

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech- Industrial Automation		
Course Title	Embedded Systems		
Course Code	IC615	No. of Credits	3
Course Code of Pre-requisite subject(s)	NIL		
Session	July 2020	Section (if, applicable)	-
Name of Faculty	Ms.V Sridevi	Department	ICE
Email	sridevi@nitt.edu	Telephone No.	9443082579
Name of Course Coordinator(s) (if, applicable)	NA		
E-mail	NA	Telephone No.	NA
Course Type	<input type="checkbox"/> Core course <input checked="" type="checkbox"/> Elective course		
Syllabus (approved in BoS)			
<p>Introduction to Embedded Systems –built in features for embedded Target Architecture – selection of Embedded processor – DMA- memory devices – Memory management methods-memory mapping, cache replacement policies- Timer and Counting devices, Watchdog Timer, Real Time Clock- Software Development tools-IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging.</p> <p>Embedded Networking: Introduction, I/O Device Ports & Buses- multiple interrupts and interrupt service mechanism – Serial Bus communication protocols -RS232 standard–RS485–USB–Inter Integrated Circuits (I2C) - CAN Bus –Wireless protocol based on Wifi, Bluetooth, Zigbee –Introduction to Device Drivers.</p> <p>Introduction to basic concepts of RTOS- Need, Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication- context switching, interrupt latency and deadline shared memory, message passing-, Inter process Communication – synchronization between processes- semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: VxWorks, μC/OS-II, RT Linux.</p> <p>Modelling embedded systems- embedded software development approach --Overview of UML modeling with UML, UML Diagrams-- Hardware/Software Partitioning, Co-Design Approaches for System Specification and modeling- Co Synthesis- features comparing Single-processor Architectures & Multi-Processor Architectures--design approach on parallelism in uniprocessors & Multiprocessors.</p> <p>Application development: Objective, Need, different Phases & Modelling of the EDLC. choice of Target Architectures for Embedded Application Development-for Control Dominated-</p>			

Data Dominated Systems-Case studies on Digital Camera, Adaptive Cruise control in a Car, Mobile Phone, automated robonoids, interface to sensors, GPS, GSM, Actuators.

COURSE OBJECTIVES

1. To provide knowledge on building blocks of embedded system, input/output interfacing & Bus communication with processors.
2. To teach automation using scheduling algorithms and real time operating system.
3. To discuss on different phases & modelling of a new embedded product.
4. To involve discussions/ practice/exercise onto revising & familiarizing the concepts

COURSE OUTCOMES (CO)

On completion of this course, the students will be able to

1. understand the functionalities of processor internal blocks, with their requirement.
2. understand the role and features of RT operating system, that makes multitask execution possible by processors.
3. understand multiple CPU based on either hardcore or soft core helps data overhead management with processing- speed reduction for μ C execution.
4. to design embedded systems to perform dedicated function.

Course Outcomes

Aligned Programme Outcomes (PO)

On completion of this course, the students will be able to

1. understand the functionalities of processor internal blocks, with their requirement	1,3
2. understand the role and features of RT operating system, that makes multitask execution possible by processors.	1,3
3. understand multiple CPU based on either hardcore or soft core helps data overhead management with processing- speed reduction for μ C execution.	1,3
4. to design embedded systems to perform dedicated function.	1,2,3

COURSE PLAN – PART II

COURSE OVERVIEW

This course covers the design of small scale to sophisticated embedded systems. The automation using scheduling algorithms and real time operating system will be discussed in this course. The different phases & modelling of embedded system will be taught in this course.

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	1 st & 6 th week	<p>Introduction to Embedded Systems –built in features for embedded Target Architecture – selection of Embedded processor – DMA- memory devices – Memory management methods-memory mapping, cache replacement policies- Timer and Counting devices, Watchdog Timer, Real Time Clock- Software Development tools-IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging.</p> <p>Embedded Networking: Introduction, I/O Device Ports & Buses- multiple interrupts and interrupt service mechanism – Serial Bus communication protocols –RS232 standard–RS485–USB–Inter Integrated Circuits (I2C) – CAN Bus –Wireless protocol based on Wifi, Bluetooth, Zigbee – Introduction to Device Drivers.</p>	PPT (Online mode)
TEST 1 (Online mode)			
2	7 th & 12 th week	<p>Introduction to basic concepts of RTOS- Need, Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-context switching, interrupt latency and deadline shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: VxWorks, μC/OS-II, RT Linux.</p> <p>Modelling embedded systems- embedded software development approach --Overview of UML modeling with UML, UML Diagrams-- Hardware/Software Partitioning, Co-Design Approaches for System Specification and modeling- Co Synthesis- features comparing Single-processor Architectures & Multi-Processor Architectures--design approach on parallelism in uniprocessors & Multiprocessors.</p>	PPT (Online mode)

TEST 2 (Online mode)

3	13 th & 14 th week	Application development: Objective, Need, different Phases & Modelling of the EDLC. choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Case studies on Digital Camera, Adaptive Cruise control in a Car, Mobile Phone, automated robonoids, interface to sensors, GPS, GSM, Actuators.	PPT (Online mode)
---	---	--	-------------------

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Test 1 (Online mode)	--	1 ½ Hour	20
2	Test 2(Online mode)	--	1 ½ Hour	20
CPA	Compensation Assessment*	--	1 ½ Hour	20
3	Programming Assisgnment (s) / Project	--		30
4	Final Assessment (Online mode)	--	2 ½ Hours	30

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

1. Anonymous feedback through questionnaire.
2. Feedback from the students during the class committee meetings.

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

MODE OF CORRESPONDENCE (email/ phone etc) - Email & Phone

COMPENSATION ASSESSMENT POLICY

Compensation test will be conducted for students who miss Test1 or Test2 (only written test). But they should get permission from the faculty by giving valid reason in written form to write retest.

Grading Policy

The students will be graded relatively with all the four assessment marks put together with the passing minimum of 35 marks. Those who have obtained F grade should appear for reassessment that will be conducted during the first week of next semester. If the student get F grade in the reassessment will have to appear for formative assessment.

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

During each online class the attendance sheet will be downloaded and consolidated. It is mandatory to maintain 75% attendance to appear for end semester examination. The students having less than 75% of attendance will not be allowed to write the end semester examination. The student he/she having less than 75% of attendance has to redo the course in the forth coming semester.

ACADEMIC DISHONESTY & PLAGIARISM

Academic honesty:

The students have the freedom to do their work meanwhile; they have to obey the institute academic rules. The students should not be involved plagiarizing other student's assignment work, peer's examination answer sheet and any mode of copying other's work.

The students involved in these activities are penalized and their name list will be sent to the office of Dean (Academic) for legal action.

ADDITIONAL INFORMATION - NIL

FOR APPROVAL



Course Faculty _____
(V SRIDEVI)



CC-Chairperson _____
(Dr D EZHILARASI)



HOD _____
(Dr G UMA)
21-10-2021

Guidelines:

- a) The number of assessments for a course shall range from 4 to 6.
- b) Every course shall have a final assessment on the entire syllabus with at least 30% weightage.
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered. Details of compensation assessment to be specified by faculty.
- d) The passing minimum shall be as per the regulations.
- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.