Faculty of Science and Technology
Savitribai Phule Pune University
Maharashtra, India

Honours* in Internet of Things
Board of Studies
(Computer Engineering)
(with effect from A.Y. 2020-21)
## Honours* in Internet of Things

<table>
<thead>
<tr>
<th>Year &amp; Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Teaching Scheme Hours / Week</th>
<th>Examination Scheme and Marks</th>
<th>Credit Scheme</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Theory</td>
<td>Tutorial</td>
<td>Practical</td>
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<tr>
<td><strong>TE &amp; V</strong></td>
<td>310601</td>
<td>Embedded Systems and Internet of Things</td>
<td>04</td>
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<tr>
<td></td>
<td>310602</td>
<td>Embedded Systems and Internet of Things Laboratory</td>
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<td><strong>TE &amp; VI</strong></td>
<td>310603</td>
<td>Internet of Things Architectures, Protocols and Systems Programming</td>
<td>04</td>
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<td><strong>BE &amp; VII</strong></td>
<td>410601</td>
<td>Machine Learning for Internet of Things</td>
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<tr>
<td></td>
<td>410602</td>
<td>Machine Learning for Internet of Things Laboratory</td>
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<td><strong>BE &amp; VIII</strong></td>
<td>410603</td>
<td>Internet of Things Security</td>
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<td>Seminar</td>
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<td>02</td>
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</table>

Total Credit for Semester V+VI+VII+VIII = 20

*To be offered as Honours for Major Disciplines as–*
1. Computer Engineering
2. Electronics and Telecommunication Engineering
3. Electronics Engineering
4. Information Technology

For any other Major Disciplines which is not mentioned above, it may be offered as Minor Degree.

Savitribai Phule Pune University
Honours* in Internet of Things
Third Year of Engineering (Semester V)
310601: Embedded System and Internet of Things

Teaching Scheme: | Credit: | Examination Scheme:
---|---|---
Theory : 04 Hours/Week | 04 | Mid_Semester(TH): 30 Marks
| | | End_Semester(TH): 70 Marks

**Companion Course, if any:** - Embedded System and Internet of Things Laboratory

**Course Objectives:**
The main objective of this course is to introduce the students to basics of embedded systems and Internet of Things.
- To learn and understand the basics of Embedded systems.
- To be acquainted with interfacing of sensors and actuators with microprocessor.
- To design embedded systems applications.
- To understand Internet of Things and its usefulness for society.

**Course Outcomes:**
On completion of the course, learner will be able to—
CO1: Identify and understand the unique characteristics and components of embedded systems
CO2: Compare various development boards Arduino, Raspberry pi, Beagle bone
CO3: Implement interfacing of various sensors, actuators to the development boards
CO4: Design, implement and test an embedded system application
CO5: Configure U-Boot, Understand IoT building blocks
CO6: Compare various IoT communication technologies and Design various IoT applications

**#Exemplar/Case Studies**—Elaborated examples/Case Studies are included at the end of each unit to explore how the learned topics apply to real world situations and need to be explored so as to assist students to increase their competencies, inculcating the specific skills, building the knowledge to be applicable in any given situation along with an articulation. One or two sample exemplars or case studies are included for each unit; instructor may extend the same with more. **Exemplar/Case Studies may be assigned as self-study by students and to be excluded from theory examinations.**

**Course Contents**

<table>
<thead>
<tr>
<th>Unit I</th>
<th>ES Overview</th>
<th>(08 Hours)</th>
</tr>
</thead>
</table>

**Components of ES:** Hardware and software

**Hardware components of ES:** Power supply: types, characteristics, selection criteria, Procesing Unit, Input devices, Output Devices

<table>
<thead>
<tr>
<th>Unit II</th>
<th>Introduction to ES System Software</th>
<th>(07 Hours)</th>
</tr>
</thead>
</table>
**Introduction to Embedded operating Systems:** Operating Systems Concepts, Real time operating systems, and, Task Scheduling, Different OS tasks, Introduction to **Real-Time Operating Systems**, characteristics, selection criteria, bootloader: U-boot.

**#Exemplar/Case Studies** — Case study: Raspberry Pi OS

<table>
<thead>
<tr>
<th>Unit III</th>
<th>Sensors, Actuators and Interfacing</th>
<th>(09 Hours)</th>
</tr>
</thead>
</table>
**Sensors:** Roles of Sensors & Actuators, Types of sensors, Active and passive, analog and digital, Contact and no-contact, Absolute and relative.

