# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**
Dundigal, Hyderabad -500 043

## ELECTRICAL AND ELECTRONICS ENGINEERING

## COURSE DESCRIPTOR

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **INTERNET OF THINGS LABORATORY** | | | | |
| **Course Code** | BPSB10 | | | | |
| **Programme** | M.Tech | | | | |
| **Semester** | I | EPS | | | |
| **Course Type** | Core | | | | |
| **Regulation** | IARE - R18 | | | | |
| **Course Structure** | **Theory** | | | **Practical** | |
| | **Lectures** | **Tutorials** | **Credits** | **Laboratory** | **Credits** |
| | - | - | - | 4 | 2 |
| **Chief Coordinator** | Dr. P Sridhar ,Professor &HOD,EEE | | | | |
| **Course Faculty** | Ms. B Navothna, Assistant Professor | | | | |

## I. COURSE OVERVIEW:

The main objective of the course is to provide knowledge on internet of things and how important it is in present scenario. IoT is a connecting bridge between physical world and cyber world and Machine to Machine communication i.e. with automation as one subset. IoT refers to uniquely identifiable objects and their virtual representations in an Internet like structure. Measurement of various electrical quantities and functioning of induction motor in the case of over voltage, current is using arduino. Design a relay to protect the home appliances from over currents, under voltages and over voltages.

## II. COURSE PRE-REQUISITES:

| Level | Course Code | Semester | Prerequisites | Credits |
|---|---|---|---|---|
| UG | AEC022 | VI | Microcontrollers and Digital Signal Processing | 4 |

## III. MARKS DISTRIBUTION:

| Subject | SEE Examination | CIA Examination | Total Marks |
|---|---|---|---|
| Internet of Things Laboratory | 70 Marks | 30 Marks | 100 |

## IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✔ | Chalk & Talk | ✘ | Quiz | ✘ | Assignments | ✘ | MOOCs |
| ✔ | LCD / PPT | ✘ | Seminars | ✘ | Mini Project | ✘ | Videos |
| ✔ | Open Ended Experiments | | | | | | |

## V. EVALUATION METHODOLOGY:

Each lab will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

All the drawing related courses are evaluated in line with lab courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end laboratory examination. There shall be ONE internal test for 10 marks each in a semester.

The emphasis on the experiments is broadly based on the following criteria:

| | |
|---|---|
| 20 % | To test the preparedness for the experiment. |
| 20 % | To test the performance in the laboratory. |
| 20 % | To test the calculations and graphs related to the concern experiment. |
| 20 % | To test the results and the error analysis of the experiment. |
| 20 % | To test the subject knowledge through viva – voce. |

**Continuous Internal Assessment (CIA):**
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

| **Component** | **Laboratory** | | **Total Marks** |
|---|---|---|---|
| **Type of Assessment** | Day to day performance | Final internal lab assessment | |
| **CIA Marks** | 20 | 10 | 30 |

**Continuous Internal Examination (CIE):**
One CIE exams shall be conducted at the end of the 12$^{th}$ Expt of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

| **Preparation** | **Performance** | **Calculations and Graph** | **Results and Error Analysis** | **Viva** | **Total** |
|---|---|---|---|---|---|
| 2 | 2 | 2 | 2 | 2 | 10 |

## VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

| Program Outcomes (POs) | | Strength | Proficiency assessed by |
|---|---|---|---|
| PO 1 | Identify, formulate and solve power system related problems using advanced level computing techniques. | 2 | Discussion |
| PO 3 | Explore ideas to carry out research / investigation independently to solve practical problems through continuing education. | 3 | Laboratory Practices |
| PO 4 | Demonstrate knowledge and execute projects on contemporary issues in multidisciplinary environment. | 2 | Projects |
| PO 5 | Ability to write and present a substantial technical report / document. | 2 | Projects |
| PO 6 | Inculcate ethics, professionalism, multidisciplinary approach, entrepreneurial thinking and effective communication skills. | 2 | - |
| PO 7 | Function effectively as an individual or a leader in a team to propagate ideas and promote teamwork. | 2 | - |

**3 = High; 2 = Medium; 1 = Low**

## VII. COURSE OBJECTIVES (COs):

**The course should enable the students to:**

| | |
|---|---|
| I | Understand the IoT using Arduino programming |
| II | Explain the interfacing of data, I/O devices with Arduino UNO |
| III | Describe the digital protection schemes in power system relays. |

