NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
B. Tech. Electronics and Communication Engineering
OPEN ELECTIVE

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Course Code	
Course Title	Introduction to Embedded Systems

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –
1. Identify design requirements of an embedded system.
2. Design embedded system hardware.
3. Comprehend operation of Real Time Operating System and Device Drivers.
4. Interpret standards related to networking of embedded systems.

Syllabus :   **Teaching Hours : 45**

UNIT I : Introduction
Embedded Systems overview, characteristics of embedded systems, Applications, examples of embedded systems.   04

UNIT II : Processors
Application-specific processors their architectures and operation, Superscalar and VLIW Architecture, Selecting a microprocessor, Computer Architecture, ARM Processor.   04

UNIT III : Introduction to Data Acquisition Systems
Introduction, DAS parameters: Accuracy, Resolution, Precision, reproducibility or repeatability, DAS design introduction and definitions, nyquist theory, ADC processing.   04

UNIT IV: RTOS in Embedded Systems:
Operating system services, Network OS, RTOS, Embedded OS, RTOS task scheduling models, Basic actions in preemptive scheduler, synchronization between processes, ISRs, OS functions and tasks and recourse management, Task prioritization, context switching, multitasking, Operating system scheduling policies, inter process communication, Event management, locking mechanism, interrupt handling, Rtx Tiny 51 OS.   14

UNIT V: Networks for Embedded Systems
Introduction, Distributed Embedded Architectures, I2C, CAN, PCI, USB, Firewire Bus.   10

UNIT VI : Embedded System Design Techniques
Embedded system Design Challenges, Common metrics, Design metric competition, UML   05

UNIT VII : Device Drivers
Parallel port, serial port device drivers, Device drivers for internal, programmable timing devices, Interrupt handling mechanisms.   04

Self-Study:
The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Assignments:
The students will be given 8- 10 programming/simulation/projects/assignments based on the syllabus as mentioned below:
   i.   I2C based LCD interfacing
   ii.   Free RTOS porting on Arduino
   iii. Android porting on Rasberry Pi
   iv.   Motion detection using Gyroscope sensor
   v.   Fitness band for health monitoring
   vi.   Contactless Tachometer

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vii.   Distance measurement using Ultrasonic sensor

viii.   IoT based remote monitoring

ix.   Smart home

Suggested Readings:

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TMH.
2. Wayne Wolf, Computers as Components Principles of Embedded Computing System Design, Morgan Kaufmann.
3. Frank Vahid, Tony Givargis, Embedded System Design: Unified Hardware/Software Introduction, Wiley Publication
4. Jonnathan W. Valvano, Embedded Microcomputer Systems Real Time Interfacing, Thomson Learning.
5. Douglas Comer, Network System Design using Network Processors, Pearson Education

L = Lecture, T = Tutorial, P = Practical, C = Credit