**Maulana Abul Kalam Azad University of Technology, West Bengal**
***(Formerly West Bengal University of Technology)***
**Syllabus for B. Tech in Computer Science and Engineering**
**(Internet of Things)**
**(Applicable from the academic session 2022-2023)**

**SEMESTER –V**

**IoT Application and Design**
**Code: PCCICB501**
**Contact: 3L/Week**

| | | |
|---|---|---|
| **Name of the course** | | **IoT Application and Design** |
| **Course Code: PCCICB501** | | **Semester: 5th** |
| Duration: 6 months | | Total Marks: 100 |
| | | |
| Teaching Scheme | | Examination Scheme |
| Theory: 3 hrs/week | | Mid Semester Assessment: 25 Marks |
| **Credit Points: 3** | | Attendance: 05 Marks |
| | | End Semester Exam: 70 Marks |
| **Objective:** | | |
| 1 | To understand the architecture and domain-specific application of IoT | |
| 2 | To learn network function and communication protocols required for IoT application | |
| 3 | To learn about the Raspberry PI platform, which is popular in IoT applications. | |
| 4 | To gain a better understanding of how web-based services are implemented on IoT devices. | |
| 5 | To learn IoT-enabled technologies and IoT platforms | |
| 6 | To gain knowledge of the Python Scripting Language, which is widely used in IoT devices. | |
| **Pre-Requisite** | | |
| 1 | Programming for problem-solving (ES-CS201) | |
| 2 | Analog and Digital Electronics (ESC-301) | |
| 3 | Data Communication and Networks (PCCICB491) | |
| **Module No.** | **Content** | **Lecture Hours** |
| 1 | • Definition, Characteristics, and Features of IoT.<br>• IoT Ecosystem<br>• IoT Decision Framework | 4 |
| 2 | • IoT Architecture, Applications, and Design<br>• Domain-specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health, and Lifestyle. | 4 |
| 3 | • IoT & M2M<br>• Software-defined networks and network function virtualization<br>• Basics of IoT System Management. | 6 |
| 4 | • IoT Physical Devices & Endpoints<br>• Introduction to Raspberry PI and other IoT boards<br>• Different types of Interfaces (Serial, SPI, I2C). | 6 |
| 5 | • Data Link Layer, Network Layer, and Session Layer.<br>• Corresponding Protocols (IEEE 802.15.4, Zigbee, 6LoWPAN, Bluetooth)<br>• LoRa, MQTT Communication | 8 |
| 6 | • Introduction to Cloud Storage models and communication APIs.<br>• Web server – Web server for IoT, Cloud for IoT<br>• Designing a RESTful web API | 8 |

| | | |
|---|---|---|
| 7 | • IoT Design Methodology and Case studies: Home Automation<br>• IoT-enabled technologies: Wireless sensor networks, Cloud computing, Big dataanalytics | 8 |
| 8 | • Python program with Raspberry Pi.<br>• Relevant applications on Python packages - JSON, XML, HTTP Lib, URL Lib, SMTP Lib.<br>• Python web application framework. | 8 |

## Textbook:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga, and Vijay Madisetti, UniversitiesPress, 2015.
2. Internet of Things, K.G. Srinivasa, G.M. Siddesh, R.R. Hanumantha, CENGAGE Leaning India, 2018
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2016.
4. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things,David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, Pearson Education, 2017.
5. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2016.Reference books:
6. Internet of Things (A Hands-on-Approach), Arshdeep Bahga and Vijay Madisetti, VPT, 2014.
7. Internet of Things: Architecture and Design Principles, Raj Kamal, McGraw Hill Education, 2017.

## Course Outcome:

Learners will be able to after completing this course to:

- Explain the meaning and use of the term "Internet of Things" in various situations.
- Prototype, program, and analyse data to build and test an IoT system.
- Describe the main components of an IoT system.
- In a typical IoT system, use cloud computing and data analytics.
- Distinguish between the layers of the IoT stack and be familiar with the essential technologiesand protocols used at each tier.

