INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE DESCRIPTOR

Course Title	**POWER SYSTEM COMPUTATIONALLABORATORY**				
Course Code	BPSB09				
Programme	M.Tech				
Semester	I	EPS			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	-	-	-	4	2
Chief Coordinator	Dr. P Sridhar ,Professor &HOD,EEE				
Course Faculty	Dr. P Sridhar ,Professor &HOD,EEE				

I. COURSE OVERVIEW:

The objective of power system computational laboratory is to analyze electrical power system in steady state and transient state. In steady state the power system parameters are obtained by different load flow methods. In transient state the system stability is analyzed. Also, the formation of Ybus and Zbus is explained. In addition to this, the other methods of power system analysis mentioned here are unit commitment and state estimation. The simulation tool adopted is MATLAB.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AEE012	VI	Power System Analysis	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Power System Computational 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 lab 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. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

All the drawing related courses are evaluated in line with lab courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end laboratory examination. There shall be ONE internal test for 10 marks each in a semester.

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 12th Expt 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	Identify, formulate and solve power system related problems using advanced level computing techniques.	2	Discussion
PO 2	Explore ideas to carry out research / investigation independently to solve practical problems through continuing education	3	Laboratory Practices
PO 3	Demonstrate knowledge and execute projects on contemporary issues in multidisciplinary environment	2	Projects
PO 4	Ability to write and present a substantial technical report / document.	2	Projects
PO 5	Inculcate ethics, professionalism, multidisciplinary approach, entrepreneurial thinking and effective communication skills.	1	-
PO 6	Function effectively as an individual or a leader in a team to propagate ideas and promote teamwork.	-	-
PO 7	Develop confidence for self-study and to engage in lifelong learning	-	

3 = High; 2 = Medium; 1 = Low

VII. COURSE OBJECTIVES (COs):

The course should enable the students to:

I	Construct Y bus, Z bus for a n bus system and analyze various load flow studies
II	Understand the steady state, transient stability analysis and economic load dispatch problem
III	State estimation of power system and unit commitment problem.

VIII. 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
BPSB09.01	CLO 1	Develop a MATLAB program for $[Y]_{bus}$ formation by direct inspection method and singular transformation method.	PO1, PO2, PO3, PO4	3
BPSB09.02	CLO 2	Estimate the steady state parameters in power system is by Gauss -Seidal load flow method, Newton - Raphson load flow method, Fast Decoupledload flow method and DC Load Flow	PO1, PO2, PO3, PO4	3
BPSB09.03	CLO 3	Construct Z_{BUS} matrix which is a prerequisite to analyze the power system in case of fault	PO1, PO2, PO3, PO4	2
BPSB09.04	CLO 4	Determine a MATLAB program for short circuit analysis	PO1, PO2, PO3, PO4	3
BPSB09.05	CLO 5	Determine the economic operation of power systems through economic load dispatch.	PO1, PO2, PO3, PO4	2
BPSB09.06	CLO 6	Recognize the optimal number of generators to supply the load demand by means of unit commitment	PO1, PO2, PO3, PO4	3
BPSB09.07	CLO 7	Estimate the state of electrical power system.	PO1, PO2, PO3, PO4	2

3 = High; 2 = Medium; 1 = Low

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

Course Learning Outcomes (CLOs)	Program Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO 1	3	2	2	3	1		
CLO 2	3	3	3	3	1		
CLO 3	2	2	3	2	1		
CLO 4	2	3	2	2	1		
CLO 5	3	2	2	3	1		
CLO 6	3	3	3	3	1		
CLO 7	3	3	3	2	1		

3 = High; 2 = Medium; 1 = Low

X. ASSESSMENT METHODOLOGIES – DIRECT

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

XI. ASSESSMENT METHODOLOGIES - INDIRECT

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

XII. SYLLABUS

LIST OF EXPERIMENTS	
Expt. 01	**FORMATION OF BUS ADMITTANCE MATRIX**
Develop program for Y_{bus} formation by direct inspection method.	
Expt. 02	**SINGULAR TRANSFORMATION**
Develop program for Y_{bus} formation by singular transformation method**.**	
Expt. 03	**GAUSS - SEIDAL LOAD FLOW METHOD**
Develop program for G-S load flow algorithm	

Expt. 04	**NEWTON - RAPHSON LOAD FLOW METHOD**
Develop program for N-R load flow algorithm in polar coordinates	
Expt. 05	**FAST DECOUPLED LOAD FLOW METHOD**
Develop program for FDLF algorithm.	
Expt. 06	**DC LOAD FLOW**
Develop program for DC load flow algorithm.	
Expt. 07	**BUILDING ALGORITHM**
Develop Program for Z_{BUS} building algorithm.	
Expt. 08	**SHORT CIRCUIT ANALYSIS**
Develop program for short circuit analysis using Z_{BUS} algorithm.	
Expt. 09	**TRANSIENT STABILITY**
Develop program for transient stability analysis for single machine connected to infinite bus	
Expt. 10	**LOAD DISPATCH PROBLEM**
Develop program for economic load dispatch problem using lambda iterative method	
Expt. 11	**DYNAMIC PROGRAMMING METHOD**
Develop program for unit commitment problem using forward dynamic programming method.	
Expt. 12	**STATE ESTIMATION**
Develop program for state estimation of power system.	

XIII. 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	Develop program for Y_{bus} formation by direct inspection method.	CLO 1	T1
2	Develop program for Ybus formation by singular transformation method	CLO 2	T1
3	Develop program for G-S load flow algorithm	CLO 4	T1
4	Develop program for N-R load flow algorithm in polar coordinates	CLO 4	T1
5	Develop program for FDLF algorithm	CLO 9	T1
6	Develop program for DC load flow algorithm	CLO 5	T1
7	Develop Program for Z_{BUS} building algorithm	CLO 6	T2
8	Develop program for short circuit analysis using Z_{BUS} algorithm	CLO 7	T1
9	Develop program for transient stability analysis for single machine connected to infinite bus	CLO 8	T1
10	Develop program for economic load dispatch problem using lambda iterative method	CLO 11	T2
11	Develop program for unit commitment problem using forward dynamic programming method	CLO 14	T2
12	Develop program for state estimation of power system	CLO 12	T2

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

S.NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs
1	Understand the implementation of transmission lines formation.	Discussion	PO1,PO2
2	Analyze the performance of transmission lines under over voltages and currents.	Laboratory Practices	PO1, PO2, PO3

Prepared by:
Dr. P Sridhar, Professor and Head

HOD, EEE