INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTOR

Course Title	**ELECTRICAL TECHNOLOGY**				
Course Code	AEE017				
Programme	B.Tech				
Semester	III	ECE			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	2
Chief Coordinator	Mr. K Devender Reddy, Assistant Professor				
Course Faculty	Dr. V.C.Jagan Mohan, Assistant Professor, EEE Mr. A Sathish Kumar, Assistant Professor, EEE Mr. Muralidhar Nayak, Assistant Professor, EEE				

I. COURSE OVERVIEW:

This course deals with the network analysis, first order, second order series RL, RC, RLC series circuits in differential equations and laplace transformation approach, two port networks, design of filters like constant K filters, T filters, Pi filters and symmetrical attenuators like T attenuator, lattice attenuator, this course also enlightens the students with the construction, principle, classification, regulation, losses, efficiency, parallel operation and different testing methods of DC machines and single phase transformers.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AEE002	II	Electrical Circuits	4
UG	AHS006	II	Engineering Physics	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Electrical Technology	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 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 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
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Seminars
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	Term paper
PO3	**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	Seminars
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:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.	-	-
PSO 2	**Problem-Solving Skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions..	2	Seminars
PSO 3	**Successful Career and Entrepreneurship:** An understanding of social-awareness & environmental wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real world applications using optimal resources as an Entrepreneur	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Analyze the transient response of RL, RC and RLC circuits for DC excitation.
II	Discuss the configurations of two port networks and evaluate two port network parameters.
III	Understand the classification and design principles of filters and symmetrical attenuators.
IV	Describe the principle of operation and testing methods of DC machines and single phase Transformers.

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
CAEE007.01	CLO 1	Understand the transient response of series RL and RC circuits by differential and Laplace transform approach.	PO1	3
CAEE007.02	CLO 2	Understand the transient response of series RLC circuit by differential and Laplace transform approach.	PO2	2
CAEE007.03	CLO 3	Explain impedance parameters in two port networks and conversion of impedance parameters into all other parameters.	PO2	2
CAEE007.04	CLO 4	Explain admittance parameters in two port networks and conversion of admittance parameters into all other parameters.	PO1, PO2	3
CAEE007.05	CLO 5	Explain ABCD parameters in two port networks and conversion of ABCD parameters into all other parameters.	PO1, PO2	3
CAEE007.06	CLO 6	Explain H-parameters in two port networks and conversion of Hybrid parameters into all other parameters.	PO1, PO2	3
CAEE007.07	CLO 7	Describe the classification of different types of filters and advantages	PO1, PO3	3
CAEE007.08	CLO 8	Describe the classification of pass band and stop band filters and their characteristic impedance.	PO1, PO3	3
CAEE007.09	CLO 9	Understand the design of constant 'k' low pass filter and high pass filter and applications	PO1, PO3	3
CAEE007.10	CLO 10	Understand the m-derived t-section, band pass filter and band elimination filter and applications.	PO1, PO3	3
CAEE007.11	CLO 11	Understand the T-type attenuator, pi- type attenuator, bridged 'T' type attenuator, lattice attenuator.	PO1, PO3	3
CAEE007.12	CLO 12	Understand the working principle of DC generator, types of generators and their characteristics.	PO1, PO2, PO4	2
CAEE007.13	CLO 13	Understand the working principle of DC motor, development of torque and their characteristics to find losses and efficiency.	PO1, PO2, PO4	2
CAEE007.14	CLO 14	Understand the principle of operation of single phase transformer types and their construction.	PO1, PO2	2
CAEE007.15	CLO 15	Determine the losses and efficiency of transformer using open circuit and short circuit test data.	PO1, PO2, PO4	2
CAEE007.16	CLO 16	Apply the concept of network theorems, DC machines and AC machines to solve real time applications.	PO1, PO3	2
CAEE007.17	CLO 17	Process the knowledge and skills for employability and to succeed national and international level competitive examinations.	PO1	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														
CLO 2		2													
CLO 3		2													
CLO 4	3	2													
CLO 5	3	2													
CLO 6	3	2													
CLO 7	2		3												
CLO 8	2		3												
CLO 9	2		3												
CLO 10	2		3												
CLO 11	2		3												
CLO 12	3	2		3										2	
CLO 13	3	2		3										2	
CLO 14	3	2		3										2	
CLO 15	3	2		3										2	
CLO 16	2		2												
CLO 17	3														