**IoT Application and Design Lab**
**Code: PCCCS592**
**Contact: 4P/Week**

| **Name of the course** | **IoT Application and Design** |
|---|---|
| **Course Code: PCCCS592** | **Semester: 5th** |
| Duration: 6 months | Total Marks: 100 |
| | |
| Teaching Scheme | Examination Scheme |
| Practical: 4 hrs/week | Mid Semester Assessment: 40Marks |
| **Credit Points: 2** | End Semester Exam: 60 Marks |

| **Pre-Requisite** | |
|---|---|
| 1 | IT Workshop (Python/Matlab/R) (PCCCS392) |
| 2 | Analog and Digital Electronics Lab (ESC-391) |
| 3 | Data Communication and Networks Lab (PCCICB491) |
| **Sl. No.** | **Laboratory Experiments** |
| 1 | Study of IoT Physical Devices & Endpoints: Familiarisation with different types ofSensors, Actuators, and Arduino |
| 2 | Study of Zigbee protocol using IoT devices |
| 3 | Study of Bluetooth protocol using IoT devices |
| 4 | Interfacing an IoT device with Smartphone: Using Bluetooth and Wi-Fi module |
| 5 | Study of the ESP232 and Node MCU |
| 6 | Study of M2M communication of multi-sensor data: Using Wired and Wireless media |
| 7 | Setting up Raspberry Pi: Installation of Operating System into the Raspberry Pi |
| 8 | Interfacing Sensor with Raspberry Pi |
| 9 | Interfacing Actuator with Raspberry Pi |
| 10 | To study data logging to cloud server of IoT data |
| 11 | Controlling actuators with the server using the Internet. |
| 12 | Study and implement Paho MQTT client in Python. |
| 13 | Study of Relevant applications on Python packages - JSON, XML, HTTP Lib, URL Lib,SMTP Lib. |
| 14 | Study of Python web application framework |
| 15 | Making a Domain-specific IoT application |

## Textbook:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga, and Vijay Madisetti,Universities Press, 2015.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2016.
3. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,Pearson Education, 2017.

## Reference books:

1. Internet of Things: Architecture and Design Principles, Raj Kamal, McGraw Hill Education,2017.

**Operating Systems**
**Code: PCC- CS502**
**Contacts: 3L**

| | | | |
|---|---|---|---|
| **Name of the Subject:** | **Operating Systems** | | |
| **Course Code: PCC-CS502** | **Semester: V** | | |
| Duration: 6 months | Maximum Marks:100 | | |
| **Teaching Scheme** | | **Examination Scheme** | |
| Theory:3 hrs./week | | Mid Semester exam: 15 | |
| Tutorial: NIL | | Assignment and Quiz: 10 marks | |
| | | Attendance : 5 marks | |
| Practical: hrs./week | | End Semester Exam :70 Marks | |
| **Credit Points:** | **3** | | |

| Unit | Content | Hrs/Unit | Marks/ Unit |
|---|---|---|---|
| 1 | **Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System. | 3 | |
| 2 | **Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching<br>**Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,<br>**Process Scheduling**: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF. | 10 | |
| 3. | **Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problemetc. | 5 | |
| 4. | **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery. | 5 | |

| | | | |
|---|---|---|---|
| 5. | **Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging.<br>**Virtual Memory**: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault<br>, Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms:<br>Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU). | 8 | |
| 6. | I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms<br>File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency andperformance.<br>Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks | 6 | |

## Text book and Reference books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia StudentEdition.
2. Operating Systems: Internals and Design Principles, 5th Edition,William Stallings, Prentice Hall of India.
3. Operating System Concepts, Ekta Walia, Khanna PublishingHouse (AICTE Recommended Textbook – 2018)
4. Operating System: A Design-oriented Approach, 1st Edition byCharles Crowley, Irwin Publishing
5. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt,Addison- Wesley
6. Design of the Unix Operating Systems, 8th Edition by MauriceBach, Prentice-Hall of India
7. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet,Marco Cesati, O'Reilly and Associates

**Operating System Lab**
**Code:** PCC- CS592
**Contacts: 4P**

| **Name of the Course:** | **Operating System Lab** |
|---|---|
| **Course Code: PCC- CS592** | **Semester: V** |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement:60 |
| Practical: 4 hrs./week | Distribution of marks:40 |
| **Credit Points:** | **2** |

1 1. **Managing Unix/Linux Operating System [8P]:**

Creating a bash shell script, making a script executable, shell syntax (variables, conditions,control structures, functions, commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks,Making file systems, Superblock, I-nodes, File system checker, Mounting file systems,
Logical Volumes, Network File systems, Backup schedules and
methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password
security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and
permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users &user groups.
2. **Process [4P]**: starting new process, replacing a process image, duplicating aprocess image, waiting for a process,
zombie process.
3. **Signal [4P]**: signal handling, sending signals, signal interface, signal sets.
4. **Semaphore [6P]**: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads [6P]**: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit,
pthread_attr_init, pthread_cancel)
6. **Inter-process communication [6P]**: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO),
message passing & shared memory(IPC version V).

