INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTOR

Course Title	**FUNDAMENTALS OF ELECTRICAL ENGINEERING**				
Course Code	**AEEB01**				
Programme	**B.Tech**				
	I	**IT**			
Course Type	**Foundation**				
Regulation	**IARE - R18**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	**1**	**4**	**-**	**-**
Chief Coordinator	**Mr. A Nareshkumar, Assistant Professor**				
Course Faculty	**Mr. A Nareshkumar, Assistant Professor** **Mr. K Lingaswamy, Assistant Professor** **Dr. M Laxmidevi Ramanaiah, Associate Professor** **Mr. A Srikanth, Assistant Professor** **Mr. T Mahesh, Assistant Professor** **Mr. N Shivaprasad, Assistant Professor**				

I. COURSE OVERVIEW:

This course introduces the concepts of basic electrical engineering parameters, quantities, analysis of DC circuits. The course teaches different fundamental laws Ohms laws, Kirchhoff laws and different electrical concepts. The students will be able to analyze networks using graph theory and circuit theorems like Thevenin's and Norton's theorems. It also describes the concept of AC circuits and their applications.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
-	-	-	-

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Fundamentals of Electrical 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 modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. 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 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	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 20 marks of 2 hours duration consisting of five descriptive type questions out of which four 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 - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

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	Term Paper

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.	1	Seminar

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 2	Software Engineering Practices: The ability to apply standard practices and strategies in software service management using open-ended programming environments with agility to deliver a quality service for business success.	-	-
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.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Understand the basic electrical circuits and circuit laws to study behavior of electrical networks.
II	Use different network reduction techniques to study characteristics of electrical networks.
III	Analyze series and parallel AC circuits using complex notation.
IV	State and use DC circuit theorems to determine unknown currents and voltages.

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the basic concepts of electricity, electrical circuits elements, application's of Kirchhoff laws to complex circuits.	CLO 1	Define the various nomenclature used to study the DC electrical circuits.
		CLO 2	Understand the concept of electrical circuit and classify electrical circuits elements.
		CLO 3	Analyze the circuits using Kirchhoff's current and Kirchhoff's voltage law.
		CLO 4	Use of series-parallel concepts for simplifying circuits.
CO 2	Explore to the working of mesh analysis and nodal analysis, inspection method, super mesh, super node analysis.	CLO 5	Describe source transformation technique to determine equivalent resistance and source current.
		CLO 6	Apply network reduction techniques to calculate unknown quantities associated with electrical circuits.
		CLO 7	Summarize the procedure of mesh analysis and nodal analysis, inspection method, super mesh, super node analysis.
		CLO 8	Apply the concept of network theorems.
		CLO 9	Summarize the procedure of thevenin's and norton's theorems to reduce complex network into simple equivalent network.
CO 3	Summarize various alternating quantities such as instantaneous, peak, RMS, average, form factor and peak factor for different periodic wave forms.	CLO 10	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 11	Interpret the alternating quantities with its instantaneous, average and root mean square values.
		CLO 12	Illustrate the concept of impedance, reactance, admittance, susceptance and conductance.

COs	Course Outcome	CLOs	Course Learning Outcome
		CLO 13	Understand the phase and phase difference and j notation.
		CLO 14	Discuss representation of rectangular and polar forms.
CO 4	Discuss the basic theory of real, reactive, apparent power and complex power, power factor.	CLO 15	Analyze the steady state behavior of R, L and C elements with sinusoidal excitation.
		CLO 16	Analyze the steady state behavior of series and parallel RL and RC circuits with sinusoidal excitation.
		CLO 17	Analyze the steady state behavior of series and parallel RLC circuits with sinusoidal excitation.
		CLO 18	Illustrate the concept of real, reactive, apparent power and complex power.
		CLO 19	Interpret the power factor in single phase AC circuits.
CO 5	Explain the concepts of graph, tree, incidence matrix, basic cut set and basic tie set matrices for planar networks, duality and dual networks.	CLO 20	Discuss the various nomenclatures related with network topology.
		CLO 21	Formulate incidence, tie-set and cut-set matrix which are used to solve the behavior of complex electrical circuits.
		CLO 22	Understand the concepts of duality and importance of dual networks.

