INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE DESCRIPTOR

Course Title	**POWER SYSTEM COMPUTER AIDED DESIGN LABORATORY**				
Course Code	AEE113				
Programme	B.Tech				
Semester	VII	EEE			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	2
Chief Coordinator	Mr. A Naresh Kumar, Assistant Professor				
Course Faculty	Mr. A Naresh Kumar, Assistant Professor				

I.   COURSE OVERVIEW:

Power System Computer Aided Design Laboratory comprises of protection, simulation, high voltage and machine related experiments. Varieties of Power system Simulation packages like Load flow, PSCAD and MATLAB are available.

II.   COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AEE113	VII	Power System	4

III.   MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Power System Computer Aided Design 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 16th 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	Lab related Exercises
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	Lab related Exercises
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	2	Lab related Exercises

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.	2	Lab related Exercises
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.	-	-
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	Simulate transmission lines using PSCAD software to analyze faults in transmission system.
II	Demonstrate load flow studies using static load flow methods using MATLAB.
III	Analyze transient state stability in power systems

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
AEC111.01	CLO 1	Understand the MATLAB environment and programming concepts.	PO 1 PO 5	2
AEC111.02	CLO 2	Understand the PSCAD environment.	PO 1 PO 2	2
AEC111.03	CLO 3	Develop the Transient stability analysis concepts.	PO 1 PO 5	3
AEC111.04	CLO 4	Understand the symmetrical and unsymmetrical faults.	PO 1 PO 2	2
AEC111.05	CLO 5	Understand the load flow studies.	PO 5	2
AEC111.06	CLO 6	Understand the transient response of RLC circuit.	PO 1 PO 2	2
AEC111.07	CLO 7	Analyse the transformer inrush current under unbalanced three phase parameters.	PO 2 PO 5	2
AEC111.08	CLO 8	Analyse the reactive power and power factor correction.	PO 5	2
AEC111.09	CLO 9	Analyse the single machine-infinite bus with STATCOM.	PO 5	2
AEC111.10	CLO 10	Develop the typical transmission line modeling.	PO 2	2
AEC111.11	CLO 11	Analyze and develop the frequency response of single and two area power systems.	PO 5	1
AEC111.12	CLO 12	Develop a distance protection scheme in long transmission line.	PO 1	3

3 = High; 2 = Medium; 1 = Low

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	3				2								1		
CLO 2	2	3											1		
CLO 3	3				3								1		
CLO 4	2				2								2		
CLO 5					2								3		
CLO 6	2	2											1		
CLO 7		2			2								2		
CLO 8					2								1		
CLO 9		3			2								2		
CLO 10		2											1		
CLO 11					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 12	3												2		

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1,PO 2,PO 5	SEE Exams	PO 1,PO 2,PO 5	Assignments	-	Seminars	-
Laboratory Practices	PO 1,PO 2,PO 5	Student Viva	PO 1,PO 2,PO 5	Mini Project	-	Certification	-
Term Paper	-						

XII. ASSESSMENT METHODOLOGIES - INDIRECT

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

XIII. SYLLABUS

LIST OF EXPERIMENTS	
Week-1	**FORMATION OF BUS ADMITTANCE AND IMPEDANCE MATRICES**
Formation of bus admittance matrices by adding one element at a time and also write a program for Zbus building algorithm using MATLAB.	
Week-2	**LOAD FLOW SOLUTION USING GAUSS SEIDEL METHOD**
Write a MATLAB program for load flow studies without and with generator buses using Gauss Seidel Method.	
Week-3	**LOAD FLOW SOLUTION USING NEWTON RAPHSON AND FDLF METHOD**
Write a MATLAB program for load flow studies using Newton Raphson and Fast Decoupled Load Flow (FDLF) method.	
Week-4	**POWER SYSTEM FAULT ANALYSIS**
Analysis of symmetrical and unsymmetrical faults using symmetrical components using MATLAB.	
Week-5	**POINT BY POINT METHOD**
Development of MATLAB program for Transient stability analysis of single machine infinite bus and multi machine system by point by point method.	
Week-6	**TRANSIENT RESPONSE OF RLC CIRCUIT**
Obtain transient response of RLC circuit using PSCAD.	
Week-7	**THREE PHASE SHORT CIRCUIT ANALYSIS IN A SYNCHRONOUS MACHINE**
Analyze symmetrical faults and short circuit studies in a given synchronous machine using PSCAD.	
Week-8	**STUDY OF TRANSMISSION SYSTEM AND SHORT CIRCUIT ANALYSIS OF 9 BUS SYSTEM**
Study of simple transmission system and also Perform short circuit analysis on IEEE 9 bus system using PSCAD.	