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

**Maulana Abul Kalam Azad University of Technology, West Bengal**
***(Formerly West Bengal University of Technology)***
**Syllabus for B. Tech in Computer Science and Engineering**
**(Internet of Things)**
**(Applicable from the academic session 2022-2023)**

**Object Oriented Programming**
**Code: PCC-CS503**
**Contacts: 3L**

| Name of the Subject: | **Object Oriented Programming** |
|---|---|
| Course Code: PCC-CS 503 | Semester: V |
| Duration:6 months | Maximum Marks:100 |

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Theory:3 hrs./week | Mid Semester exam: 15 |
| Tutorial: NIL | Assignment and Quiz : 10 marks |
| | Attendance: 5 marks |
| Practical: hrs./week | End Semester Exam:70 Marks |
| Credit Points: | 3 |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Abstract data types and their specification.How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementingoperations, illustrated by the Text example. | 8 | |
| 2 | Features of object-oriented programming. Encapsulation, object identity, polymorphism –but not inheritance. | 8 | |
| 3 | Inheritance in OO design. Design patterns. Introduction and classification. Theiterator pattern. | 6 | |
| 4 | Model-view-controller pattern. Commands as methods and as objects. ImplementingOO language features. Memory management. | 6 | |
| 5 | Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process | 6 | |

**Text book and Reference books:**


1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

**Object Oriented Programming & Java Lab**
**Code: PCC-CS593**
**Contacts: 4P**

| **Name of the Course:** | **Object Oriented Programming Lab** |
|---|---|
| **Course Code: PCC-CS593** | **Semester: V** |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement:60 |
| Practical: 4 hrs./week | Distribution of marks:40 |
| **Credit Points:** | **2** |

**Laboratory Experiments:**

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming
6. Assignments on applet programming

**Note: Use Java for programming**

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

## Introduction to Industrial Management (Humanities III)

**Code:** HSMC-501

**Contacts: 2L**

| Name of the Course: | **Introduction to Industrial Management (Humanities III)** |
|---|---|
| Course Code: HSMC-501 | Semester: V |
| Duration:6 months | Maximum Marks:100 |

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Theory:2 hrs./week | Mid Semester exam: 15 |
| Tutorial: NIL | Assignment and Quiz : 10 marks |
| | Attendance: 5 marks |
| Practical: NIL | End Semester Exam:70 Marks |
| Credit Points: | 2 |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction**<br>System- concept, definition, types, parameters, variables and behavior.<br>Management – definition andfunctions.<br>Organization structure:<br>i. Definition.<br>ii. Goals.<br>iii. Factors considered in formulatingstructure.<br>iv. Types.<br>v. Advantages and disadvantages.<br>vi. Applications.<br>Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation ofauthority, centralization and decentralization in industrial management.<br>Organizational culture and climate –meaning, differences and factors affecting them.<br>Moral-factors affecting moral.<br>Relationship between moral andproductivity.<br>Job satisfaction- factors influencing jobsatisfaction.<br>Important provisions of factory act andlabor laws. | 6 | |

| | | | |
|---|---|---|---|
| 2 | **Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT):**<br><br>2.1 CPM & PERT-meaning, features, difference, applications. 2.2 Understand different terms used in network diagram. Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples).<br>Determination of critical path on network.<br>Floats, its types and determination of floats.<br>Crashing of network, updating and its applications. | 8 | |
| 3 | **Materials Management:**<br><br>Material management-definition, functions, importance, relationship with other departments.<br>Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department.<br>Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice.<br>Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores.<br>Inventory control:<br>i. Definition.<br>ii. Objectives.<br>iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis.<br>v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.).<br>3.6 Material Requirement Planning (MRP)- concept, applications and brief details about software packages available in market. | 6 | |