X. 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
AEEB01.01	CLO 1	Define the various nomenclature used to study the DC electrical circuits.	PO1	3
AEEB01.02	CLO 2	Understand the concept of electrical circuit and classify electrical circuits elements.	PO1	3
AEEB01.03	CLO 3	Analyze the circuits using Kirchhoff's current and Kirchhoff's voltage law.	PO1	3
AEEB01.04	CLO 4	Use of series-parallel concepts for simplifying circuits.	PO2	3
AEEB01.05	CLO 5	Describe source transformation technique to determine equivalent resistance and source current.	PO2	3
AEEB01.06	CLO 6	Apply network reduction techniques to calculate unknown quantities associated with electrical circuits.	PO2	2
AEEB01.07	CLO 7	Summarize the procedure of mesh analysis and nodal analysis, inspection method, super mesh, super node analysis.	PO2	2
AEEB01.08	CLO 8	Apply the concept of network theorems.	PO2	2
AEEB01.09	CLO 9	Summarize the procedure of thevenin's and norton's theorems to reduce complex network into simple equivalent network.	PO2	2
AEEB01.10	CLO 10	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.	PO1	2
AEEB01.11	CLO 11	Interpret the alternating quantities with its instantaneous, average and root mean square values.	PO2	1
AEEB01.12	CLO 12	Illustrate the concept of impedance, reactance, admittance, susceptance and conductance.	PO4	2

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEEB01.13	CLO 13	Understand the phase and phase difference and j notation.	PO2	2
AEEB01.14	CLO 14	Discuss representation of rectangular and polar forms.	PO2	2
AEEB01.15	CLO 15	Analyze the steady state behavior of R, L and C elements with sinusoidal excitation.	PO1	2
AEEB01.16	CLO 16	Analyze the steady state behavior of series and parallel RL and RC circuits with sinusoidal excitation.	PO4	3
AEEB01.17	CLO 17	Analyze the steady state behavior of series and parallel RLC circuits with sinusoidal excitation.	PO4	3
AEEB01.18	CLO 18	Illustrate the concept of real, reactive, apparent power and complex power.	PO1	2
AEEB01.19	CLO 19	Interpret the power factor in single phase AC circuits.	PO4	3
AEEB01.20	CLO 20	Discuss the various nomenclatures related with network topology.	PO4	3
AEEB01.21	CLO 21	Formulate incidence, tie-set and cut-set matrix which are used to solve the behavior of complex electrical circuits.	PO4	3
AEEB01.22	CLO 22	Understand the concepts of duality and importance of dual networks.	PO4	3

3= High; 2 = Medium; 1 = Low

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)			Program Specific Outcomes (PSOs)
	PO 1	PO 2	PO 4	PSO1
CO 1	3	3		1
CO 2	3	2		
CO 3	3	1	2	1
CO 4	2	3		1
CO 5			3	

3= High; 2 = Medium; 1 = Low

XII. 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	3												1		

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 2	3														
CLO 3	3												1		
CLO 4		3													
CLO 5		3													
CLO 6		2													
CLO 7		2													
CLO 8		2													
CLO 9		2											1		
CLO 10	2												1		
CLO 11		1													
CLO 12				2											
CLO 13		2													
CLO 14		2													
CLO 15	2														
CLO 16				3									1		
CLO 17				3									1		
CLO 18	2														
CLO 19				3											
CLO 20				3									1		
CLO 21				3									1		
CLO 22				3											

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO4,PSO1	SEE Exams	PO1, PO2, PO4,PSO1	Assignments	PO4	Seminars	PO1,PSO1
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO1, PO2, PO4,PSO1						

XIV. ASSESSMENT METHODOLOGIES – INDIRECT

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

XV. SYLLABUS

MODULE-I	**INTRODUCTION TO ELECTRICAL CIRCUITS**
Circuit concept: Basic definitions, Ohm's law at constant temperature, classification of elements, R, L, C parameters, independent and dependent sources, Kirchhoff's laws, equivalent resistance of series, parallel and series parallel networks.	
MODULE -II	**ANALYSIS OF ELECTRICAL CIRCUITS**
Circuit analysis: Source transformation, Star to delta and delta to star transformation, mesh analysis and nodal analysis, inspection method, super mesh, super node analysis; DC Theorems: Thevenin's and Norton's.	
MODULE -III	**INTRODUCTION TO AC CIRCUITS**
Single phase AC circuits: Representation of alternating quantities, instantaneous, peak, RMS, average, form factor and peak factor for different periodic wave forms. **Phase and phase difference:** J notation, representation of rectangular and polar forms. Concept of reactance, impedance, susceptance and admittance.	
MODULE -IV	**COMPLEX POWER ANALYSIS**
Complex power analysis: Concept of real, reactive, apparent power and complex power, power factor in single phase AC circuits consisting of R, L, C, RL, RC and RLC combinations.	
MODULE -V	**NETWORK TOPOLOGY**
Network Topology: Definitions, Graph, Tree, Incidence matrix, Basic cut set and Basic Tie set Matrices for Planar Networks, Duality and Dual Networks.	
Text Books:	
1. A Chakrabarthy, "Electric Circuits", DhanipatRai& Sons, 6th Edition, 2010. 2. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition, 2010. 3. M E Van Valkenberg, "Network Analysis", PHI, 3rd Edition, 2014.	
Reference Books:	
1. John Bird, "Electrical Circuit Theory and Technology", Newnes, 2nd Edition, 2003. 2. C L Wadhwa, "Electrical Circuit Analysis including Passive Network Synthesis", New Age International, 2nd Edition, 2009. 3. David A Bell, "Electric circuits", Oxford University Press, 7th Edition, 2009.	