**Working of Sensors:** Position, occupancy and motion, velocity and acceleration, force, pressure, flow, Acoustic, Humidity, light, radiation, temperature, chemical, biosensor, camera.

**Development boards:** Types of boards - Arduino, Raspberry pi, Beagle bone, ESP8266, selection criteria. Interfacing of sensors with development boards.

<table>
<thead>
<tr>
<th>Unit IV</th>
<th>Embedded System - Application Development</th>
<th>(08 Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated Development Platforms for Application Development in ES environment, SDLC-Requirements, Architecture, Design, Components, Coding, Testing and Deployment. Study of any two Open source IDE for ES application development with respect to any of the two indicated Case studies</td>
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</tbody>
</table>

**#Exemplar/Case Studies**

- **Design and development of ES Applications:** Object detection, Traffic signal, digital clock, robotics arm movement, fire alarm, automated disinfection tent, Bus ticketing system, Tyre pressure monitoring system, smart metering.

<table>
<thead>
<tr>
<th>Unit V</th>
<th>IoT</th>
<th>(08 Hours)</th>
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</thead>
<tbody>
<tr>
<td>Introduction of IoT: Definition and characteristics of IoT, Technical Building blocks of IoT, Device, Communication Technologies, Data, Physical design of IoT, IoT enabling technologies, IoT Issues and Challenges- Planning, Costs and Quality, Security and Privacy, Risks</td>
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</tbody>
</table>

**#Exemplar/Case Studies**

- **Smart Home:** Characteristics of Smart Home - Smart Home Energy Management, Smart Appliances, Communication Technologies for Smart Homes, maintenance, security, challenges.

- **Smart Agricultural:** characteristics and applications - Scarecrow, Smart Irrigation System, Crop Water Management, Integrated Pest Management, Sensor-based field and resource mapping, Remote equipment monitoring)

<table>
<thead>
<tr>
<th>Unit VI</th>
<th>Communication under IoT</th>
<th>(08 Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IoT Protocols:MQTT, CoAP, XMPP and AMQT, IoT communication models, IoT Communication technologies: Bluetooth, BLE, Zigbee, Zwave, NFC, RFID, LiFi, Wi-Fi, Interfacing of wifi, RFID, Zigbee,NFC with development board.</td>
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</table>

**#Exemplar/Case Studies**

- **e-health:** Characteristics of e-health and applications- monitoring of health parameters, smart medicine box, elderly people monitoring, challenges.

- **IoT Smart City:** Characteristics and applications— Smart Economy, Smart People, Smart Goverence, Smart Mobility, Smart Environment, Smart Living Smart Grid, Smart Home, Transport and Traffic Management, Smart Healthcare

**Learning Resources**

**Text Books:**

**Reference Books:**
Savitribai Phule Pune University  
Honours* in Internet of Things  
Third Year of Engineering (Semester V)  
310602: Embedded System and Internet of Things Laboratory

<table>
<thead>
<tr>
<th>Teaching Scheme</th>
<th>Credit Scheme</th>
<th>Examination Scheme and Marks</th>
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<tbody>
<tr>
<td>Practical: 02 Hrs/Week</td>
<td>01</td>
<td>Term Work: 50 Marks</td>
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</table>

**Companion Course**: Embedded Systems and Internet of Things

**Course Objectives:**
- To understand the fundamentals and functionality of various embedded board platforms.
- To design and implement interconnection and integration of sensors to embedded board platform.
- To design and implement application of IoT using various sensors.

**Course Outcomes:**
On completion of the course, student will be able to—
- Understand the working of embedded boards.
- Apply the knowledge to interface various sensors with IoT development board.
- Design and implement IoT system for real time applications.

**Guidelines for Laboratory Conduction**

- **Lab Assignments**: Following is list of suggested laboratory assignments for reference. Laboratory Instructors may design suitable set of assignments for respective course at their level. Beyond curriculum assignments and mini-project may be included as a part of laboratory work. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. The inclusion of few optional assignments that are intricate and/or beyond the scope of curriculum will surely be the value addition for the students and it will satisfy the intellectuals within the group of the learners and will add to the perspective of the learners. For each laboratory assignment, it is essential for students to draw/write/generate flowchart, algorithm, test cases, mathematical model, test data set and comparative/complexity analysis (as applicable). Batch size for practical and tutorial may be as per guidelines of authority.

