

EE-453L: Power System Operation and Control Laboratory

Course Description		The objective of the Lab includes learning of different Power system operation methods and control methods by using different software's and mathematical techniques.			
Measurable Learning Outcomes	CLOs	Description	Domain	PLOs	Level, Strength
	CLO1	Perform skillfully the optimal power flow methods in power system.	Psychomotor	PLO02	P3 Medium
	CLO2	Perform skillfully the power system control and stability using software tools.	Psychomotor	PLO05	P3 Medium
	CLO3	Deliver effective presentation and participate effectively in group discussion to maximize learning.	Affective	PLO12	A2 Low
Manuals		REQUIRED Lab handouts.			
Grading Policy		Lab Evaluation	26%	CLO1, CLO2 and CLO3	
		Open Ended Lab	10%	CLO2	
		Complex Engineering Problem	15%	CLO2, and CLO3	
		Lab Manual	26%	CLO1 and CLO2	
		Viva/quiz	23%	CLO1 and CLO2	

List of Experiments – EE-453L Power System Operation and Control

No.	Title	CLOs
1	Analysis of different basic Parameters to solve power flow and power operation techniques.	CLO 1,3
2	Implementation of Gauss-Siedle Method for multivariable power system	CLO 1,3
3	Analysis of multivariable power system using Newton Raphson Method	CLO 1,3
4	Analysis of multivariable power system using Fast Decoupled Method	CLO 1,3
5	Perform Economic Dispatch operation of Generators in Power system	CLO1,3
6	Perform tap-changing in transformers to analyse voltage regularity in power system	CLO 1,3
7	Perform Unit Commitment operation for selection of Generators by Dynamic Programming	CLO 1,3
8	Perform control operation of generator to extract generator reactive capability curves and power compensation	CLO 2,3
9	Perform reduction of Buses in main power system to reduce system for understanding and calculation.	CLO 2,3
10	Perform transient stability analysis of generators for calculating the critical angle.	CLO 2,3
11	Perform Load frequency control of generator using PI controller.	CLO 2,3
12	Perform Numerical solution of non-linear equations in power system stability by Euler's Method	CLO 2,3
13	Perform steady state analysis and stability analysis of synchronous Machine.	CLO 2,3

Assessment Rubrics of Power System Operation and Control

Performance parameter	Meets Expectations (100-80%)	Average performance (80-40%)	Does not meet expectations. (40-0%)	Marks
Lab Performance (CLO1,2)	Selects appropriate mathematical tool to solve power system problem, carefully selection of simulation tools and solving techniques to performs simulation Accurately.	Needs guidance to select appropriate mathematical tool to solve power system, simulation performance required guidance and contain minor errors.	Have no idea about proper mathematical solving methods and simulation techniques.	[20]
Affective participation within group (CLO3)	Affective participation in the lab with collaborative involvement to complete lab tasks.	Moderate participation in group to complete lab tasks.	Low level participation in group discussion and Act of irresponsibility was observed.	[6]
Lab Manual (CLO 1,2)	Submit the lab report (including tables, simulation procedure, observations/ graphs, summary) on due time.	Submit the complete report (including code, procedure, simulation, observations/ graphs) manual after due time and having some minor errors.	Submit the incomplete lab manual after due time and having major errors in results and conclusion.	[26]
Viva/Quiz (CLO1,2)	Knows the complete theory of the experiment and effectively explains/answer to the instructor.	Knows the complete theory of the experiment and explains it to the instructor with little hesitation.	Does not know the theory of the experiment and unable to explain it to the instructor.	[23]
Open Ended Lab (OEL) CLO2	Rubrics for Open Ended Lab are compiled separately.			[10]
Complex Engineering Problem (CEP) CLO2, CLO3	Rubrics for Complex Engineering Problem are compiled separately.			[15]
Total				[100]

Assessment Rubrics of Open-Ended Lab (OEL) CLO2

Performance Parameter	Good (100-80%)	Average (80-40%)	Below average (40-0%)	Marks
Understanding of the task	Have a complete knowledge about the assigned lab tasks.	Moderate understanding of the experiment.	Does not interpret the assigned tasks and unable to explain it.	[2]
Performance	Perfect execution, no bugs in the mathematical work and simulation, completion of the tasks, accurate compilation.	Errors found in the compilation of mathematical work and simulation.	Have no idea about the mathematical calculation, simulation and the operation is substantially wrong.	[5]
Report	Submits a lab report on due time.	Submits incomplete lab report on due time.	Submits a copied lab report or submission after due time.	[3]
Total				[10]

Assessment Rubrics of CEP

Performance	Meets Expectations	Average	Does not meet Expectations.	Marks
	(100-80%)	(80-40%)	(40-0%)	
Simulation techniques CLO2	Selects relevant tools in simulation to solve the problem, appropriate selection of controller for controlling of system.	Selects relevant tools in simulation to solve the problem, appropriate selection of controller with minor error.	Have no idea about appropriate tools for solving problem and no idea of controller settings.	[5]
Report of CEP CLO2	Submit the CEP Report (Including Literature Review, procedure, and observations/graphs) on due time	Submit the CEP report (Including Literature Review, procedure, and observations/graphs) manual less accurate and not having information.	Submit the CEP report (Including Literature Review, procedure, and observations/graphs) manual less accurate and after due date.	[5]
Presentation of CEP CLO3	Effective presentation is delivered, and adequate teamwork is shown by team members.	Average presentation is delivered, and moderate teamwork is shown by group members.	Below the average presentation is delivered and no cooperation is represented by team members.	[5]
Total				[15]

Assessment Rubrics for participation in Lab and CEP (CLO3)

Observed Lifelong learning Skills	Description	Performed each standard. (.2,.1)	Not performed Each standard (0)
Coordination with others (.2)	Affectively coordinate with students to complete lab task and project.		
Collaborative work effort (.2)	Active involvement and collaboration of students to complete task within lab and project.		
Sense of Responsibility (.1)	Act of irresponsibility was observed from the student, while performing any lab or project task within groups.		