INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**				
Course Code	AEE018				
Programme	B. Tech				
Semester	III	ME | CE | AE			
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 Mr. S Srikanth, Assistant Professor Mr. B Muralidhar Nayak, Assistant Professor Ms. B Manogna, Assistant Professor 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 8th and 16th 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
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Seminar
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	2	Five Minutes Video
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	Assignment

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:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	1	Seminar
PSO 2	**Problem-Solving Skills:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability	-	-
PSO 3	**Successful Career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to 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
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

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
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
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		
CLO 9				2											
CLO 10		1											1		
CLO 11				2									1		
CLO 12		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
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. **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.
2. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.
3. Willianm Hayt, Jack E Kemmerly S M Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7th Edition, 2010.
4. J P J Millman, C C Halkias, Satyabrata Jit, "Millman"s Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 1998.
5. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI / PHI, 9th Edition, 2006.
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.
2. U A Bakshi,Atul P Godse "Basic Electrical and Electronics Engineering", Technical Publications, 9th Edition, 2016.
3. A Bruce Carlson, "Circuits", Cengage Learning, 1st Edition, 2008.
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 R2:1.1
2	Understand the concept of Ohm's Law	CLO 1	T2: 1.9 R2:1.5
3	Discuss different elements in power systems and sources	CLO 1	T2:1.10 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 R2:1.6
6	Explain Kirchhoff's laws for electrical networks	CLO 1	T2: 1.12 R2:1.14
7-8	Understand series, parallel circuits	CLO 1	T2: 2.6 R2:1.7&1.8
9	Derive the formula for Star delta and delta star transformations techniques.	CLO 2	T2: 2.7 R2:1.12
10	Analyze networks using reduction techniques.	CLO 2	T2: 2.6 R2:1.7&1.8
11	Understand the concept of faradays laws	CLO 3	T2: 1.11 R2:6.2
12	Understand working of different measuring instruments	CLO 3	T2: 10.4 R2:4.0
13-14	Understand working of different measuring instruments	CLO 3	T2: 10.5.1.1 R2:4.0

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
15-16	Understand working of different measuring instruments	CLO 3	T2: 10.5.1.3 R2:4.0
17	Discuss what is a DC machine	CLO 4	T2: 7.1 R2:5.2
18	Understand the working principle of DC machine	CLO 4	T2: 7.6 R2:5.3
19-20	Demonstrate the cross section view of a DC machine	CLO 5	T2: 7.2 R2:5.4
21-22	Derive the mathematical equation of EMF induced in a DC generator	CLO 7	T2: 7.6.1 R2:5.7
23	Classify the types of DC generator	CLO 6	T2: 7.6.3 R2:5.10,5.11,5.12 ,5.13,5.14
24	Understand the working principle of DC motor	CLO 4	T2: 7.7 R2:5.16
25	Classify the types of DC motor	CLO 6	T2: 7.7.6 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 R2:5.20
27	Understand the applications of DC motor	CLO 4	T2: 7.7.6.1-7.7.6.3 R2:5.31
28	Understand the three point starter	CLO 4	T2: 7.7.7 R2:5.25
29	Understand the concepts of alternating quantities	CLO 4	T2: 4.1 R2:2.1
30	Understand the representation of sinusoidal quantity and analyzing	CLO 4	T2: 4.5-4.6 R2:2.2
31	Understand three phase systems	CLO 4	T2: 5.2.4.1-5.2.4.2 R2:3.2
32	Understand the working principle of Transformer	CLO 4	T2: 6.5 R2:602
33	Derive mathematical equation of EMF induced in a single phase transformer	CLO 7	T2: 6.6.1 R2:6.6
34-35	Understand the percentage efficiency and voltage regulation	CLO 7	T2: 6.9-6.10 R2:6.13&6.15
36	Understand the working principle of induction motor	CLO 8	T2: 9.3 R2:7.2
37	Analyze the speed torque characteristics	CLO 9	T2: 9.3.1 R2:7.8
38	Understand the working principle of Alternator	CLO 9	T2: 8.4 R2:7.11
39-40	Derive the mathematical equation of EMF induced in a Alternator	CLO 9	T2: 8.4 R2:7.13
41-42	Analyze the percentage efficiency of an alternator.	CLO 9	T2: 8.8 R2:7.16
42-43	Analyze the percentage voltage regulation of alternator.	CLO 9	T2: 8.8 R2:7.21
44-47	Understand the functioning of P-N Junction diode	CLO 12	T4: 4.11 R2:8.1
48–50	Understand and analyze P -N diode as half wave rectifier, full wave rectifier, bridge rectifier and filters	CLO 11	T4: 4.23 R2:8.8,8.17,8.18, 8.19

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
51-53	Understand the functioning of Zener diode as a voltage regulator.	CLO 12	T4: 4.19,5.2 R2:8.22.5
54	Analyze simple problems on diodes.	CLO 12	T4: 4.23 R2:8.23
55-56	Understand the concept of bipolar junction: DC characteristics,	CLO 14	T4: 6.4-6.5 R2:9.1
57-59	Examine CE, CB, CC configurations.	CLO 14	T4: 6.6 R2:9.21,9.22,9.23
60	Analyze biasing and load line,	CLO 14	T4: 6.3 R2:9.3
61-63	Model Transistor as an amplifier	CLO 14	T4: 6.7 R2:9.5
64-65	Analyze simple problems on transistors.	CLO 14	T4: 6.6 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

Prepared by:
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