XVI. 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

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
2	Understand the concept of Ohm's Law.	CLO 3	T2: 1.9 R2:1.5
3	Discuss different elements in power systems and sources.	CLO 3	T2:1.10 R2:1.2&1.4
4-5	Describe voltage-current relationship of resistive networks, inductive networks, capacitive networks.	CLO 3	T2: 2.3-2.5 R2:1.6
6	Explain Kirchhoff's laws for electrical networks.	CLO 4	T2: 1.12 R2:1.14
7-8	Understand series, parallel circuits.	CLO 4	T2: 2.6 R2:1.7&1.8
9	Derive the formula for star delta and delta star Transformations techniques.	CLO 6	T2: 2.7 R2:1.12
10	Analyze networks using reduction techniques.	CLO 6	T2: 2.6 R2:1.7&1.8
11	Discuss the mesh analysis and nodal analysis.	CLO 7	T2: 1.11 R2:6.2
12	Analyze simple problems on mesh analysis and nodal analysis.	CLO 7	T2: 10.4 R2:4.0
13-14	Discuss the inspection method.	CLO 7	T2: 10.5.1.1 R2:4.0
15-16	Analyze simple problems on inspection method.	CLO 7	T2: 10.5.1.3 R2:4.0
17	Discuss the inspection method, super mesh, super node analysis.	CLO 7	T2: 7.1 R2:5.2
18	Discuss the DC Thevenin's and Norton's Theorems.	CLO 7	T2: 7.6 R2:5.3
19-20	Analyze simple problems on Thevenin's Theorem.	CLO 7	T2: 7.2 R2:5.4
21-22	Analyze simple problems on Norton's Theorem.	CLO 7	T2: 7.6.1 R2:5.7
23	Analyze simple problems on super mesh, super node analysis.	CLO 7	T2: 7.6.3 R2:5.10,5.11
24	Understand the Representation of alternating quantities.	CLO 7	T2: 7.7 R2:5.16
25	Understand the instantaneous, peak, RMS, average, form factor and peak factor for different periodic wave forms.	CLO 7	T2: 7.7.6 R2:5.21,5.22
26	Demonstrate the phase and phase difference.	CLO 7	T2:7.7.5 R2:5.20
27	Discuss the representation of sinusoidal quantity and analyzing.	CLO 10	T2: 4.1 R2:2.1
28	Understand the concept of reactance.	CLO 10	T:4.5-4.6 R2:2.2
29	Understand the concept of impedance.	CLO 10	T2: 5.2.4.1 R2:3.2
30	Understand the concept of susceptance and admittance.	CLO 14	T2: 6.5 R2:602
31	Understand the representation of rectangular and polar forms.	CLO 13	T2: 6.6.1 R2:6.6
32	Understand the concepts of alternating quantities.	CLO 15	T2: 6.9-6.10 R2:6.13&6.15
33	Analyze the real, reactive, apparent power and complex power.	CLO 17	T2: 9.3 R2:7.2
34-35	Explain the concept of power factor in single phase AC circuits.	CLO 16	T2: 9.3.1 R2:7.8

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
36	Understand the consisting of single phase AC circuit consisting of R.	CLO 16	T2: 8.4 R2:7.11
37	Understand the consisting of single phase AC circuit consisting of L.	CLO 18	T2: 8.4 R2:7.13
38	Understand the consisting of single phase AC circuit consisting of C.	CLO 16	T2: 8.8 R2:7.16
39-40	Understand the consisting of single phase AC circuit consisting of RL combination.	CLO 7	T2: 8.8 R2:7.21
44-47	Understand the consisting of single phase AC circuit consisting of RC combination.	CLO 18	T4: 4.11 R2:8.1
48–50	Understand the consisting of single phase AC circuit consisting of RLC combination.	CLO 18	T4: 4.23 R2:8.8,8.17
51-53	Understand the concept of graph and tree.	CLO 20	T4: 4.19,5.2 R2:8.22.5
54	Analyze simple problems on graph and tree.	CLO 20	T4: 4.23 R2:8.23
55-56	Examine incidence matrix for planar networks, duality and dual networks.	CLO 20	T4: 6.4-6.5 R2:9.1
57-59	Examine basic cut set matrices for planar networks, duality and dual networks.	CLO 20	T4: 6.6 R2:9.21,9.22
60	Examine basic tie set matrices for planar networks.	CLO 20	T4: 6.3 R2:9.3
61-63	Understand the concept of duality and dual networks.	CLO 21	T4: 6.7 R2:9.5
64-65	Analyze simple problems on duality and dual networks.	CLO 22	T4: 6.6 R2:9.7

XVII. 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 of passive elements for different input signals - ramp, saw tooth and triangular.	Seminar/ NPTEL	PO1	PSO1
3	Resistance colour coding.	NPTEL	PO1	PSO1

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