NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	B. Tech		
Course Title	Embedded Systems Architectures		
Course Code	CSPC61	No. of Credits	3
Course Code of Pre-requisite subject(s)	CSPC51	Class	III Year
Session	January 2023	Section (if, applicable)	A
Name of Faculty	Dr. B. Shameedha Begum	Department	CSE
Email	shameedha@nitt.edu,	Telephone No.	0431-250 3215
Name of Course Coordinator(s) (if, applicable)	--		
E-mail		Telephone No.	
Course Type	Programme core		

Syllabus (approved in Senate)

Unit I Introduction to Embedded System

Introduction - A Systems Engineering Approach to Embedded System Design - Architecture - Importance – System model - Programming Languages and Examples - Standards and Networking - Multiple standards-based device.

Unit II Embedded Hardware: Hardware Building Blocks

The Embedded Board and the Von-Neumann Model - Basic Hardware Materials: Embedded Processors - ISA Architecture Models - Internal processor design - Processor Performance - Memory - Board I/O - Board Buses - Component Interfacing.

Unit III Embedded Software: Device Drivers

Interrupt - Handling - Memory Device Drivers - On-board Bus Device Drivers - Examples - Embedded Operating Systems - Process - Multitasking and Process Management - I/O and File System Management.

Unit IV OS for Embedded Systems

Process - Multitasking and Process Management - POSIX - OS Performance Guidelines - selecting right OS's and Board Support Packages (BSPs) - Middleware and Application Software - Development Tools for Embedded System - Embedded C programming.

Unit V Design, Development and Case studies

Creating an Embedded System Architecture - Implementation and Testing - Implementing the Design - Quality Assurance and Testing of the Design - Debugging - System Level Performance Analysis - Maintaining the Embedded System - Embedded GPU Design - Embedded Computing System on FPGAs - Hardware-Software Co-design - Embedded Systems Security - Typical Case Studies: Automotive Driver Assistance - Mobile Agents for Embedded System.

Textbook:

1. Tammy Noergaard, "Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers", Second Edition, Elsevier Embedded Technology Series, Newnes Publication, 2012.
2. Krzysztof Iniewski, "Embedded Systems: Hardware, Design, and Implementation", Wiley & Sons, Inc. Edited, 2013.
3. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Third Edition, McGraw Hill Education (India), 2014.

Reference Books:

1. Julio Sanchez, Maria P. Canton, "Embedded Systems Circuits and Programming", Taylor and Francis, 2012.
2. J. Staunstrup, Wayne Wolf, "Hardware/Software Co-Design: Principles and Practice", Prentice Hall.
3. Michael Barr, and Anthony Massa, "Programming Embedded Systems: With C and GNU Development Tools", Second Edition, O'Reilly, 2007.
4. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Third Edition, Kaufmann Publishers, 2012.
5. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time System Programming", Tata McGraw Hill, 2004.
6. Jack Ganssle, "Embedded Systems: World Class Designs", Elsevier, 2008.
7. Kiyofumi Tanaka, "Embedded Systems: High Performance Systems, Applications and Projects", Intech Publication, 2012.

COURSE OBJECTIVES

- To understand basics of Embedded Systems Architecture
- To understand the intricacies of Embedded programming

COURSE OUTCOMES (CO)

Upon completion of the course, the students will be able to:

- Ability to comprehend the architecture of Embedded systems
- Ability to design embedded systems for simple tasks
- Ability to design and develop programs for specific embedded applications

Course Outcome (CO)	Aligned Programme Outcome
CO1	2,7,8,11,12
CO2	1,3, 4, 6,7, 12
CO3	1,3,4,10,12

COURSE PLAN – PART II

COURSE OVERVIEW

This course mainly describes about the importance of Embedded Systems Architectures (ESA) and how is it implemented and used. The course introduces the basic functionalities provided by embedded systems. In this course you will learn what an embedded system is, explore use cases and applications of it, and understand the ESA concept, students will be exposed to various issues and security concerns surrounding ESA.

