NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	**B.Tech. ELECTRONICS AND COMMUNICATION ENGINEERING**		
Course Title	**EMBEDDED SYSTEMS**		
Course Code	**ECPE14**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**ECPE12**		
Session	**Jan 2024**	**Section (if, applicable)**	**A, B**
Name of Faculty	**B. Naresh Kumar Reddy**	**Department**	**ECE**
Official Email	**bnkreddy@nitt.edu**	**Telephone No.**	**+91-9966539090**
Name of Course Coordinator(s) (if, applicable)			
Official E-mail		**Telephone No.**	
Course Type (please tick appropriately)	☐ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

Introduction to Embedded Computing: Characteristics of Embedding Computing Applications, Concept of Real time Systems, Challenges in Embedded System Design, Design Process. Embedded System Architecture: Instruction Set Architecture, CISC and RISC instruction set architecture, Basic Embedded Processor/Microcontroller Architecture (ATOM processor, Introduction to Tiva family etc.)

Designing Embedded Computing Platform: Bus Protocols, Bus Organization, Memory Devices and their Characteristics, Memory mapped I/O, I/O Devices, I/O mapped I/O, Timers and Counters, Watchdog Timers, Interrupt Controllers, Interrupt programming, DMA Controllers, GPIO control, A/D and D/A Converters, Need of low power for embedded systems, Mixed Signals Processing.

Programming Embedded Systems: Basic Features of an Operating System, Kernel Features, Real-time Kernels, Processes and Threads, Context Switching, Scheduling, Shared Memory Communication, Message-Based Communication, Real-time Memory Management, Dynamic Allocation, Device Drivers, Real-time Transactions and Files, Realtime OS (VxWorks, RT-Linux, Psos).

Network Based Embedded Applications: Embedded Networking Fundamentals, Layers and Protocols, Distributed Embedded Architectures, Internet-Enabled Systems, IoT overview and architecture, Interfacing Protocols (like UART, SPI, I2C, GPIB, FIREWIRE, USB,). Various wireless protocols and its applications: NFC, ZigBee, Bluetooth, Bluetooth Low Energy, Wi-Fi. CAN. Overview of wireless sensor networks and design examples

Case studies: Embedded system design using ATOM processors, Galileo and Tiva based embedded system applications.

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COURSE OBJECTIVES

1. To introduce the Building Blocks of Embedded System
2. To educate in Various Embedded Development Strategies
3. To Introduce Bus Communication in processors, Input/output interfacing.
4. To develop and maintain applications written using Embedded C.
5. To develop simple embedded systems for real time operations

MAPPING OF COs with POs

Course Outcomes On completion of this course, the students will be able to	**Programme Outcomes (PO)** (Enter Numbers only)
1. Get an insight into the overall landscape and characteristics of embedded systems.	**1,2,4**
2. Become familiar with the architecture and programming aspects of the embedded processor (ATOM).	**2,5**
3. Develop application software for embedded systems using the RTOS functions.	**6,7**
4. Become aware of Linux capabilities and will be able to develop embedded Linux systems.	**3,5**
5. Analyse various examples embedded systems and become familiar with the design of embedded systems.	**2,3**

COURSE PLAN – PART II

COURSE OVERVIEW

Embedded systems course is continuous of the Microprocessor and Microcontrollers, is intended to Designing, Implementation and Test of embedded applications. The topics covered are definition of embedded systems, history, classification, characteristics and major applications, Quality attributes of embedded systems, types of processors, ASICs, PLDs, COTS, Memory Interface, communication interface, embedded firmware design and development, RTC, RTOS, Task, task scheduling ,threads, multitasking, Task communication, Task synchronization techniques, device drivers.