- **Term Work**: Term work is continuous assessment that evaluates a student's progress throughout the semester. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Categorical assessment criteria for the term work should establish unambiguous standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratories or on the fields to show that the course outcomes have been achieved. It is recommended to conduct internal monthly practical examination as part of continuous assessment.

- **Assessment**: Students’ work will be evaluated typically based on the criteria like attentiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.

- **Laboratory Journal**: Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD or similar media containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Submission of journal/ term work in the form of softcopy is desirable and appreciated.
### Suggested List of Laboratory Experiments/Assignments

Student should perform at least 10 experiments with all experiments from group A and any 5 assignments from group B and one from group C assignments.

*(Use suitable programming language/Tool for implementation)*

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Group A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Study of Raspberry Pi 4, Arduino board and Operating systems for the same. Understand the process of OS installation on the Raspberry Pi.</td>
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<tr>
<td>2.</td>
<td>Study of different sensors:- temperature sensor, bio-sensor, IR sensor, chemical sensor(PH), gauge sensor, ultrasonic sensor etc.</td>
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<tr>
<td>3.</td>
<td>Understand the connection and configuration of GPIO and its use in programming. Write an application of the use of push switch and LEDs.</td>
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<td>4.</td>
<td>Write an application to read temperature from the environment. If temperature crosses threshold value then it notifies with buzzer.</td>
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<tr>
<th>Group B</th>
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<th>Group C</th>
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Savitribai Phule Pune University  
Honours* in Internet of Things  
Third Year of Engineering (Semester V)  
310603: Internet of Things Architectures, Protocols and Systems Programming

<table>
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<td>End Semester Assessment: 70</td>
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</table>

Prerequisite: Computer Networks, Embedded Systems

Course Objectives

Objective of this course is to provide students with

1. The knowledge and understanding of Internet of Things
2. Provide a strong foundation of fundamentals of Internet of Things and need of IoT Security
3. Get acquainted with various communication protocols of Internet of Things
4. Detailed understanding of present scope of Internet of Things with case studies

Course Outcomes

1. Model Internet of Things using various protocols of standard communication layers
2. Represent and analyze various communication models, carry out the comparative analysis in terms of specified parameters
3. Choose an appropriate communication model for given design criteria
4. Understand essentials of IoT Security
5. Provide most optimum model of connectivity solution to various things in different application areas.

Course Contents

<table>
<thead>
<tr>
<th>Module I</th>
<th>Introduction to Internet of and Things (IoT)</th>
<th>10 Hrs</th>
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<tbody>
<tr>
<td><strong>Introduction</strong>: Enabling Technologies of IoT, Logical Design of IoT, IoT communication Models, IoT Communication API’s</td>
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<tr>
<td><strong>Cloud Services</strong>: IAAS, PAAS, SAAS, IoT Specific Cloud Services</td>
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<tr>
<td><strong>RFID</strong>: Introduction to RFID and its Applications in IoT.</td>
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<table>
<thead>
<tr>
<th>Module II</th>
<th>Key Protocols-1</th>
<th>8 Hrs</th>
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<tbody>
<tr>
<td><strong>PHY/MAC Layer</strong>: Wireless HART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy</td>
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<tr>
<td><strong>Network Layer</strong>: IPv4, IPv6, 6LoWPAN, ICMP, RPL, COAP</td>
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<table>
<thead>
<tr>
<th>Module III</th>
<th>Key Protocols- 2</th>
<th>8 Hrs</th>
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**Transport Layer**: (TCP, UDP, DCCP, SCTP)-(TLS, DTLS)

**Session Layer**: HTTP, CoAP, XMPP, AMQP, MQTT

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<tr>
<th>Module IV</th>
<th>IoT Security</th>
<th>6Hrs</th>
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<tr>
<th>Module V</th>
<th>System Software for IoT</th>
<th>6Hrs</th>
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<tbody>
<tr>
<td><strong>Software for IoT Development Boards like Arduino, Raspberry Pi, Beagle Bone, Intel Galileo</strong>: IDE, Simulator, Emulator, Debugger, OS, Software Libraries for Internet connectivity</td>
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<tr>
<td>Devices, Gateways, Internet, and Web/Cloud Services Software Development Prototyping Online Component API and Web APIs</td>
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<thead>
<tr>
<th>Module IV</th>
<th>IoT Case Studies</th>
<th>7 Hrs</th>
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<tbody>
<tr>
<td>Smart Cities, Agriculture, Health and Lifestyle, Industry, Home Automation, Telecom/5G.</td>
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**Text Books**