| | | | |
|---|---|---|---|
| 4 | **Production planning and Control (PPC):**<br>Types and examples of production. PPC :<br>i. Need and importance. ii. Functions.<br>iii. Forms used and their importance.<br>iv. General approach foreach type of production.<br>Scheduling- meaning and need for productivity and utilisation.<br>Gantt chart- Format and method to prepare.<br>Critical ratio scheduling-method and numeric examples.<br>Scheduling using Gantt Chart (for at least 5-7 components having 5-6 | 8 | |
| | machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples.<br>4.7 Bottlenecking- meaning, effect and ways to reduce. | | |
| 5 | **Value Analysis (VA) and Cost Control:**<br>5.1 VA-definition, terms used, process and importance. 5.2 VA flow diagram. DARSIRI method of VA.<br>Case study of VA-at least two.<br>Waste-types, sources and ways to reduce them.<br>Cost control-methods and important guide lines. | 4 | |
| 6 | **Recent Trends in IM:**<br>ERP (Enterprise resource planning) - concept, features and applications.<br>Important features of MS Project.<br>Logistics- concept, need and benefits.<br>Just in Time (JIT)-concept and benefits.<br>Supply chain management-concept and benefits. | 4 | |

**Text book and Reference books:**

1. L.S. Srinath– "CPM & PERT principles and Applications".
2. Buffa – "Modern Production Management".
3. N. Nair – "Materials Management".
4. O. P. Khanna – " Industrial Engineering & Management".
5. Mikes – "Value Analysis".
6. S.C. Sharma, "Engineering Management – Industrial Engineering &Management", Khanna Book Publishing Company, New Delhi

**Maulana Abul Kalam Azad University of Technology, West Bengal**
***(Formerly West Bengal University of Technology)***
**Syllabus for B. Tech in Computer Science and Engineering**
**(Internet of Things)**
**(Applicable from the academic session 2022-2023)**

| | | | |
|---|---|---|---|
| **PCCICB502** | **Wireless Sensor Networks** | 3L:0T: | 3 credits |

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

Single-node architecture, Hardware components & design constraints,

Operating systems and execution environments, introduction to TinyOS and nesC.

Text/Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

Course Outcomes:

At the end of the course the students will be able to

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN

**Maulana Abul Kalam Azad University of Technology, West Bengal**
***(Formerly West Bengal University of Technology)***
**Syllabus for B. Tech in Computer Science and Engineering**
**(Internet of Things)**
**(Applicable from the academic session 2022-2023)**

| | | | |
|---|---|---|---|
| **PECICB501A** | **Embedded System** | 3L:0T:0P | 3 credits |

**Overview of Embedded System**: Embedded System, Embedded Processor in System, Components of Embedded
System, Brief introduction to Embedded software in system, Design Process in Embedded System.

**Embedded Hardware:**
**Processor & Memory:** Brief overview of 8051 Architecture and real world interfacing, Introduction to advanced
Processor Architectures-ARM, Processor and Memory organization, Parallelism in instruction level, Processor and
memory selection.

**I/O Types:** Serial and Parallel communication Ports, Timer and Counting devices, Watchdog timers, real time
clock, Serial bus Communication Protocols- I2C, CAN, and Parallel Communication Protocol-ISA.

**Interrupt Service Mechanism:** Concept of ISR, different interrupt sources, Interrupt handling Mechanism,
Multiple Interrupts, Interrupt Latency and deadline.

**Embedded Software Development-**
**Software Development:** Programming concept in ALP (assembly language programming) and High level
language-C, Processor directives, functions and macros and other programming elements, Embedded C++ concept
only.

**RTOS(Real time operating System)-** OS overview, Process, Interrupt and memory management, RTOS overview,
Basic Design rule using RTOS, Task scheduling using Priority based scheduling, cyclic scheduling and round robin
scheduling.

**Embedded system Design using PIC microcontroller:** Introduction toMicrochip PIC16 family, PIC16F873
processor architecture- features, memory organization, on chip peripherals, Watchdog timer, ADC, Data EEPROM,

Asynchronous serial port, SPI mode, I2C mode, Interfacing with LCD, ADC, sensors, stepper motor, key board,DAC.

**Case study of different types of Embedded System:** Design of Automated Chocolate Vending Machine, Digital
Camera.

**Text Book**

1. Microcontrollers Theory and Application, Ajay V. Deshmukh, TMH, 2011.
2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, TMH, 2011
319

