

## PHXXX: EMBEDDED NETWORKING

### Objectives

To introduce the basics of Embedded system communication protocols and USB and CAN bus and wireless communication systems. Also to introduce the fundamentals of Ethernet and embedded Ethernet.

### UNIT -I:

#### Embedded Communication Protocols:

Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming - ISA/PCI Bus protocols – Firewire.

### UNIT -II:

#### USB and CAN Bus:

USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types –Enumeration –Descriptors –PIC 18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames –Bit stuffing –Types of errors – Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN.

### UNIT -III:

#### Ethernet Basics:

Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet protocol.

### UNIT -IV:

#### Embedded Ethernet:

Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure.

### UNIT -V:

#### Wireless Embedded Networking:

Wireless sensor networks – Introduction – Applications – Network Topology – Localization – Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing – Data Centric routing.

#### Expected out come

The student will be able to understand the fundamentals of embedded system communication through Ethernet and wireless embedded networking.

**TEXT BOOKS:**

1. Embedded Systems Design: A Unified Hardware/Software Introduction - Frank Vahid, Tony Givargis, John & Wiley Publications (2002)
2. Parallel Port Complete: Programming, interfacing and using the PC's parallel printer port - Jan Axelson, Penram Publications (1996)

**REFERENCE BOOKS:**

1. Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F series - Dogan Ibrahim, Elsevier (2008)
2. Embedded Ethernet and Internet Complete - Jan Axelson, Penram publications (2003).
3. Networking Wireless Sensors - Bhaskar Krishnamachari, Cambridge press (2005)