## VIII. COURSE LEARNING OUTCOMES (CLOs):

| CLO Code | CLO's | At the end of the course, the student will have the ability to: | PO's Mapped | Strength of Mapping |
|---|---|---|---|---|
| BPSB10.01 | CLO 1 | List out the different IOT applications and importance of IOT in present scenario. | PO3, PO4, PO5 | 2 |
| BPSB10.02 | CLO 2 | List the application of Arduino and Node MCU | PO3, PO4, PO5 | 2 |
| BPSB10.03 | CLO 3 | Know the different sensors available to measure the current and voltage | PO3, PO4, PO5 | 2 |
| BPSB10.04 | CLO 4 | Design the digital voltmeter and ammeter for both AC and DC circuits | PO3, PO4, PO5 | 2 |
| BPSB10.05 | CLO 5 | Design a digital frequency meter to measure the frequency in an AC circuit. | PO1, PO3, PO4, PO5 | 2 |
| BPSB10.06 | CLO 6 | Measure the power and energy consumption in a home using Arduino | PO3, PO4, PO5 | 3 |
| BPSB10.07 | CLO 7 | Measure the power factor and phase angle in an AC circuit using Arduino/Node MCU. | PO1, PO3, PO4, PO5 | 2 |
| BPSB10.08 | CLO 8 | Design a system to control the traffic signals through IOT | PO1, PO3, PO4, PO5 | 2 |
| BPSB10.09 | CLO 9 | Develop a system to control the direction of three phase induction motor | PO3, PO4, PO5 | 3 |
| BPSB10.10 | CLO 10 | Model a system to control the railway gate using stepper motors. | PO3, PO4, PO5 | 2 |
| BPSB10.11 | CLO 11 | Know the functioning of relay module and a 3phase contactor. | PO3, PO4, PO5 | 2 |
| BPSB10.12 | CLO 12 | Design a system to protect the three phase induction motor from abnormal fault conditions | PO1, PO3, PO4, PO5 | 2 |

| CLO Code | CLO's | At the end of the course, the student will have the ability to: | PO's Mapped | Strength of Mapping |
|---|---|---|---|---|
| BPSB10.13 | CLO 13 | Design a system to control the direction and speed of DC motor | PO3, PO4, PO5 | 3 |
| BPSB10.14 | CLO 14 | Design a relay to protect the home appliances from over currents, under voltages and over voltages. | PO1, PO3, PO4, PO5 | 3 |

**3 = High; 2 = Medium; 1 = Low**

## IX. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

| Course Learning Outcomes (CLOs) | Program Outcomes (POs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
| CLO 1 | | | 2 | 2 | 2 | | |
| CLO 2 | | | 3 | 2 | 2 | | |
| CLO 3 | | | 2 | 2 | 2 | | |
| CLO 4 | 2 | | 2 | 2 | 2 | | |
| CLO 5 | | | 2 | 2 | 2 | | |
| CLO 6 | | | 3 | 2 | 2 | | |
| CLO 7 | 2 | | 3 | 2 | 2 | | |
| CLO 8 | 2 | | 3 | 2 | 2 | | |
| CLO 9 | | | 3 | 2 | 2 | | |
| CLO 10 | | | 3 | 2 | 2 | | |
| CLO 11 | | | 3 | 2 | 2 | | |
| CLO 12 | | | 2 | 2 | 2 | | |
| CLO 13 | | | 3 | 2 | 2 | | |
| CLO 14 | 2 | | 2 | 2 | 2 | | |

**3 = High; 2 = Medium; 1 = Low**

## X. ASSESSMENT METHODOLOGIES – DIRECT

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CIE Exams | PO1, PO3, PO4, PO5 PSO3 | SEE Exams | PO1, PO3, PO4, PSO3 | Assignments | - | Seminars | - |
| Laboratory Practices | PO1, PO3, PO4,PSO3 | Student Viva | PO1, PO3, PO4, PSO3 | Mini Project | - | Certification | - |

## XI. ASSESSMENT METHODOLOGIES - INDIRECT

| | | | |
|---|---|---|---|
| ✔ | Early Semester Feedback | ✔ | End Semester OBE Feedback |
| ✘ | Assessment of Mini Projects by Experts | | |