**Reference Book**

1. Embedded System Design: A unified Hardware/ Software Introduction, by Frank Vahid, Willey, 2011.
2. Design with PIC Microcontrollers , J. B. Peatman, Pearson India,2008

| | | | |
|---|---|---|---|
| **Subject:** Internet Technology | | | |
| **Course Code: PECICB501B** | | **Semester: V** | |
| **Duration: 36 Hours** | | **Maximum Marks: 100** | |
| **Teaching Scheme** | | **Examination Scheme** | |
| Theory: 3 | | End Semester Exam: 70 | |
| Tutorial: 0 | | Attendance : 5 | |
| Practical: | | Continuous Assessment: 25 | |
| **Credit: 3** | | | |
| | | | |
| **Aim:** | | | |
| **Sl. No.** | | | |
| **1** | To gain comprehensive knowledge of Internet and its working. | | |
| **2** | Ability to use services offered by internet. | | |
| **3** | To enhance skill to develop websites using HTML , CSS, JS. | | |
| | | | |
| **Objective:** | | | |
| **Sl. No.** | | | |
| **1** | To introduce the students to the network of networks -Internet. | | |
| **2** | To enable the students to use various services offered by internet. | | |
| **3** | To gain knowledge about the protocols used in various services of internet. | | |
| **4** | To understand the working and applications of Intranet and Extranet. | | |
| | | | |
| **Pre-Requisite:** | | | |
| **Sl. No.** | | | |
| **1** | Understanding of basic programming logic. | | |
| **Contents** | | **Hrs./week** | |
| **Chapter** | **Name of the Topic** | **Hours** | **Marks** |

| | | | |
|---|---|---|---|
| 01 | Introduction to Networking<br>Overview of Networking, Intranet, Extranet and Internet, Domain and | 8 | 12 |
| | Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP, Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6, Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IPtables, Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast, Electronic Mail | | |
| 02 | Web Programming<br><br>Introduction to HTML, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value, Image Maps, area, attributes of image area, Extensible Markup Language (XML), CGI<br>Scripts, GET and POST Methods. | 8 | 15 |
| 03 | Server Side Programming and Scripting<br>Basic PHP Programming, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling, JavaScript basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation, Definition of cookies, Create and Store cookie. | 8 | 15 |
| 04 | Security Issues<br>Network security techniques, Password and Authentication, VPN, IP Security, security in electronic transaction, Secure Socket Layer(SSL), Secure Shell (SSH), Introduction to Firewall, Packet filtering, Stateful, Application layer, Proxy. | 6 | 13 |
| 05 | Advance Internet Technology<br>Internet Telephony (VoIP), Multimedia Applications, Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streamingmedia, Codec and Plugins, IPTV, Search Engine Optimization, Metadata. | 6 | 15 |
| | Sub Total: | 36 | 70 |
| | Internal Assessment Examination & Preparation of Semester Examination | | 30 |
| | Total: | | 100 |

**Practical**
**Course Code: BITCSC591**
**Credit: 2**
**Skills to be developed:**
Intellectual skills:

1. Ability to understand Web Design and Development.
2. Ability to analyze problems and provide program based solutions.

**List of Practical:**

**Maulana Abul Kalam Azad University of Technology, West Bengal**
***(Formerly West Bengal University of Technology)***
**Syllabus for B. Tech in Computer Science and Engineering**
**(Internet of Things)**
**(Applicable from the academic session 2022-2023)**

**1. As compatible to theory syllabus.**

**Assignments:**
**Based on the curriculum as covered by subject teacher.**

**List of Books Text Books:**

| **Name of Author** | **Title of the Book** | **Edition/ISSN/ISBN** | **Name of the Publisher** |
|---|---|---|---|
| N.P. Gopalan and J. Akilandeswari | Web Technology: A Developer's Perspective | | PHI |
| | | | |
| **Reference Books:** | | | |
| Rahul Banerjee | Internetworking Technologies, An Engineering Perspective | | PHI Learning |

| **List of equipment/apparatus for laboratory experiments:** | |
|---|---|
| Sl. No. | |
| **1.** | Computer with moderate configuration |
| | |

**End Semester Examination Scheme. Maximum Marks-70. Time allotted-3hrs.**

| **Group** | **Unit** | **Objective Questions** (MCQ only with the correct answer) | | **Subjective Questions** | | | |
|---|---|---|---|---|---|---|---|
| | | No of question to be set | Total Marks | No of question to be set | To answer | Marks per question | Total Marks |
| A | 1 to 5 | 10 | 10 | | | | |
| B | 1 to 5 | | | 5 | 3 | 5 | 70 |
| C | 1 to 5 | | | 5 | 3 | 15 | |

1. Only multiple choice type question (MCQ) with one correct answer are to be set in the objective part.
2. Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

**Examination Scheme for end semester examination:**

| **Group** | **Chapter** | **Marks of each question** | **Question to be set** | **Question to be answered** |
|---|---|---|---|---|
| **A** | **All** | **1** | **10** | **10** |
| **B** | **All** | **5** | **5** | **3** |
| **C** | **All** | **15** | **5** | **3** |
| | | | | |

