# INSTITUTE OF AERONAUTICAL ENGINEERING

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

## AERONAUTICAL ENGINEERING

## COURSE DESCRIPTOR

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING** | | | | |
| **Course Code** | AEE018 | | | | |
| **Programme** | B. Tech | | | | |
| **Semester** | III | AE \| CE \| ME | | | |
| **Course Type** | Foundation | | | | |
| **Regulation** | IARE - R16 | | | | |
| **Course Structure** | **Theory** | | | **Practical** | |
| | **Lectures** | **Tutorials** | **Credits** | **Laboratory** | **Credits** |
| | 3 | 1 | 4 | 3 | 2 |
| **Chief Coordinator** | Mr. N Shivaprasad, Assistant Professor | | | | |
| **Course Faculty** | Mr. N Shivaprasad, Assistant Professor<br>Mr. S Srikanth, Assistant Professor<br>Mr. B Muralidhar Nayak, Assistant Professor<br>Ms. B Manogna, Assistant Professor<br>Ms. B Navothna, Assistant Professor | | | | |

## I. COURSE OVERVIEW:

Electrical and Electronics Engineering course deals with the concepts of electrical circuits, basic law's of electricity, different methods to solve the electrical networks and the instruments to measure the electrical quantities. It also focuses on the construction, operational features of energy conversion devices such as DC and AC machines, Transformers. It also emphasis on basic electronics semiconductor devices and their characteristics and operational features.

## II. COURSE PRE-REQUISITES:

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

## III. MARKS DISTRIBUTION:

| Subject | SEE Examination | CIA Examination | Total Marks |
|---|---|---|---|
| Basic Electrical and Electronics Engineering | 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:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

**Semester End Examination (SEE):** The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit carries equal weight age in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

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

| | |
|---|---|
| 50 % | To test the objectiveness of the concept. |
| 50 % | To test the analytical skill of the concept OR to test the application skill of the concept. |

**Continuous Internal Assessment (CIA):**
CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

| **Component** | **Theory** | | **Total Marks** |
|---|---|---|---|
| **Type of Assessment** | CIE Exam | Quiz / AAT | |
| **CIA Marks** | 25 | 05 | 30 |

**Continuous Internal Examination (CIE):**
Two CIE exams shall be conducted at the end of the 8$^{th}$ and 16$^{th}$ week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

**Quiz / Alternative Assessment Tool (AAT):**
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

## VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

| Program Outcomes (POs) | | Strength | Proficiency assessed by |
|---|---|---|---|
| PO1 | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | 3 | Seminar |
| PO2 | **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 | 2 | Five Minutes Video |
| PO4 | **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 | Assignment |

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

## VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

| Program Specific Outcomes (PSOs) | | Strength | Proficiency assessed by |
|---|---|---|---|
| PSO1 | **Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products | 1 | Seminar |
| PSO2 | **Professional skills:** Imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles | - | - |
| PSO3 | **Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies | - | - |
| PSO4 | **Successful career and entrepreneurship:** To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats | - | - |

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

## VIII. COURSE OBJECTIVES (COs):

| The course should enable the students to: | |
|---|---|
| I | Understand Kirchhoff laws and their application in series and parallel circuits. |
| II | Discuss principle and operation of measuring instruments. |
| III | Analyze the characteristics of alternating quantities, electrical machines. |
| IV | Illustrate the V-I characteristics of various diodes and bi-polar junction transistor. |

## 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 |
|---|---|---|---|---|
| AEE018.01 | CLO 1 | Analyze the circuits using Kirchhoff's current and Kirchhoff's voltage law. | PO1 | 3 |
| AEE018.02 | CLO 2 | Use star delta transformation for simplifying complex circuits. | PO1 | 3 |

