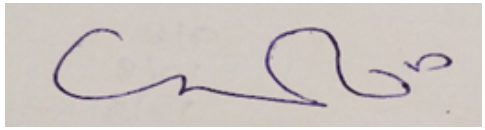
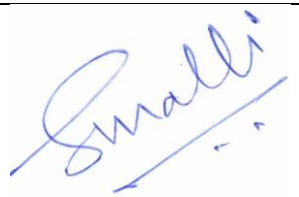
MANIPAL SCHOOL OF INFORMATION SCIENCES
MANIPAL
(A constituent unit of MAHE, Manipal)

Master of Engineering - ME (Embedded Systems)

Course File

Course Name	:	Embedded Software Design
Course Code	:	ESD 5203
Academic Year	:	2024 – 25
Semester	:	II
Name of the Course Coordinator	:	Dr. SATHYENDRANATH MALLI
Name of the Program Coordinator	:	Dr. DINESH RAO

	
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 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	An ability to independently carry out research /investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to 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	Ability to develop and implement embedded systems requirements based on theoretical principles and practical knowledge.
PO5	Ability to demonstrate knowledge of the underlying principles and evaluation methods for analyzing and decision-making.

1. Course Plan

1.1 Primary Information

Course Name	**:**	Embedded Software Design [ESD 5203]
L-T-P-C	**:**	3-0-0-3
Contact Hours	**:**	36 Hours
Pre-requisite	**:**	Basic Knowledge on OOP's and Java
Core/ PE/OE	**:**	Core

1.2 Course Outcomes (COs)

CO	At the end of this course, the student should be able to:	No. of Contact Hours	Program Outcomes (PO's)	BL
CO1	Analyze the OOP concepts for the embedded system applications	6	P3, P4	3
CO2	Evaluate the applications using JAVA constructs for the general purpose and embedded systems	14	P3	4
CO3	Analyze the models for an embedded application using the concept of UML	8	P4, P5	3
CO4	Interpret embedded application model using suitable diagrams using UML tool	8	P5	3

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	20%	20%	10%	50%
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.		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 1:** February 2024 **Assignment 2:** March 2024	As per academic calendar.

Topics covered	OOPs concepts, Java Constructs, Specification of object-oriented systems	Modelling object-oriented systems, UML		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 ESD	CO1
L2	Discussion on OOP's concepts	CO1
L3	Developing object-oriented systems in Java: Classes, methods	CO2
L4	Developing object-oriented systems in Java: Classes, methods	CO2
L5	Developing object-oriented systems in Java: Interfaces	CO2
L6	Generics Scope rules and access control	CO2
L7	Developing object-oriented systems in Java: Inner classes	CO2
L8	Functional programming constructs – lambdas	CO2
L9	Functional programming constructs – lambdas	CO2
L10	Threads, concurrency control and timers	CO2
L11	Threads, concurrency control and timers	CO2
L12	Threads, concurrency control and timers	CO2
L13	Developing object-oriented systems in Java: I/O Streams	CO2

L14	Developing object-oriented systems in Java: Network I/O Security and Cryptography	CO2
IT1		CO1 & CO2
L15	Object-oriented principles of composition: Aggregation – Inheritance	CO1
L16	Object-oriented principles of composition: Aggregation – containment	CO1
L17	Object-oriented principles of composition: Delegation - Structural design patterns for composing objects	CO1
L18	Specification of object-oriented systems: UML for specifying functional requirements	CO3
L19	Use cases and Scenarios	CO3
L20	Subsystems, packages and deployment - Assigning responsibilities to objects in UML	CO3
L21	Specifying quality attributes: Performance- Security – Privacy- Safety	CO3
L22	UML for modelling object-oriented systems - Class diagrams	CO3
L23	UML for modelling object-oriented systems - Class diagrams	CO3
L24	UML for modelling object-oriented systems - Collaboration Diagrams	CO3
L25	UML for modelling object-oriented systems - Collaboration Diagrams	CO3
L26	UML for modelling object-oriented systems - Sequence diagrams	CO3
L27	UML for modelling object-oriented systems - State diagrams	CO3
L28	Modelling real-time embedded systems behaviors: UML real-time profile	CO4
L29	Modelling real-time embedded systems behaviors: UML real-time profile	CO4
L30	Testing Java programs: Challenges in testing object-oriented Program-Functional testing	CO4
L31	Testing Java programs: Challenges in testing object-oriented Program-Functional testing	CO4

IT2		CO3 & CO4
L32	Testing quality properties of the system- Java SE Embedded	CO4
L33	Compact Profile: Overview and technical details-Compact1, Compact2, and Compact3 profiles and their capabilities	CO4
L34	Designing systems using embedded profile	CO4
L35	Realtime and Embedded Specification for Java: Real-time threads – Asynchrony-Time	CO4
L36	Clocks and Timers-System and Options – POSIX realtime signals - Examples of programs using realtime specifications for Java	CO4

1.5 References

1. UML Distilled: A Brief Guide to the Standard Object Modeling Language (3rd Edition), Addison-Wesley Professional. 2003.
2. The Java Programming Language. Ken Arnold, James Gosling and David Holmes. Addison-Wesley Professional; 4th edition (August 27, 2005)
3. http://www.oracle.com/technetwork/java/embedded/resources/tech/compact-profiles-overview-2157132.html
4. Realtime Specification for Java 2.0 https://java.net/projects/rtsj-2/pages/Home .

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

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

1.7 Course Timetable

	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5
MON	ESD							
TUE								
WED			ESD					
THU								
FRI			ESD					
SAT								

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	Analyze the OOP concepts for the embedded system applications	10	-	2	10	**0.11**
CO2	Evaluate the applications using JAVA constructs for the general purpose and embedded systems	40	10	4	40	**0.44**
CO3	Analyze the models for an embedded application using the concept of UML	-	30	2	30	**0.29**
CO4	Interpret embedded application model using suitable diagrams using UML tool	-	10	2	20	**0.16**
	Marks (weightage)	**0.2**	**0.2**	**0.1**	**0.5**	**1.0**

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.

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

= (10/2.5 + 0 + 2 + 10/ 2)/100 = 0.11

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	0.4	2	• 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	• Performance is measured using assignments/quiz attainment level. • Assignments/quiz are evaluated for a maximum of 10 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**	**Y**	
CO2				**Y**	
CO3				**Y**	**Y**
CO4					**Y**
Average Articulation Level			*	*	*