NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization		**B.Tech / CSE**	
Course Title		**Embedded Systems Architectures**	
Course Code	**CSPC61**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**CSPC51**	**Semester**	**VI**
Session	**~~July /~~ January 2022**	**Section (if, applicable)**	**B**
Name of Faculty	**Prof. N. Ramasubramanian** **Dr. S. Malini**	**Department**	**CSE**
Official Email	**nrs@nitt.edu** **malini@nitt.edu**	**Telephone No.**	**-**
Name of Course Coordinator(s) (if, applicable)		**Nil**	
Official E-mail	**Nil**	**Telephone No.**	**Nil**
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 Codesign - Embedded Systems Security - Typical Case Studies: Automotive Driver Assistance - Mobile Agents for Embedded System.

Course Objectives

- To understand basics of embedded systems architecture.
- To understand the intricacies of embedded programming.

Mapping of COs with POs	
Course Outcomes (COs)	**Programme Outcomes (POs) (Enter Numbers only)**
1. Ability to comprehend the architecture of Embedded systems.	PO2, PO7, PO8, PO11, PO12
2. Ability to design embedded systems for simple tasks.	PO1, PO3, PO4, PO5, PO6, PO7, PO12
3. Ability to design and develop programs for specific embedded applications.	PO1, PO3, PO4, PO10, PO12

COURSE PLAN - PART II

Course Overview

This course aims to introduce the basics of Embedded Systems Architecture. To make the students comprehend the architecture of Embedded systems, it is planned to provide embedded system introduction, Hardware Building Blocks, Device Drivers, Embedded system OS. It will also provide couple of case studies to enable them in designing embedded systems for simple tasks.

Course Teaching and Learning Activities

Sl. No.	Week	Topic	Mode of Delivery
1	1	**Unit I** Introduction to Embedded System	Online (MS Teams)
2		A Systems Engineering Approach to Embedded System Design	Online (MS Teams)
3		Architecture, Importance	Online (MS Teams)
4	2	System model	Online (MS Teams)
5		Programming Languages and Examples	Online (MS Teams)
6		Standards and Networking	Online (MS Teams)
7	3	Multiple standards-based device	Online (MS Teams)
8		**Unit II** Introduction to Hardware Building Blocks	Online (MS Teams)
9		The Embedded Board and the Von-Neumann Model	Online (MS Teams)
10	4	Basic Hardware Materials: Embedded Processors	Online (MS Teams)
11		ISA Architecture Models	Online (MS Teams)
12		Internal processor design	Online (MS Teams)
13	5	Processor Performance	Online (MS Teams)
14		Memory	Online (MS Teams)
15		Board I/O	Online (MS Teams)
16	6	Board Buses	Online (MS Teams)

17		Component Interfacing	Online (MS Teams)
18		**Unit III** Introduction to Embedded Software: Device Drivers	Online (MS Teams)
19	7	Interrupt - Handling	Online (MS Teams)
20		Memory Device Drivers	Online (MS Teams)
21		On-board Bus Device Drivers	Online (MS Teams)
22	8	Examples	Online (MS Teams)
23		Embedded Operating Systems	Online (MS Teams)
24		Process	Online (MS Teams)
25	9	Multitasking and Process Management	Online (MS Teams)
26		I/O and File System Management	Online (MS Teams)
27		**Unit IV** OS for Embedded Systems, Process	Online (MS Teams)
28	10	Multitasking and Process Management	Online (MS Teams)
29		POSIX, OS Performance Guidelines	Online (MS Teams)
30		selecting right OS's and Board Support Packages (BSPs)	Online (MS Teams)
31	11	Middleware and Application Software	Online (MS Teams)
32		Development Tools for Embedded System	Online (MS Teams)
33		Embedded C programming	Online (MS Teams)
34		**Unit V** Creating an Embedded System Architecture	Online (MS Teams)
35	12	Implementation and Testing	Online (MS Teams)
36		Implementing the Design	Online (MS Teams)
37		Quality Assurance and Testing of the Design	Online (MS Teams)
38		Debugging, System Level Performance Analysis	Online (MS Teams)
39	13	Maintaining the Embedded System, Embedded GPU Design	Online (MS Teams)
40		Embedded Computing System on FPGAs	Online (MS Teams)
41		Hardware-Software Co design	Online (MS Teams)
42	14	Embedded Systems Security	Online (MS Teams)
43		Typical Case Studies: Automotive Driver Assistance	Online (MS Teams)
44		Mobile Agents for Embedded System	Online (MS Teams)

Course Assessment Methods (shall range from 4 to 6)				
Sl. No.	**Mode of Assessment**	**Week/Date**	**Duration**	**% Weightage**
1	Cycle Test 1	23.02.2022	1 hour	20%
2	Cycle Test 2	As per academic calendar schedule	1 hour	20%
3	Assignment 1	24.03.2022	-	15%
4	Assignment 2	April 1st week	-	15%
5	Compensation Assessment*	As per academic calendar schedule	1 hour	20%
6	Final Assessment*		2 hours	30%

***Mandatory**: refer to guidelines.

Course Exit Survey (mention the ways in which the feedback about the course shall be assessed)

1. Students' feedback through PAC meetings

2. Feedbacks are collected before final examination through MIS or any other standard format followed by the institute

3. Students, through their Class Representatives, may give their feedback at any time to the course faculty which will be duly addressed.

Course Policy (including compensation assessment to be specified)

Mode of Correspondence (e mail/ phone etc): Email, MS Teams.

Compensation assessment policy

1. One compensation assessment will be given after completion of Cycle Test 1 and 2 for the students those who are absent for any assessment due to genuine reason.

2. Compensatory assessments would cover the syllabus of Cycle tests 1 and 2.

3. The prior permission and required documents must be submitted for absence signed by HoD/CSE.

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

- Possessing a mobile phone, 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 programmes.

Additional Information, If Any

Text Books

1. Tammy Noergaard, "Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers", 2nd 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.

1. The course faculty is available for consultation during the time intimated to the students then and there.

2. Relative grading adhering to the instructions from the office of the Dean (Academic) will be adopted for the course.

For Approval

(Prof. N. Ramasubramanian)	(Dr. R. Leela Velusamy)	(Dr. S. Mary Saira Bhanu)
24.08.22		
(Dr. S. Malini)		
Course Faculty	CC-Chairperson	HOD