| CLO Code | CLO's | At the end of the course, the student will have the ability to: | PO's Mapped | Strength of Mapping |
|---|---|---|---|---|
| AEE018.03 | CLO 3 | Generalize operation and principle of measuring instruments. | PO2 | 3 |
| AEE018.04 | CLO 4 | Demonstrate the working principle of DC motor, DC generator and transformer. | PO2 | 3 |
| AEE018.05 | CLO 5 | Describe the construction of machines and transformer. | PO2 | 2 |
| AEE018.06 | CLO 6 | Classify the types of DC machines. | PO2 | 2 |
| AEE018.07 | CLO 7 | Derive the EMF equation of DC generator, transformer and Torque equation of DC motor. | PO2 | 2 |
| AEE018.08 | CLO 8 | Discuss the principle of operation of induction motor. | PO2 | 2 |
| AEE018.09 | CLO 9 | Explain the construction and characteristics of alternator. | PO4 | 2 |
| AEE018.10 | CLO 10 | Explain the construction and characteristics of 3-phase induction motor. | PO2 | 1 |
| AEE018.11 | CLO 11 | Compare the operation of half wave, full wave and bridge rectifiers. | PO4 | 2 |
| AEE018.12 | CLO 12 | Differentiate the operation of Diodes and transistors. | PO2 | 2 |
| AEE018.13 | CLO 13 | Apply the concept of diodes in converting AC to DC rectification process. | PO1 | 2 |
| AEE018.14 | CLO 14 | Distinguish the different configurations of transistor. | PO4 | 2 |
| AEE018.15 | CLO 15 | Examine the voltage, current and frequency of electric network using CRO. | PO1 | 3 |
| AEE018.16 | CLO 16 | Apply the knowledge of electromagnetic laws and basic concepts of electronics. | PO2 | 3 |
| AEE018.17 | CLO 17 | Process the knowledge and skills for employability and to succeed national and international level competitive examinations. | PO2 | 3 |

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

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

| CLOs | Program Outcomes (POs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO 1 | 3 | 3 | | | | | | | | | | | | | | |
| CLO 2 | | | | | | | | | | | | | | | | |
| CLO 3 | | 3 | | | | | | | | | | | 1 | | | |
| CLO 4 | | 3 | | | | | | | | | | | 1 | | | |
| CLO 5 | | 2 | | | | | | | | | | | 1 | | | |
| CLO 6 | | 2 | | | | | | | | | | | 1 | | | |
| CLO 7 | | 2 | | | | | | | | | | | 1 | | | |
| CLO 8 | | 2 | | | | | | | | | | | 1 | | | |

| CLOs | Program Outcomes (POs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO 9 | | | | 2 | | | | | | | | | | | | |
| CLO 10 | | 1 | | | | | | | | | | | 1 | | | |
| CLO 11 | | | | 2 | | | | | | | | | 1 | | | |
| CLO 12 | | 2 | | | | | | | | | | | 1 | | | |
| CLO 13 | 2 | | | | | | | | | | | | | | | |
| CLO 14 | | | | 2 | | | | | | | | | | | | |
| CLO 15 | 3 | | | | | | | | | | | | | | | |
| CLO 16 | | 3 | | | | | | | | | | | | | | |
| CLO 17 | | 3 | | | | | | | | | | | | | | |

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

## XI. ASSESSMENT METHODOLOGIES – DIRECT

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CIE Exams | PO1,PO2, PO4 | SEE Exams | PO1,PO2 PO4 | Assignments | PO4 | Seminars | PO1 |
| Laboratory Practices | PO1 | Student Viva | - | Mini Project | - | Certification | - |
| Term Paper | - | | | | | | |

## XII. ASSESSMENT METHODOLOGIES - INDIRECT

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

## XIII. SYLLABUS

| | | |
|---|---|---|
| **UNIT -I** | **ELECTRICCIRCUITS,ELECTROMAGNETISM AND INSTRUMENTS** | **Classes: 10** |
| **Electrical Circuits:** Basic definitions, types of elements, Ohm's Law, resistive networks, inductive networks, capacitive networks, Kirchhoff's Laws, series, parallel circuits and star delta transformations, simple problems, Faradays law of electromagnetic induction; Instruments: Basic principles of indicating instruments, permanent magnet moving coil and moving iron instruments. | | |
| **UNIT -II** | **DC MACHINES** | **Classes: 10** |
| **DC Machines:** Principle of operation of DC generator, EMF equation, principle of operation of DC motors, torque equation, types of DC machines, applications, three point starter. | | |
| **UNIT -III** | **ALTERNATING QUANTITIES AND AC MACHINES** | **Classes: 08** |
| **Alternating Quantities:** Sinusoidal AC voltage, average and RMS values, form and peak factor, concept of three phase alternating quantity; Transformer: Principle of operation, EMF equation, losses, | | |