## XII. SYLLABUS

| LIST OF EXPERIMENTS | |
|---|---|
| **Expt-1** | **DESIGN OF DIGITAL DC VOLTMETER AND AMMETER** |
| Design a Digital DC Voltmeter and Ammeter to measure the voltage and current in DC electrical circuits using Arduino and display the values in LCD display | |
| **Expt-2** | **DESIGN OF DIGITAL AC VOLTMETER AND AMMETER** |
| Design a Digital AC Voltmeter and Ammeter to measure the voltage and current in AC electrical circuits using Arduino and display the values in LCD display. | |
| **Expt-3** | **DIRECTION CONTROL OF THREE PHASE INDUCTION MOTOR** |
| Design a system to control the direction of three phase induction motor through IOT | |
| **Expt-4** | **DESIGN OF DIGITAL FREQUENCY METER** |
| Design a Digital frequency meter to measure the frequency in any AC electrical circuit using Arduino and display the values in LCD display | |
| **Expt-5** | **MEASUREMENT OF POWER AND ENERGY** |
| Measure the power and energy in electrical circuit using Arduino and display the values in LCD display | |
| **Expt-6** | **MEASUREMENT OF PHASE SHIFT AND POWER FACTOR** |
| Measure the phase shift and power factor in an electrical circuit for different loads using Arduino and display the value in LCD display. | |
| **Expt-7** | **IMPLEMENTATION OF OVER CURRENT RELAY** |
| Design an over current relay for distribution system and displaying the tripping status of the relay in substation through IOT | |
| **Expt-8** | **OVER/UNDER VOLTAGE PROTECTION OF HOME APPLIANCES** |
| Design a system to protect home appliances from over and under voltages using Arduino. | |
| **Expt-9** | **PROTECTION OF THREE PHASE INDUCTION MOTOR** |
| Design a system for protecting the three phase induction motor from over voltages, over currents, temperature and displaying the status of the motor at remote location using IOT. | |
| **Expt-10** | **TRAFFIC SIGNAL CONTROL** |
| Design a traffic control system using IOT | |
| **Expt-11** | **RAILWAY GATE CONTROL BY STEPPER MOTORS** |
| Design a railway gate control using stepper motor using IOT | |
| **Expt-12** | **DIRECTION AND SPEED CONTROL OF DC MOTOR** |
| Control the speed and direction of a DC motor using Arduino and display the status of the motor at the remote location using IOT. | |

## XIII. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

| Week No. | Topics to be covered | Course Learning Outcomes | Reference |
|---|---|---|---|
| 1-3 | Introduction to internet of things and arduino | CLO 1 | T1 |
| 4-5 | Understand the applications of various sensors | CLO 2 | T1 |
| 7-8 | Design various direct current instruments using arduino | CLO 4 | T1 |
| 9-10 | Design various alternating current instruments using arduino | CLO 4 | T1 |
| 11-13 | Design a system to control the direction of three phase induction motor through IOT | CLO 9 | T1 |
| 14-16 | Digital frequency meter to measure the frequency in any AC electrical circuit using Arduino | CLO 5 | T1 |
| 17-19 | Measurement of power, energy, phase shift and power factor for different loads using arduino | CLO 6 | T2 |
| 20-22 | Measurement of phase shift and power factor for different loads using arduino | CLO 7 | T1 |
| 23-24 | Design traffic control system using IOT | CLO 8 | T1 |
| 25-27 | Demonstrate the tripping status of the relay in substation through IOT | CLO 11 | T2 |
| 28-30 | Design for protection of home appliances from over and under voltages using Arduino | CLO 14 | T2 |
| 31-33 | Evaluate the program for protecting the three phase induction motor from over voltages, over currents, and displaying the status of the motor at remote location using IOT | CLO 12 | T2 |
| 33-34 | Evaluate the program for protecting the three phase induction motor from temperature and displaying the status of the motor at remote location using IOT | CLO 13 | T2 |
| 35-36 | Design for protection of home appliances from over and under voltages using Arduino | CLO 14 | T2 |

## XIV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

| S.NO | DESCRIPTION | PROPOSED ACTIONS | RELEVANCE WITH POs |
|---|---|---|---|
| 1 | Describe the importance of internet of things in present scenario. | Discussion | PO1,PO3 |
| 2 | Understand the implementation of internet of things using arduino. | Projects | PO1, PO3 |
| 3 | Analyze the performance of three phase induction motor under over voltages and currents. | Laboratory Practices | PO1, PO3, PO4 |
| 4 | Demonstrate a prototype for protection of home appliances from over and under voltages. | Laboratory Practices | PO3, PO5 |

**Prepared by:**

Ms. B Navothna, Assistant Professor

**HOD, EEE**