# INSTITUTE OF AERONAUTICAL ENGINEERING

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

## INFORMATION TECHNOLOGY

## COURSE DESCRIPTOR

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **FUNDAMENTALS OF ELECTRICAL ENGINEERING LABORATORY** | | | | |
| **Course Code** | **AEEB05** | | | | |
| **Programme** | **B.Tech** | | | | |
| **Semester** | **I** | **IT** | | | |
| **Course Type** | **Foundation** | | | | |
| **Regulation** | **IARE - R18** | | | | |
| **Course Structure** | **Theory** | | | **Practical** | |
| | **Lectures** | **Tutorials** | **Credits** | **Laboratory** | **Credits** |
| | **3** | **1** | **4** | **3** | **1.5** |
| **Chief Coordinator** | **Mr. A Nareshkumar, Assistant Professor** | | | | |
| **Course Faculty** | **Mr. A Nareshkumar, Assistant Professor**<br>**Mr. K Lingaswamy, Assistant Professor**<br>**Dr. M Laxmidevi Ramanaiah, Associate Professor**<br>**Mr. A Srikanth, Assistant Professor**<br>**Mr. T Mahesh, Assistant Professor**<br>**Mr. N Shivaprasad, Assistant Professor** | | | | |

## I. COURSE OVERVIEW:

The aim of this course is to conduct experiments on basic concepts of electrical circuits and it is further extended to cover the application of basic concepts by the inclusion of series and parallel electrical circuits. The course deals with the alternating quantities and DC machines, AC machines in power stations. This course includes experiments deal with the study of Thevenin's and Norton's theorems.

## II. COURSE PRE-REQUISITES:

| Level | Course Code | Semester | Prerequisites | Credits |
|---|---|---|---|---|
| - | - | - | - | - |

## III. MARKS DISTRIBUTION:

| Subject | SEE Examination | CIA Examination | Total Marks |
|---|---|---|---|
| Fundamentals of Electrical Engineering 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 laboratory 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.

**Semester End Examination (SEE):** The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

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 16$^{th}$ week 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 | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | 3 | Calculations of the observations |
| PO 2 | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | 3 | Characteristic curves |
| PO 3 | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | 2 | Discussion |
| PO 4 | **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | 2 | Term observations |

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

## VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

| Program Specific Outcomes (PSOs) | | Strength | Proficiency assessed by |
|---|---|---|---|
| PSO 1 | Professional Skills: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity. | 2 | Presentation on real-world problems |
| PSO 2 | Problem-Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success. | 2 | Discussion |
| PSO 3 | Successful Career and Entrepreneurship: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies. | 1 | Presentation on real-world problems |

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

## VIII. COURSE OBJECTIVES (COs):

| The course should enable the students to: | |
|---|---|
| I | Examine the basic laws and network reduction techniques |
| II | Measure impedance of series RL, RC and RLC circuits |
| III | Prove the various theorems used to reduce the complexity of electrical network |

## IX. 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 |
|---|---|---|---|---|
| AEEB05.01 | CLO 1 | Understand the application of basic concept of electrical circuits KCL and KVL in series and parallel circuits. | PO 1,PO 2 | 2 |