| | | |
|---|---|---|
| efficiency and regulation.<br>**Three Phase Induction Motor:** Principle of operation, slip, slip torque characteristics, efficiency, applications; Alternator: Principle of operation, EMF Equation, efficiency, regulation by synchronous impedance method. | | |
| **UNIT-IV** | **SEMICONDUCTOR DIODE AND APPLICATIONS** | **Classes: 09** |
| **Semiconductor Diode:** P-N Junction diode, symbol, V-I characteristics, half wave rectifier, full wave rectifier, bridge rectifier and filters, diode as a switch, Zener diode as a voltage regulator. | | |
| **UNIT-V** | **BIPOLAR JUNCTION TRANSISTOR AND APPLICATIONS** | **Classes: 08** |
| **Bipolar junction:** DC characteristics, CE, CB, CC configurations, biasing, load line, transistor as an amplifier. | | |
| **Text Books:** | | |
| 1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6th Edition, 2004.<br>2. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.<br>3. Willianm Hayt, Jack E Kemmerly S M Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7th Edition, 2010.<br>4. J P J Millman, C C Halkias, Satyabrata Jit, "Millman"s Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 1998.<br>5. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI / PHI, 9th Edition, 2006.<br>6. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI / PHI, 9th Edition, 2006. | | |
| **Reference Books:** | | |
| 1. David A Bell, "Electric Circuits", Oxford University Press, 9th Edition, 2016.<br>2. U A Bakshi,Atul P Godse "Basic Electrical and Electronics Engineering", Technical Publications, 9th Edition, 2016.<br>3. A Bruce Carlson, "Circuits", Cengage Learning, 1st Edition, 2008.<br>4. M Arshad, "Network Analysis and Circuits", Infinity Science Press, 9th Edition, 2016. | | |

## XIV.COURSE PLAN:

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

| Lecture No | Topics to be covered | Course Learning Outcomes (CLOs) | Reference |
|---|---|---|---|
| 1 | Discuss the basic definitions of voltage, current, power and energy | CLO 1 | T2: 1.2-1.8<br>R2:1.1 |
| 2 | Understand the concept of Ohm's Law | CLO 1 | T2: 1.9<br>R2:1.5 |
| 3 | Discuss different elements in power systems and sources | CLO 1 | T2:1.10<br>R2:1.2&1.4 |
| 4-5 | Describe voltage-current relationship of resistive networks, inductive networks, capacitive networks | CLO 1 | T2: 2.3-2.5<br>R2:1.6 |
| 6 | Explain Kirchhoff's laws for electrical networks | CLO 1 | T2: 1.12<br>R2:1.14 |
| 7-8 | Understand series, parallel circuits | CLO 1 | T2: 2.6<br>R2:1.7&1.8 |
| 9 | Derive the formula for Star delta and delta star transformations techniques. | CLO 2 | T2: 2.7<br>R2:1.12 |
| 10 | Analyze networks using reduction techniques. | CLO 2 | T2: 2.6<br>R2:1.7&1.8 |
| 11 | Understand the concept of faradays laws | CLO 3 | T2: 1.11<br>R2:6.2 |