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO3, PO4	SEE Exams	PO1, PO2, PO3, PO4	Assignments	PO1, PO2, PO3, PO4	Seminars	PO3
Laboratory Practices	PO4	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO2						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

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

XIII. SYLLABUS

UNIT - I	TRANSIENT ANALYSIS (FIRST AND SECOND ORDER CIRCUITS)	Classes: 09
Transient response of RL, RC, and RLC Series circuits DC excitations, initial conditions, solution using differential equations approach and Laplace transform method.		

UNIT - II	TWO PORT NETWORKS	
Equivalent circuit model: No load test and blocked rotor test, circuit model, starting methods, speed control of induction motors, induction generator, principle of operation, isolated induction generator, circle diagram, determination of induction motor parameters from circle diagram, problems.		
UNIT - III	**FILTERS AND SYMMETRICAL ATTENUATORS**	**Classes: 09**
Filters: Classification of Filters, Filter Networks, Classification of Pass Band and Stop Band, Characteristics Impedance in the Pass and Stop Bands, Constant-k Low Pass Filter, High Pass Filter, m- derived T-Section, Band Pass filter and Band Elimination filter. Symmetrical Attenuators: T-Type Attenuator, pi- Type Attenuator, Bridged T type Attenuator, Lattice Attenuator.		
UNIT - IV	**D.C. MACHINES**	**Classes: 09**
D.C Generators: Principle of operation of DC Machines, EMF equation, types of generators, voltage build up, critical resistance, magnetization and load characteristics of DC generators. D.C. Motors: Types of DC motors, back EMF, torque equation, characteristics, losses and efficiency, Swinburne's test, brake test on DC shunt motor, Speed control of DC shunt motor, three point starter, applications, numerical problems.		
UNIT - V	**SINGLE PHASE TRANSFORMERS**	**Classes: 09**
Principle of operation of single phase transformer, types, constructional features, phasor diagram on no load and load, equivalent circuit, losses and efficiency of transformer and regulation, OC and SC tests, (Simple problems)		
Text book:		
1. J B Gupta, "Theory and Performance of Electrical Machines", S K Kataria & Sons publications, 14th edition, 2010. 2. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw-Hill, 4th Edition 2010 3. A Chakrabarhty, ―Electric Circuits‖, Dhanipat Rai & Sons Publication 6th Edition, 2010. 4. I J Nagrath, D P Kothari, ―Electrical Machines‖, Tata Mc Graw Hill Publication, New Delhi, 2 nd Edition, 2010.		
References:		
1. V K Mehta, ―Principles of Electrical Engineering‖, S Chand Publications, Re print, 2005 2. I J Nagarath, D P Kothari, ―Theory and Problems of basic electrical engineering‖, PHI Publications, 1st Edition, 2013. 3. N C Jagan, C Lakhminaraya, ―Network Analysis‖, BS Publications 2nd Edition, 2011. 4. Sudhakar, Shyam Mohan, ―Electrical Circuits‖, Mc Graw Hill Publication, 3rd Edition, 2015.		

XIV. COURSE PLAN:

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

Lecture No	Topics to be covered	CLOs	Reference
1	Understand Concepts of basic electrical engineering	CLO 1	T2: 11.1 R3: 7.4
2-4	Understand the Transient behavior of R, L and C elements in a circuit and numerical problems on transient behavior of R, L and C circuits	CLO 1	T2: 11.1 R3: 7.4
5-7	Compute initial conditions and time response for current and voltage in first order R-L circuits and numerical problems on transient behavior of R-L circuits	CLO 1	T2: 11.2 R3: 8.2
8-10	Compute initial conditions and time response for current and voltage in first order R-C circuits and numerical problems on transient behavior of R-C circuits	CLO 1	T2: 11.3 R3: 8.3