| CLO Code | CLO's | At the end of the course, the student will have the ability to: | PO's Mapped | Strength of Mapping |
|---|---|---|---|---|
| AEEB05.02 | CLO 2 | Understand the basic concept of electrical circuits Ohm's law. | PO 1,PO 2 | 2 |
| AEEB05.03 | CLO 3 | Summarize the procedure of mesh analysis. | PO 1 | 3 |
| AEEB05.04 | CLO 4 | Summarize the procedure of nodal analysis. | PO 1, PO 4 | 3 |
| AEEB05.05 | CLO 5 | List out various alternating quantities such as Sinusoidal AC voltage, average and RMS values, form and peak factor, and understand concept of three phase alternating quantity. | PO 1, PO 4 | 3 |
| AEEB05.06 | CLO 6 | Interpret the alternating quantities with its instantaneous, average and root mean square values. | PO 1, PO 4 | 2 |
| AEEB05.07 | CLO 7 | Illustrate the concept of impedance, reactance, admittance, susceptance and conductance. | PO 1,PO 2 | 2 |
| AEEB05.08 | CLO 8 | Analyze the steady state behavior of R, L and C elements with sinusoidal excitation. | PO 1, PO 4 | 1 |
| AEEB05.09 | CLO 9 | Analyze the steady state behavior of series and parallel RL and RC circuits with sinusoidal excitation. | PO 1, PO 4 | 1 |
| AEEB05.10 | CLO 10 | Analyze the steady state behavior of series and parallel RLC circuits with sinusoidal excitation. | PO 1 | 3 |
| AEEB05.11 | CLO 11 | Interpret the power factor in single phase AC circuits. | PO 1 | 3 |
| AEEB05.12 | CLO 12 | Apply network reduction techniques to calculate unknown quantities associated with electrical circuits. | PO 1, PO 4 | 2 |
| AEEB05.13 | CLO 13 | Summarize the procedure of Thevinins theorem. | PO 1, PO 4 | 2 |
| AEEB05.14 | CLO 14 | Summarize the procedure of Norton's theorem. | PO 1 | 2 |

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

| Course Learning Outcomes (CLOs) | Program Outcomes (POs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CLO 1 | 2 | 2 | | | | | | | | | | | | 2 | 1 |
| CLO 2 | 2 | 2 | | | | | | | | | | | | 2 | |
| CLO 3 | 3 | | | | | | | | | | | | 1 | | |
| CLO 4 | 1 | | | 3 | | | | | | | | | | 1 | |
| CLO 5 | 1 | | | 3 | | | | | | | | | | 1 | |
| CLO 6 | 1 | | | 2 | | | | | | | | | | | |

| Course Learning Outcomes (CLOs) | Program Outcomes (POs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CLO 7 | 1 | 2 | | | | | | | | | | | | | |
| CLO 8 | 1 | | | 1 | | | | | | | | | | | |
| CLO 9 | 1 | | | 1 | | | | | | | | | | | |
| CLO 10 | 3 | | | | | | | | | | | | | 1 | |
| CLO 11 | 3 | | | | | | | | | | | | | 1 | |
| CLO 12 | 1 | | | 2 | | | | | | | | | | | |
| CLO 13 | 1 | | | 2 | | | | | | | | | | | |
| CLO 14 | 2 | | | | | | | | | | | | | | |

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## XI. ASSESSMENT METHODOLOGIES – DIRECT

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CIE Exams | PO 1, PO 2 PO 4 | SEE Exams | PO 1, PO 2 PO 4 | Assignments | - | Seminars | - |
| Laboratory Practices | PO 1, PO 2 PO 4, PSO 2 | Student Viva | PO 1 | Mini Project | - | Certification | - |

## XII. ASSESSMENT METHODOLOGIES - INDIRECT

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

## XIII. SYLLABUS

| LIST OF EXPERIMENTS | |
|---|---|
| **Week-1** | **OHM'S LAW , KIRCHOFF'S CURRENT LAW AND VOLTAGE LAW** |
| Verification of ohm's law, Kirchhoff's current and voltage laws using hardware and digital simulation. | |
| **Week-2** | **VOLT – AMPHERE METHOD** |
| Determination of unknown resistance and its temperature dependency. | |
| **Week-3** | **MESH ANALYSIS** |
| Determination of mesh currents using hardware and digital simulation. | |
| **Week-4** | **NODAL ANALYSIS** |
| Measurement of nodal voltages using hardware and digital simulation. | |