**Maulana Abul Kalam Azad University of Technology, West Bengal**
***(Formerly West Bengal University of Technology)***
**Syllabus for B. Tech in Computer Science and Engineering**
**(Internet of Things)**
**(Applicable from the academic session 2022-2023)**

| | |
|---|---|
| **Course Code: PECICB501C** | **Category: Professional Elective Course** |
| **Course Name: Smart Sensors and IoT** | **Semester: 5th** |
| **L-T-P: 3-0- 0** | **Credit: 3** |
| **Total Lectures: 40** | |
| **Pre-Requisite: Analog and Digital Electronics** | |

## Course Objectives:

1. To provide the preliminary knowledge in sensors or transducers and understanding on how IoT systems are designed, characterized, and analyzed.
2. To introduce the students with various optical, thermal, ultrasonic, velocity and acceleration sensors.
3. To provide, basic knowledge of interfacing with various development board for IoT applications.
4. To understand about smart and wireless sensors and their implementation in IoT.
5. To gain the knowledge about sensors applications in various IoT application field.

## Course Content:

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | **Sensors/Transducers and Actuators fundamentals:** Principles, Sensor Classification, Characteristics, Performance, Error Analysis, Different types of Actuators (Pneumatic, Hydraulic, Electrical, Thermal and Mechanical). | 6 |
| 2 | **Introduction to Thermal, Optical, Velocity and Acceleration sensors:** Photo detectors, Resistance based temperature sensors, Semiconductor temperature sensors, Ultrasonic distance sensor, Electromagnetic velocity sensor, Accelerometer (capacitive, piezo-resistive and piezoelectric), Gyroscope (rotor, monolithicand optical). | 8 |
| 3 | **Interfacing:** Temperature and Humidity sensors, Tilt sensor, Accelerometer, Distance sensors, Obstacles sensors etc with Arduino and Raspberry Pi Development Board for various IoT applications. | 6 |
| 4 | **Smart Sensors:** Introduction, Architecture of Smart Sensors: Important components and their features. Some smart sensors: ACOEM Eagle, EnOcean Push Button, NEST Sensor, Ninja Blocks,<br>Introduction to Wearable Electronics Sensors. | 6 |

| | | |
|---|---|---|
| **5** | **Smart sensors and IoT:** Seven Generations of IoT Sensors: Industrial sensors, First Generation, Advanced Generation, Integrated IoT Sensors, Polytronics Systems, Sensors' Swarm, and Printed Electronics – their Description & Characteristics. Interfacing of Sensors for IoT application. | 6 |
| **6** | **Wireless Sensor:** Structure, Energy Storage Module, Power Management Module, RF Module, Sensing Module. | 4 |
| **7** | **Applications**: Agriculture**,** Home Security, Smart City, Automobile, Medical field. | 4 |

## Course Outcomes:

1. Use concepts for converting a physical parameter into an electrical quantity.
2. Choose an appropriate sensor comparing different standards and guidelines to make sensitive measurements of physical parameters.
3. Design and develop circuits using various sensors for IoT application.
4. Use concepts in smart and wireless sensors and their implementation in IoT.

**Learning Resources:**

## Text Book(s):

1. 1 Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.
2. Jon. S. Wilson, "Sensor Technology Hand Book", 2011, 1st edition, Elsevier, Netherland.
3. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Development Copyrights ,2014.
4. , Hiroto Yasuura, Chong-Min Kyung, Yongpan Liu, Youn-Long Lin, "Smart Sensors at the IoT Frontier", Springer Link.

## Reference Books:

1. John G Webster, "Measurement, Instrumentation and sensor Handbook", 2017, 2nd edition, CRC Press, Florida.
2. Eric Udd and W.B. Spillman, "Fiber optic sensors: An introduction for engineers and scientists", 2013, 2nd edition, Wiley, New Jersey.

3. Bahaa E. A. Saleh and Malvin Carl Teich, "Fundamentals of photonics", 2012, 1st edition, John Wiley, New York.
4. D. Patranabis , "Sensors and Transducers" –PHI Learning Private Limited.
5. W. Bolton ,"Mechatronics" –Pearson Education Limited.
6. D. Patranabis , "Sensors and Actuators",x 2nd Ed., PHI, 2013
7. Subhas C. Mukhopadhyay, "Wearable Electronics Sensors, For Safe and Healthy Living", Springer Link.