of applications types executables.	10	-	-	10	0.09
CO2	Analyze the various components of LPCxxxx processors	20	-	-	15	0.155
CO3	Analyze the I/O configurations and functionalities of GPIO – registers- timers	20		-	20	0.18
CO4	Apply and understand the terminology of communication protocol	-	50	-	30	0.35
CO5	Analyze and Evaluate the design of embedded systems by interfacing sensors and actuators	-	-	10	25	0.225
	Marks (weightage)	0.2	0.2	0.1	0.5	1.0



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Note:

- In-semester Assessment is considered as the Internal Assessment (IA) in this course for 50 marks, which includes the performances in class participation, assignment work, class tests, 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.

$$\begin{aligned}\text{Weightage for CO1} &= (\text{IT1 marks for CO1} / 2.5 + \text{IT2 marks for CO1} / 2.5 + \text{Assignment marks for CO1} + \text{ESE marks for CO1} / 2) / 100 \\ &= (25/2.5 + 0 + 0 + 20/2) / 100 = 0.2\end{aligned}$$



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1.9 Assessment Details

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

Sl. No.	Tools	Weightage	Frequency	Details of Measurement (Weightage/Rubrics/Duration, etc.)
1	Internal Test	0.4	2	<ul style="list-style-type: none">• 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 40 marks.
2	Assignments	0.1	1	<ul style="list-style-type: none">• Performance is measured using assignments/quiz attainment level.• Assignments/quiz are evaluated for a maximum of 10 marks.
3	ESE	0.5	1	<ul style="list-style-type: none">• 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	
CO4			Y		
CO5					Y
Average Articulation Level			*	*	*