**Reference Books**

1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning
2. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally
5. Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition
6. Data and Computer Communications; By: Stallings, William; Pearson Education Pte.Ltd., Delhi, 6th Edition

**Relevant MOOCs Course**

- NPTEL- [Introduction to internet of things - Course (nptel.ac.in)](http://nptel.ac.in)
- Coursera
  - [An Introduction to Programming the Internet of Things (IOT) | Coursera](https://www.coursera.org/subject/internet)
Savitribai Phule Pune University, Pune  
Honours* in  Internet of Things  
Fourth Year of Engineering (Semester VII)  
410601: Machine Learning for Internet of Things

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<td>End-Sem (paper): - 30 Marks</td>
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Prerequisites: Microprocessor, Computer Network, Embedded System & IOT

**Course Objectives:**
The main objective of this course is to introduce the students to the basics of Machine Learning Concepts applicable with Internet of Things.
- To learn and understand the basics of Machine Learning and IoT
- To get acquainted with machine learning for IOT Data Analysis.
- To learn and understand Machine learning and deep learning methods for IoT applications.
- To design IoT applications using ML, DL methods
- To understand the Internet of Things and its benefits for society.

**Course Outcomes:**
On completion of this course, student will be able to--
- CO1: Identify and understand the machine learning elements and techniques
- CO2: Implement data preprocessing methods for IoT using python
- CO3: Compare Machine Learning and Deep Learning
- CO4: Identify and understand Machine Learning accelerators for IoT Devices
- CO5: Design & implement deep learning model for sensor data
- CO6: Compare advanced machine learning techniques
- CO7: Design various IoT applications using ML and DL techniques

**Course Contents**

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<thead>
<tr>
<th>Unit</th>
<th>Overview of Machine Learning</th>
<th>8 Hours</th>
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<td>Introduction to Machine Learning:</td>
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<table>
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<tr>
<th>Unit II</th>
<th>Predictive Analysis for IoT</th>
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<tr>
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<td>IOT Data Pre-processing:</td>
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<tr>
<td></td>
<td>Data Preparation for Predictive Maintenance Modeling, Cleaning and Standardizing IoT Data, Applying Advanced Data Exploration Techniques</td>
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<td>Feature Engineering:</td>
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<td></td>
<td>Exploring Feature Engineering, Applying Feature Selection Techniques, Feature set selection using ML, Machine learning for Internet of Things data analysis</td>
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<table>
<thead>
<tr>
<th>Unit III</th>
<th>ML &amp; DL Methods for IoT</th>
<th>06 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Machine learning (ML) methods for IoT Applications:</td>
<td></td>
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<tr>
<td></td>
<td>Decision Trees (DTs), Support Vector Machines (SVMs), Bayesian theorem-based algorithms, k-Nearest neighbour (KNN), Random forest (RF), Association Rule (AR) algorithms, Ensemble learning (EL), k-Means clustering, Principal component analysis (PCA)</td>
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<td></td>
<td>Deep learning (DL) methods for IoT Applications:</td>
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<td></td>
<td>Convolutional neural networks (CNNs), Recurrent neural networks (RNNs), Deep autoencoders (AEs), Restricted Boltzmann machines (RBMs), Deep belief networks (DBNs), Generative adversarial networks (GANs), Ensemble of DL networks (EDLNs)</td>
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### Unit IV: Machine Learning Accelerators for IoT Devices

**06 Hours**

**Compact fast Machine Learning Accelerators for IOT devices:**
Edge Computing on IOT Devices, IOT Based Smart Buildings, Distributed Machine Learning, Machine Learning Accelerator, Machine Learning Model Optimization, **Least-Squares-Solver for Shallow Neural Network:** Introduction, Algorithm Optimization, Hardware Implementation