Lecture No	Topics to be covered	CLOs	Reference
11-12	Compute initial conditions and time response for current and voltage in first order R-L-C circuits	CLO 1	T2: 11.4
13-15	Compute initial conditions and time response for current and voltage in first order R-C circuits	CLO 1	T2: 11.3 R3: 8.3
16-17	Apply the concept of transient response of first order R-L circuits using Laplace transform for solving numerical problems on transient behavior of R-L circuits	CLO 1	T2: 13.2 R3: 8.2
18-19	Apply the concept of transient response of first order R-C circuits Laplace transform for solving numerical problems on transient behavior of R-C circuits	CLO 1	T2: 13.3 R3: 7.4.4
20	Compute initial conditions for current and voltage in second order RLC circuit s	CLO 2	T2: 11.3 R3: 8.0
21	Compute initial conditions for current and voltage in second order RLC circuit s	CLO 2	T2: 13.4 R3: 8.4
22	Compute initial conditions for current and voltage in second order RLC circuits Laplace transform	CLO 2	T2: 13.5 R3: 8.4
23	Understand parameters useful for computing different networks	CLO 3	T2: 13.6 R3: 8.4
24-26	Understand Impedance parameters for two port networks and numerical problems	CLO 3	T2: 15.2 R3: 9.1
27-29	Understand Admittance parameters for two port networks and numerical problems	CLO 4	T2: 15.3 R3: 9.3
30-31	Able to compute Hybrid parameters for two port networks and numerical problems	CLO 6	T2: 15.6 R3: 9.6
32-33	Able to compute ABCD Parameters for two port networks and numerical problems	CLO 5	T2: 15.4 R3: 9.5
34-35	Understand the conversion one parameter to another parameter	CLO 4	T2: 15.8 R3: 9.7
36	Understand the conditions for Reciprocity and Symmetry	CLO 4	T2: 15.8 R3: 9.8
37-38	Understand the series, parallel and cascaded connection of two port networks and numerical problems	CLO 4	T2: 15.9 R3: 9.7
39-40	Understand image parameters for two port networks and numerical problems	CLO 6	T2: 15.10 R3: 9.9
41-42	Remember filters and its applications, and filters concept, filter networks classification, and its types	CLO7	T2: 17.1 R3: 10.1
43-44	Understand the designing of constant K-low pass filter and numerical problems	CLO9	T2: 17.6 R3: 10.8
45	Understand the designing of m-derived band pass filter	CLO 10	T2: 17.8 R3: 10.9
46	Understand the designing of m-derived band elimination filter	CLO 10	T2: 17.8 R3: 10.9
47	Understand the designing of symmetrical T-type attenuator	CLO 11	T2: 17.12 R3: 10.10
48	Understand the designing of Pi-type attenuator	CLO 11	T2: 17.13 R3: 10.11
49	Understand the designing of symmetrical lattice type attenuators	CLO 11	T2: 17.14 R3: 10.11
50	Understand the designing of bridged T - type attenuator	CLO 11	T2: 17.15 R3: 10.11
51	Understand working principle, constructional features, EMF induced in DC generator	CLO 12	T1: 4.2 R2: 2.2
52	Explain performance characteristics of DC generator	CLO 12	T1: 4.11 R2: 2.5
53	Understand working principle, constructional features, EMF induced in DC motor	CLO 13	T1: 4.3 R2: 3.2

Lecture No	Topics to be covered	CLOs	Reference
54	Understand efficiency, losses and torque developed	CLO 13	T1: 4.3 R2: 3.4
55	Explain different test conducts on DC machines	CLO 13	T1: 4.14 R2: 3.6
56	Understand working principle, constructional features and types of single phase transformer	CLO 14	T1: 1.2 R2: 4.2
57	Explain phasor diagram under different power factor conditions	CLO 15	T1: 1.6 R2: 4.4
58	Understand losses and efficiency of transformer and regulation types of single phase transformer	CLO 15	T1: 1.10 R2: 4.6
59	Explain different test conducts on single phase transformer	CLO 15	T1: 1.7 R2: 4.9

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

S. No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Digital simulation of electric circuits.	Guest Lecture	PO1, PO3	PSO2

Prepared by:

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HOD, ECE