Week-9	TRANSFORMER INRUSH CURRENT
Determination of transformer inrush current under unbalanced three phase parameters using PSCAD.	
WeeK-10	SMALL SIGNAL STABILITY ANALYSIS
Development of PSCAD Model for stability analysis of single machine-infinite bus with STATCOM.	
Week-11	TRANSMISSION LINE PARAMETERS
Obtaining parameters of a typical transmission line and modelling it in PSCAD.	
Week 12	LOAD FREQUENCY CONTROL
Obtain the frequency response of single and two area power system using PSCAD.	
Week 13	POWER QUALITY

Familiarization with PSCAD and Understanding of
   a) Reactive power and power factor correction in AC circuits.
   b) Current harmonics drawn by power electronics interface.	

Week 14	DISTANCE PROTECTION
Development of PSCAD model to study the distance protection scheme in long transmission line.	

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	Reference
1	Formation of bus admittance matrices by adding one element at a time and also write a program for Zbus building algorithm using MATLAB	CLO 1	T1-2.1 to 2.7
2	Write a MATLAB program for load flow studies without and with generator buses using Gauss Seidel Method.	CLO 1	T1-20.1 to 20.2
3	Write a MATLAB program for load flow studies using Newton Raphson and Fast Decoupled Load Flow (FDLF) method.	CLO 2	T1-8.1 to 8.2
4	Analysis of symmetrical and unsymmetrical faults using symmetrical components using MATLAB.	CLO 3	T1–8.3 to 8.7
5	Development of MATLAB program for Transient stability analysis of single machine infinite bus and multi machine system by point by point method	CLO 4	T1-10.1 to 10.10
6	Obtain transient response of RLC circuit using PSCAD.	CLO 5	T1-10.11 to10.13
7	Analyze symmetrical faults and short circuit studies in a given synchronous machine using PSCAD.	CLO 6	T1-11.1 to 11.5
8	Study of simple transmission system and also Perform short circuit analysis on IEEE 9 bus system using PSCAD.	CLO 7	T1 –11.12
9	Determination of transformer inrush current under unbalanced three phase parameters using PSCAD.	CLO 8	T1–17.1 to 17.6
10	Development of PSCAD Model for stability analysis of single machine-infinite bus with STATCOM.	CLO 9	T1–14.1 to 14.3
11	Obtaining parameters of a typical transmission line and modelling it in PSCAD.	CLO 10	T1-14.9
12	Obtain the frequency response of single and two area power system using PSCAD	CLO 11	T1-19.1 to 19.3
13	Familiarization with PSCAD and Understanding of a) Reactive power and power factor correction in AC	CLO 12	T1–17.1 to 17.6

Week No.	Topics to be covered	Course Learning Outcomes	Reference
	circuits. b) Current harmonics drawn by power electronics interface.		
14	Development of PSCAD model to study the distance protection scheme in long transmission line.	CLO 12	T1–14.1 to 14.3

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 2	PSO 1
2	Conditional probability, Sampling distribution, correlation, regression analysis and testing of hypothesis	Seminars / NPTEL	PO 2, PO5	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	NPTEL	PO 5	PSO 1

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