| | |
|---|---|
| **Week-5** | **SINGLE PHASE AC CIRCUITS** |
| Calculation of average value, RMS value, form factor, peak factor of sinusoidal wave. | |
| **Week-6** | **IMPEDANCE OF SERIES RL CIRCUIT** |
| Examine the impedance of series RL Circuit | |
| **Week-7** | **IMPEDANCE OF SERIES RC CIRCUIT** |
| Measure the impedance of series RC Circuit | |
| **Week-8** | **IMPEDANCE OF SERIES RLC CIRCUIT** |
| Calculate the impedance of series RLC Circuit | |
| **Week-9** | **MEASUREMENT OF POWER CONSUMED BY A FLUORESCENT LAMP** |
| To obtain power consumed and power factor of a fluorescent lamp, operated at different voltages. | |
| **Week-10** | **CHOKE COIL PARAMETERS** |
| Determination of internal resistance and inductance of choke coil. | |
| **WeeK-11** | **THEVENIN'S THEOREM** |
| Reform conversion of complex network into simple series circuit. | |
| **Week-12** | **NORTON'S THEOREM** |
| Reform conversion of complex network into simple parallel circuit. | |

## XIV. COURSE PLAN:

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

| Week No. | Topics to be covered | Course Learning Outcomes (CLOs) | Reference |
|---|---|---|---|
| 1 | Understand the application of basic concept of electrical circuits KCL and KVL in series and parallel circuits. | CLO 1 | T2:1.12 & 2.6<br>R2:1.7,1.8&1.14 |
| 2 | Understand the basic concept of electrical circuits Ohm's law. | CLO 2 | T2:1.9<br>R2:1.5 |
| 3 | Summarize the procedure of mesh analysis. | CLO 3 | T2: 7.6.3<br>R2:5.10,5.11,5.12 |
| 4 | Summarize the procedure of nodal analysis. | CLO 4 | T2: 7.7.6<br>R2:5.21,5.22,5.23 |
| 5 | List out various alternating quantities such as Sinusoidal AC voltage, average and RMS values, form and peak factor, and understand concept of three phase alternating quantity. | CLO 5 | T2: 6.9-6.10<br>R2:6.13&6.15 |
| 6 | Interpret the alternating quantities with its instantaneous, average and root mean square values. | CLO 6 | T2: 9.3.1 R2:7.8 |

| Week No. | Topics to be covered | Course Learning Outcomes (CLOs) | Reference |
|---|---|---|---|
| 7 | Illustrate the concept of impedance, reactance, admittance, susceptance and conductance. | CLO 7 | T2: 8.8 R2:7.21 |
| 8 | Analyze the steady state behavior of R, L and C elements with sinusoidal excitation. | CLO 8 | T4: 4.11 R2:8.1 |
| 9 | Analyze the steady state behavior of series and parallel RL and RC circuits with sinusoidal excitation. | CLO 9 | T4:4.19,5.2 R2:8.22.5 |
| 10 | Analyze the steady state behavior of series and parallel RLC circuits with sinusoidal excitation. | CLO 10 | T4: 4.23 R2:8.8,8.17, |
| 11 | Interpret the power factor in single phase AC circuits. | CLO 11 | T4: 4.23 R2:8.8,8.18 |
| 12 | Apply network reduction techniques to calculate unknown quantities associated with electrical circuits. | CLO 12 | T4: 6.6 R2:9.21,9.22,9.23 |
| 13 | Summarize the procedure of Thevinins theorem. | CLO 13 | T4: 6.6 R2:9.21,9.22,9.23 |
| 14 | Summarize the procedure of Norton's theorem. | CLO 14 | R2: 2.2-2.6 |

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

| S No | Description | Proposed actions | Relevance with POs | Relevance with PSOs |
|---|---|---|---|---|
| 1 | To improve standards and analyze the concepts. | Seminars | PO 1, PO 4 | PSO 1 |
| 2 | Encourage students to solve real time applications and prepare towards competitive examinations. | NPTEL | PO 2 | PSO 1 |

**Prepared by:**

Mr. A Nareshkumar, Assistant Professor

**HOD, IT**