### Unit V: Deep Learning for IOT

**06 Hours**

**Deep Learning for IOT:**
Deep Learning Models For Sensor Data, Embedded Deep Learning, Real Time IOT Imaging with Deep Neural Network

### Unit VI: Applications of ML and IOT: Case Study Approach

**06 Hours**

**Applications of ML and IOT:**
Case Studies: IOT for Agriculture, Remote Patient Monitoring, Smart City, Smart Transportation, IOT Security using ML

### Books: Text:


### Reference:


### Mooc Courses:

1. **Predictive Analytics for IOT, by Microsoft on edx**  
   Link: [https://www.edx.org/course/predictive-analytics-for-iot-solutions?source=aw&awc=6798_1594277292_cca42f86ac19afe29904595a53aad9e1c](https://www.edx.org/course/predictive-analytics-for-iot-solutions?source=aw&awc=6798_1594277292_cca42f86ac19afe29904595a53aad9e1c)
2. **INTERNET of Things and Machine Learning Training**  
Savitribai Phule Pune University, Pune
Honours* in Internet of Things
410602: Machine Learning for Internet of Things Laboratory
Fourth Year of Engineering (Semester VII)

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Credit</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR: 02 Hours/Week</td>
<td>01</td>
<td>TW: 50 Marks</td>
</tr>
</tbody>
</table>

**Guidelines for Instructor's Manual**
The instructor's manual is to be developed as a reference and hands-on resource. It should include prologue (about University/program/ institute/ department/foreword/ preface), University syllabus, conduction & Assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

**Guidelines for Student's Laboratory Journal**
The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software & Hardware requirements, Assessment grade/marks and assessor's sign, Theory- Concept in brief, algorithm, flowchart, test cases, Test Data Set(if applicable), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal must be avoided. Use of DVD containing students programs maintained by Laboratory In-charge is highly encouraged. For reference one or two journals may be maintained with program prints in the Laboratory.

**Guidelines for Laboratory /TW Assessment**
Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters, such as timely completion, performance, innovation, efficient codes, punctuality and

**Guidelines for Practical Examination**
Problem statements must be decided by the internal examiner in consultation with the external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. The questions asked will in no way be the deciding factor for passing the students. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of student's academics.

**Guidelines for Laboratory Conduction**
The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

**Operating System recommended**: 64-bit Open source Linux or its derivative

**Programming tools recommended**: - Data Mining Tool like WEKA, R Studio for R Programming, Anaconda for Python programming, Arduino IDE

**Hardware Requirement**: Various sensors as per selected application( Temperature Sensor, ...
<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Group A</th>
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</table>
| 1      | **Programming for IOT**: R- programming, Python Libraries, Azure Cloud platform  
Examining Machine Learning for IoT  
Develop an Application on Arduino/Raspberry-Pi to capture the values of temperature sensor after every 15 sec of time interval, store this values in .csv format and predict the temperature at particular time t using linear regression analysis.  
**Hint:**  
Create the dataset of at least 20-25 instances, use any data analysis tool (WEKA/R) |
| 2      | **Getting Started with Azure Machine Learning**  
Deploy your first Azure/Think Speak IoT Edge module to a virtual Linux or Windows device  
**Reference**  
1. [Deploy your first IoT Edge module to a Linux device](#)  
2. [Deploy your first IoT Edge module to a Windows device](#)  
3. [Things Speak for IoT](#)  
4. [Collect the sensor data on private cloud using Things Speak](#) |
| 3      | **Exploring Code-First Machine Learning with Python**  
1. Download the Dataset of your choice  
2. Divide the dataset into Training data and Testing data.  
3. Perform the classification of the instances using any machine learning algorithm like KNN Algorithm, Naïve Bayes, Decision Tree or any.  
4. Evaluate the machine learning model by considering the parameter (TPR, TNR, FPR, FNR, accuracy, precision, recall, error rate etc.)  
**References**  
1. [https://www.kaggle.com/datasets](https://www.kaggle.com/datasets)  
### Teaching Scheme:

<table>
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<tr>
<th>TH: 04 Hours/Week</th>
<th>Credit</th>
<th>Examination Scheme:</th>
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<tbody>
<tr>
<td></td>
<td>04</td>
<td>Mid_Semester(TH): 30 Marks</td>
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<td>End_Semester(TH): 70 Marks</td>
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</table>

