

## EMBEDDED NETWORKING

| II Semester: ECE(ES)  |   |                        |   |   |                  |               |            |       |
|---|---|------------------------|---|---|------------------|---------------|------------|-------|
| Course Code   | Category  | Hours / Week           |   |   | Credits          | Maximum Marks |            |       |
| BESBC19   | Elective  | L                      | T | P | C                | CIA           | SEE        | Total |
|   |   | 3                      | 0 | 0 | 3                | 30            | 70         | 100   |
| Contact Classes: 45   | Tutorial Classes: 15  | Practical Classes: Nil |   |   | Total Classes:60 |               |            |       |
| <b>I. COURSE OVERVIEW:</b><br>Embedded networking is the network design and topology, hardware devices, and communication/data exchange protocols required to link and exchange information across embedded systems. It covers embedded communication protocols, USB and CAN bus for fast communication and Ethernet and protocols. The applications of embedded networking systems include home appliances, internet-of-things , office automation, security, telecommunication, instrumentation.  |   |                        |   |   |                  |               |            |       |
| <b>II. COURSE OBJECTIVE:</b><br>The students will try to learn:<br>I. The basic embedded communication protocols and their use in embedded systems.<br>II. The fundamental concepts of Ethernet, its design and protocols used in embedded networking.<br>III. The characteristics of wireless embedded networking protocols useful for design and implementation of internet and wireless devices.   |   |                        |   |   |                  |               |            |       |
| <b>III. COURSE OUTCOMES:</b><br>After successful completion of the course, students should be able to:  |   |                        |   |   |                  |               |            |       |
| CO 1  | Illustrate Serial and parallel communication protocols used for data Communication in embedded networking systems.                      |                        |   |   |                  |               | Understand |       |
| CO 2  | Infer the USB and CAN serial bus system used to communicate between several embedded micro controllers and network systems.             |                        |   |   |                  |               | Apply      |       |
| CO 3  | Explain the basic principles of Ethernet for providing an internet connection, connect devices to a local network                       |                        |   |   |                  |               | Apply      |       |
| CO 4  | Develop the frame work for embedded Ethernet protocols used to create local area networks.  |                        |   |   |                  |               | Apply      |       |
| CO 5  | Make use of the various client-server programming models for the users to access the information stored on a web server on the Internet |                        |   |   |                  |               | Apply      |       |
| CO 6  | Classify the wireless local area networks for the user device to communicate with the network.  |                        |   |   |                  |               | Analyze    |       |
| <b>IV. SYLLABUS:</b><br><b>MODULE – I: EMBEDDED COMMUNICATION PROTOCOLS</b><br>Embedded Networking: Introduction, serial/parallel communication, serial communication protocols, RS232 standard, RS485, synchronous serial protocols, serial peripheral interface, inter integrated circuits I2C– pc parallel port programming, ISA/PCI bus protocols, fire wire.<br><b>MODULE – II: USB AND CAN BUS</b><br>USB bus, introduction, speed identification on the bus, USB states, USB bus communication: Packets ,dataflow types, enumeration, descriptors,PIC18 microcontroller USB interface, C programs;<br>CANbus: Introduction, frames, bitstuffing, types of errors, nominal bittiming, PIC microcontroller CAN interface, simple application with CAN.<br><b>MODULE – III: ETHERNET BASICS</b><br>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 communications, inside the Internet protocol

#### **MODULE – IV: EMBEDDED ETHERNET**

Exchanging messages using UDP and TCP: Inside 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.

#### **MODULE – V: WIRELESS EMBEDDED NETWORKING**

Wireless sensor networks: Introduction, applications, network topology, localization approaches, time synchronization, energy efficient MAC protocols, SMAC, energy efficient and robust routing, data centric routing: direct diffusion, pull vs. push diffusion

#### **V. TEXT BOOKS:**

1. Frank Vahid, Tony Givargis, “Embedded Systems Design: A Unified Hardware/Software Introduction” John & Wiley Publications, 1<sup>st</sup> Edition, 2002.
2. Embedded Systems Design: A Unified Hardware/Software Introduction - Frank Vahid, Tony Givargis, John & Wiley Publications, 2002.
3. Parallel Port Complete: Programming, interfacing and using the PCs parallel printer port -Jan Axelson, Penram Publications, 1996.

#### **VI. REFERENCE BOOKS:**

1. Dogan Ibrahim, “Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18 F series”, Elsevier, 1<sup>st</sup> Edition, 2008.
2. Jan Axelson, “Embedded Ethernet and Internet Complete”, Penram Publications, 2003.
3. Bhaskar Krishnamachari, “Networking Wireless Sensors”, Cambridge Press 2005.

#### **VII. WEB REFERENCES:**

1. <http://nptel.ac.in/courses/108102045/26>
2. <http://freevideolectures.com/Course/2341/Embedded-Systems/27>
3. [http://nptel.iitg.ernet.in/courses/Elec\\_Engg/IIT%20Delhi/Embedded%20Systems%20\(Video\).htm](http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm)

#### **VIII. E-TEXT BOOKS:**

1. <http://dsp-book.narod.ru/ESDUA.pdf>
2. [https://booksite.elsevier.com/samplechapters/9780750686112/Sample\\_Chapters/01~Front\\_Matter.pdf](https://booksite.elsevier.com/samplechapters/9780750686112/Sample_Chapters/01~Front_Matter.pdf)