Understand need of microprocessors, microcontrollers in development of various projects and to know complete Operating Systems, RTOS

COURSE TEACHING AND LEARNING ACTIVITIES (Add more rows)

S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	Week 1 **(3 contact Hours)**	Characteristics of Embedding Computing Applications, Concept of Real time Systems, Challenges in Embedded System Design, Design Process.	PPT and Chalk
2	Week 2 **(3 contact Hours)**	Embedded System Architecture: Instruction Set Architecture, CISC and RISC instruction set architecture.	PPT and Chalk
3	Week 3 **(3 contact Hours)**	Basic Embedded Processor/ Microcontroller Architecture (ATOM processor, Introduction to Tiva family etc.)	PPT and Chalk
4	Week 4 **(3 contact Hours)**	**Designing Embedded Computing Platform:** Bus Protocols, Bus Organization, Memory Devices and their Characteristics, Memory mapped I/O,	PPT and Chalk

5	Week 5 **(3 contact Hours)**	I/O Devices, I/O mapped I/O, Timers and Counters, Watchdog Timers, Interrupt Controllers, Interrupt programming, DMA Controllers.	PPT and Chalk
6	Week 6 **(3 contact Hours)**	GPIO control, A/D and D/A Converters, Need of low power for embedded systems, Mixed Signals Processing.	PPT and Chalk
7	Week 7 **(3 contact Hours)**	**Programming Embedded Systems:** Basic Features of an Operating System, Kernel Features, Real-time Kernels, Processes and Threads, Context Switching, Scheduling.	PPT and Chalk
8	Week 8 **(3 contact Hours)**	Shared Memory Communication, Message-Based Communication, Real-time Memory Management, Dynamic Allocation.	PPT and Chalk
9	Week 9 **(3 contact Hours)**	Device Drivers, Real-time Transactions and Files, Realtime OS (VxWorks, RT-Linux, Psos).	PPT and Chalk
10	Week 10 **(3 contact Hours)**	**Network Based Embedded Applications:** Embedded Networking Fundamentals, Layers and Protocols, Distributed Embedded Architectures.	PPT and Chalk
11	Week 11 **(3 contact Hours)**	Internet-Enabled Systems, IoT overview and architecture, Interfacing Protocols (like UART, SPI, I2C, GPIB,FIREWIRE, USB,).	PPT and Chalk
12	Week 12 **(3 contact Hours)**	Various wireless protocols and its applications: NFC, ZigBee, Bluetooth, Bluetooth Low Energy, Wi-Fi. CAN.	PPT and Chalk
13	Week 13 **(3 contact Hours)**	Overview of wireless sensor networks and design examples.	PPT and Chalk
14	Week 14 **(3 contact Hours)**	**Case studies:** Embedded system design using ATOM processors.	PPT and Chalk
15	Week 15 **(3 contact Hours)**	Embedded system design using Galileo.	PPT and Chalk
16	Week 16 **(3 contact Hours)**	Embedded system design using Tiva based embedded system applications.	PPT and Chalk

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COURSE ASSESSMENT METHODS				
S.No.	**Mode of Assessment**	**Week/Date**	**Duration**	**% Weightage**
1	Assessment I (CT I)	Feb 3rd Week	60 Minutes	20
2	Assessment II (CT II)	March 3rd Week	60 Minutes	20
3	Assignment 1	April 3rd Week		10
4	Compensation Assessment	Apr 1st Week	60 Minutes	20
5	End Assessment	May 2nd Week	180 Minutes	50

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

1. Feedback from the students during class committee meeting.
2. Queries through questionnaire.

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism etc.)

ATTENDANCE

As per Institute rules

At least 75% attendance in each course is mandatory. A maximum of 10% is 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. Students awarded 'V 'grade must compulsorily redo the course.

COMPENSATION ASSESSMENT

1. Attending all the assessments are MANDATORY for every student.
2. Those students who missed any of the continuous assessments (CAs) due to genuine reasons can appear for retest. The scores in the retest will be considered for computing marks for CA.

ACADEMIC HONESTY & PLAGIARISM

1. All the students are expected to be genuine during the course work. Taking of information by means of copying simulations, assignments, looking or attempting to look at another student's paper or bringing and using study material in any form for copying during any Assessments is considered dishonest.
2. Tendering of information such as giving one's program, simulation work, assignments to another student to use or copy is also considered dishonest.
3. Preventing or hampering other students from pursuing their academic activities is also considered as academic dishonesty.

Any evidence of such academic dishonesty will result in the loss of marks on that assessment. Additionally, the names of those students so penalized will be reported to the class committee chairperson and HoD of the concerned department.

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ADDITIONAL INFORMATION
Queries and feedback may also be emailed to the Course Faculty at **bnkreddy@nitt.edu**
FOR APPROVAL
Course Faculty BNKreddy **CC-Chairperson** _____ **HOD** _____ 22/1/2024