Master of Engineering - ME (Embedded Systems)

Course Name : Microcontrollers and its Applications

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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

Course File

//2025 //2025

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Signature of Program Coordinator Signature of Course Coordinator

with Date with Date

Course Plan 5 1.

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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]

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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 Program Outcomes BL

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Hours (PO's)

Employ the knowledge of Microcontrollers to build 14 PO1

CO1 embedded systems. 3

Explain the concept of Programming Microcontrollers

CO2 6 PO2 2

using Assembly and Embedded C.

Demonstrate Embedded Systems by interfacing Sensors

CO3 and Actuators. 16 PO3 3

1.3 Assessment Plan

Components Internal Test 1 Flexible Assessments End semester/ Makeup

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(2 - 3 in number) 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. Applying; Analyzing;

Understanding. Understanding.

Pattern Answer all 5 questions of 10 marks Assignment: (Programming on Embedded Answer all 10 full questions of

each. C.) 10 marks each.

Schedule As per academic calendar. Assignment submission: November 2024 As per academic calendar.

Topics covered Introduction - Microprocessor,

microcontroller Comprehensive examination

Reset circuitry, LED inetrfacing Programming on Embedded C. covering the full syllabus.

ARM microcontroller, timers, Students are expected to

Serial communication answer all questions.

1.4 Lesson Plan

L. No. TOPICS Course Outcome Addressed

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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

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L16 LCD interfacing, stepper motor inroduction CO1

L17 Programming of LCD, stepper motors CO1

L18 Serial communication introduction CO 3

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

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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

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

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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

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CO No. CO Name Mid semester Assignment (Max. 20) End Semester (Max. 100) CO wise Weightage

(Max. 50)

CO1 Employ the knowledge of Microcontrollers to build 30 - 50 0.47

embedded systems.

CO2 Explain the concept of Programming Microcontrollers using Assembly and Embedded C. 20

10 20 0.29

CO3 Demonstrate Embedded Systems by interfacing - 10 30 0.23

Sensors and Actuators.

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. - Performance is measured using ESE attainment level.
3	ESE	0.5	1	- 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 * * *