| Lecture No | Topics to be covered | Course Learning Outcomes (CLOs) | Reference |
|---|---|---|---|
| 12 | Understand working of different measuring instruments | CLO 3 | T2: 10.4<br>R2:4.0 |
| 13-14 | Understand working of different measuring instruments | CLO 3 | T2: 10.5.1.1<br>R2:4.0 |
| 15-16 | Understand working of different measuring instruments | CLO 3 | T2: 10.5.1.3<br>R2:4.0 |
| 17 | Discuss what is a DC machine | CLO 4 | T2: 7.1<br>R2:5.2 |
| 18 | Understand the working principle of DC machine | CLO 4 | T2: 7.6<br>R2:5.3 |
| 19-20 | Demonstrate the cross section view of a DC machine | CLO 5 | T2: 7.2<br>R2:5.4 |
| 21-22 | Derive the mathematical equation of EMF induced in a DC generator | CLO 7 | T2: 7.6.1<br>R2:5.7 |
| 23 | Classify the types of DC generator | CLO 6 | T2: 7.6.3<br>R2:5.10,5.11,5.12 ,5.13,5.14 |
| 24 | Understand the working principle of DC motor | CLO 4 | T2: 7.7<br>R2:5.16 |
| 25 | Classify the types of DC motor | CLO 6 | T2: 7.7.6<br>R2:5.21,5.22,5.23 ,5.24 |
| 26 | Derive mathematical equation of torque generated in a DC motor | CLO 7 | T2:7.7.5<br>R2:5.20 |
| 27 | Understand the applications of DC motor | CLO 4 | T2: 7.7.6.1-7.7.6.3<br>R2:5.31 |
| 28 | Understand the three point starter | CLO 4 | T2: 7.7.7<br>R2:5.25 |
| 29 | Understand the concepts of alternating quantities | CLO 4 | T2: 4.1<br>R2:2.1 |
| 30 | Understand the representation of sinusoidal quantity and analyzing | CLO 4 | T2: 4.5-4.6<br>R2:2.2 |
| 31 | Understand three phase systems | CLO 4 | T2: 5.2.4.1-5.2.4.2<br>R2:3.2 |
| 32 | Understand the working principle of Transformer | CLO 4 | T2: 6.5<br>R2:602 |
| 33 | Derive mathematical equation of EMF induced in a single phase transformer | CLO 7 | T2: 6.6.1<br>R2:6.6 |
| 34-35 | Understand the percentage efficiency and voltage regulation | CLO 7 | T2: 6.9-6.10<br>R2:6.13&6.15 |
| 36 | Understand the working principle of induction motor | CLO 8 | T2: 9.3<br>R2:7.2 |
| 37 | Analyze the speed torque characteristics | CLO 9 | T2: 9.3.1<br>R2:7.8 |
| 38 | Understand the working principle of Alternator | CLO 9 | T2: 8.4<br>R2:7.11 |
| 39-40 | Derive the mathematical equation of EMF induced in a Alternator | CLO 9 | T2: 8.4<br>R2:7.13 |
| 41-42 | Analyze the percentage efficiency of an alternator. | CLO 9 | T2: 8.8<br>R2:7.16 |
| 42-43 | Analyze the percentage voltage regulation of alternator. | CLO 9 | T2: 8.8<br>R2:7.21 |

| Lecture No | Topics to be covered | Course Learning Outcomes (CLOs) | Reference |
|---|---|---|---|
| 44-47 | Understand the functioning of P-N Junction diode | CLO 12 | T4: 4.11<br>R2:8.1 |
| 48–50 | Understand and analyze P -N diode<br>as half wave rectifier, full wave rectifier, bridge rectifier and filters | CLO 11 | T4: 4.23<br>R2:8.8,8.17,8.18, 8.19 |
| 51-53 | Understand the functioning of Zener diode as a voltage regulator. | CLO 12 | T4: 4.19,5.2<br>R2:8.22.5 |
| 54 | Analyze simple problems on diodes. | CLO 12 | T4: 4.23<br>R2:8.23 |
| 55-56 | Understand the concept of bipolar junction: DC characteristics, | CLO 14 | T4: 6.4-6.5<br>R2:9.1 |
| 57-59 | Examine CE, CB, CC configurations. | CLO 14 | T4: 6.6<br>R2:9.21,9.22,9.23 |
| 60 | Analyze biasing and load line, | CLO 14 | T4: 6.3<br>R2:9.3 |
| 61-63 | Model Transistor as an amplifier | CLO 14 | T4: 6.7<br>R2:9.5 |
| 64-65 | Analyze simple problems on transistors. | CLO 14 | T4: 6.6<br>R2:9.7 |

## 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. | Guest lectures | PO2 | PSO1 |
| 2 | Voltage - Current relationship for passive elements for different input signals - ramp, saw tooth and triangular. | Seminars / NPTEL | PO1 | PSO1 |
| 3 | Resistance color coding | NPTEL | PO1 | PSO1 |

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