### Prerequisite Courses, if any:
- Fundamentals of Embedded Systems, IoT
- Basic of Network Security

### Companion Course, if any:

### Course Objectives:
- To understand IoT security issues and concerns
- To understand the main threats and attacks in IoT Environment
- To ensure user authentication
- To understand Security Requirements in IoT Architecture
- To create awareness of IoT security
- To apply Security concepts/techniques for IoT applications

### Course Outcomes:
On completion of the course, learner will be able to–
- CO1 - Describe IoT security issues and concerns
- CO2 - Discuss the main threats and attacks in IoT Environment
- CO3 - Verify user authentication
- CO4 - Discuss Security Requirements in IoT Architecture
- CO5 - Develop awareness of IoT security
- CO6 - Use security concepts/techniques for IoT applications

### Course Contents

#### Unit I
**Introduction: Securing the Internet of Things & Security Architecture**
(07 Hours)

#### Unit II
**Security and Vulnerability in the Internet of Things**
(08 Hours)

#### Unit III
**IoT Node Authentication**
(07 Hours)
Security Goals in IoT, Public-Key-Based Authentication, Identify-Based Authentication, Trust models & privacy preservation, Encryption and Digital Signature, IP Connectivity, Lightweight Cryptography, Existing Security Schemes for IoT

#### Unit IV
**Data Protection & Security Requirements in IoT Architecture**
(08 Hours)
Data Protection in IoT: Data lifecycle in IoT, Protecting Data in IoT


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<thead>
<tr>
<th>Unit V</th>
<th>Security in Enabling Technologies &amp; Existing Security Scheme for IoT</th>
<th>(06 Hours)</th>
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<tr>
<th>Unit VI</th>
<th>Introduction to the Use Cases and Emerging Standards and Technologies for Security and privacy in IoT</th>
<th>(06 Hours)</th>
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<tr>
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<td>Smart Cities Overview, The IoT and Secure Orchestration Opportunity in Cities, Security in Smart Cities, Smart Cities Example Use Cases</td>
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<tr>
<td></td>
<td>Blockchain technology for security and privacy in IoT, Blockchain Overview, Challenges Associated with secure IoT Deployment and Blockchain in IoT. Case Study- Smart Home, Food supply chain traceability system</td>
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</table>

Learning Resources

Text Books:

Reference Books:

Online Resources:

https://nptel.ac.in/courses/106/105/106105195/
Savitribai Phule Pune University
Honours* in Internet of Things
Fourth Year of Engineering (Semester VIII)
410604: Seminar

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<tr>
<th>Teaching Scheme</th>
<th>Credit Scheme</th>
<th>Examination Scheme and Marks</th>
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<tbody>
<tr>
<td>Practical: 02 Hours/Week</td>
<td>02</td>
<td>Presentation: 50 Marks</td>
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</table>

**Course Objectives:**
- To train the student to independently search, identify and study important topics in computer science.
- To develop skills among students to study and keep themselves up to date of the technological developments taking place in computer science.
- To expose students to the world of research, technology and innovation.

**Course Outcomes:**
- On completion of the course, student will be able to
- To train the student to independently search, identify and study important topics in computer science.
- To develop skills among students to study and keep themselves up to date of the technological developments taking place in computer science.
- To expose students to the world of research, technology and innovation

**Guidelines for Seminar:**
- The department will assign an internal guide under which students shall carry out Hons. seminar work
- In order to select a topic for Hons. Seminar, the student shall refer to various resources like books, magazines, scientific papers, journals, the Internet and experts from industries and research institutes
- The topic selected for Hons. Seminar by the students will be scrutinized and if found suitable, shall be approved by the internal guide
- Student shall submit the progress of his/her Hons. Seminar work to the internal guide.
- The student shall prepare a REPORT on the work done on Hons. Seminar and submit it at the time of presentation.

**Evaluation of IT Seminar Work**
- During the seminar work, its progress will be monitored, by the internal guide.
- At the end of seminar work, copy of Hons. Seminar Report should be prepared and submitted to department.
- End Examination shall be based on the Report, Presentation.
- Guidelines for Assessment: Panel of staff members along with a guide would be assessing the seminar work based on these parameters-Topic, Contents and Presentation, regularity, Punctuality and Timely Completion, Question and Answers, Report, Paper presentation/Publication, Attendance and Active Participation.

**References:**