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Contact Hour	Topic	Mode of Delivery
1.	1	Introduction to the course- A Systems Engineering Approach to Embedded System Design	Chalk & Talk with PPT
2.	2	Overall Architecture & Importance of Embedded system	Chalk & Talk with PPT
3.	3	System model - Programming Languages and Examples	Chalk & Talk with PPT
4.	4	Standards and Networking - Multiple standards-based devices	Chalk & Talk with PPT
5.	5	The Embedded Board and the Von-Neumann Model	Chalk & Talk with PPT
6.	6	Basic Hardware materials and components on board	Chalk & Talk with PPT
7.	7	Embedded processor	Chalk & Talk with PPT

8.	8	Embedded processor performance	Chalk & Talk with PPT
9.	9	Board memory	Chalk & Talk with PPT
10.	10	Board I/O	Chalk & Talk with PPT
11.	11	Board buses	Chalk & Talk with PPT
12.	12	Component Interfacing	Chalk & Talk with PPT
13.	13	Doubt Clarification	Chalk & Talk
14.		**Cycle Test 1**	
15.	14	Device Drivers	Chalk & Talk with PPT
16.	15	Embedded Operating Systems(OS), Example	Chalk & Talk with PPT
17.	16	Process - Multitasking and Process Management -	Chalk & Talk with PPT
18.	17	OS Performance Guidelines, Board Support Packages (BSPs)	Chalk & Talk with PPT
19.	18	Middleware	Chalk & Talk with PPT
20.	19	Application Software	Chalk & Talk with PPT
21.	20	Development Tools for Embedded System	Chalk & Talk with PPT
22.	21	Embedded C programming	Chalk & Talk with PPT
23.	22	Defining the Embedded System—Creating the Architecture	Chalk & Talk with PPT
24.	23	Architecture Business Cycles of Embedded Systems	Chalk & Talk with PPT
25.	24	Doubt Clarifications	Chalk & Talk
26.		**Cycle Test 2**	
27.	25	Computer-Aided Design (CAD) and the Hardware-	Chalk & Talk with PPT

28.	26	Quality Assurance and Testing of the Design - Debugging -	Chalk & Talk with PPT
29.	27	Translation Tools—Preprocessors, Interpreters, Compilers, and Linkers	Chalk & Talk with PPT
30.	28	System Level Performance Analysis - Maintaining the Embedded System	Chalk & Talk with PPT
31.	29	Embedded GPU Design	Chalk & Talk with PPT
32.	30	Embedded Computing Systems on FPGAs	Chalk & Talk with PPT
33.	31	Hardware-Software Co-design	Chalk & Talk with PPT
34.	32	Embedded Systems Security	Chalk & Talk with PPT
35.	33	Recent challenges in implementing Embedded system security	Chalk & Talk with PPT
36.	34	Typical Case Studies: Automotive Driver Assistance	Chalk & Talk with PPT
37.	35	Mobile Agents for Embedded System	Chalk & Talk with PPT
38.	36	Summarize of the course, Doubt clarifications	Chalk & Talk with PPT
39.	37 & 38	Term Project evaluation	PPT
40	39 & 40	Term Project evaluation	PPT

COURSE ASSESSMENT METHODS-THEORY (shall range from 4 to 6)

S. No.	Mode of Assessment	Week/Date	Duration	Marks % Weightage
1.	Cycle Test-1	As per the Academic Schedule	1 hour	15
2.	Cycle Test-2	As per the Academic Schedule	1 hour	15
3.	Quiz/ Assignment	1st week of March, 2023	-	10
4.	Term project	last week of March, 2023	-	20
5.	Compensation Assessment*	As per the Academic Schedule	1 hour	15
6.	End Semester Examination	As per Academic Schedule	3 hours	40
	TOTAL			**100**

*guidelines are provided at next page for Compensation Assessment.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Students' feedback through class committee meetings.
2. Feedback questionnaire from students – from MIS at the end of the semester.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)

Mode of Correspondence through email or Phone.

*** COMPENSATION ASSESSMENT POLICY**

In case of emergency, the student should submit compensatory assignments on submission of appropriate documents as proof. Compensatory assessments would be framed according to the time frame available, and the assessment task missed by the students.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmers.

ADDITIONAL INFORMATION

The students can get their doubts clarified at any time with their faculty member.

FOR APPROVAL

Course Faculty	CC- Chairperson	HOD
For Aditi Roy ADITI ROY		
(Dr. B. Shameedha Begum)	(Dr. R. Mohan)	(Dr. S. Mary Saira Bhanu)