2023
TP-153

Course Specification
(Bachelor)

Course Title:	Power System Lab
Course Code:	EE1472
Program:	Electrical Engineering
Department:	Electrical Engineering
College:	College of Engineering
Institution:	Imam Mohammad Ibn Saud Islamic University
Version:	V1
Last Revision Date:	04-11-2025

Table of Contents

A. General information about the course: 3
B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods 4
C. Course Content 6
D. Students Assessment Activities 6
E. Learning Resources and Facilities 6
F. Assessment of Course Quality 7
G. Specification Approval 7

A. General information about the course:

1. Course Identification

1. Credit hours: (1)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (8th level, 4th year)					
4. Course general Description:					
In this lab course, students will gain hands-on experience in the analysis, design, and operation of power systems. They will explore key topics such as power flow analysis, fault analysis, voltage and frequency regulation, reactive power compensation, stability studies, and transmission line analysis. Students will learn how to simulate power systems using software like PSS/E, PowerWorld, ETAB, Power Factory and Simulink, and also conduct real-world experiments with transformers, protection systems, renewable energy integration, and transmission lines. The transmission line experiments will include studying the characteristics of transmission lines, voltage drops, line parameters, and the impact of different loading conditions. By the end of the course, students will have a comprehensive understanding of power system operation and control, equipped with the skills to simulate and analyze system performance using advanced tools and techniques.					
5. Pre-requirements for this course (if any)**:**					
EE1471					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- Provide students with hands-on experience in designing, analyzing, and simulating power systems using advanced software tools like PSS/E, PowerWorld, ETAB, Power Factory and Simulink.
- Enable students to understand and perform power system studies such as power flow analysis, fault analysis, voltage regulation, stability, and reactive power compensation.
- Equip students with practical skills to analyze transmission line characteristics, including voltage drops, line parameters, and the effects of loading conditions on system performance.
- Foster the ability to simulate and analyze the integration of renewable energy sources (solar, wind) into the grid.
- Develop proficiency in using power system hardware and equipment, such as transformers, protection relays, and renewable energy setups, to validate and analyze simulation results.

- Cultivate problem-solving skills by conducting experiments and simulations that challenge students to troubleshoot, optimize, and develop solutions for real-world power system scenarios.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
2	E-learning	-	-
3	Hybrid • Traditional classroom • E-learning	-	-
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	-
2.	**Laboratory/Studio**	30
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)**	-
Total		30

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
K1	Apply the fundamental principles of power system analysis, including load flow, fault analysis, and stability assessment.	1.5	hands-on experiments, and simulations	Report Evaluation Mid and Final Exams
2.0	**Skills**			
S1	Analyze and optimize economic dispatch and reactive power compensation strategies to improve system efficiency and reliability.	2.5	hands-on experiments, and simulations	Report Evaluation
S2	Conduct simulations and real-time analysis of power system operations, including power flow, fault scenarios, and stability studies.	6.6	hands-on experiments, and simulations	Mid and Final Exams
S2	Evaluate the electrical and mechanical characteristics of transmission lines through analytical and experimental methods.	6.5	hands-on experiments, and simulations	Report Evaluation
3.0	**Values, autonomy, and responsibility**			
V1	Effectively present technical results using graphs, tables, and diagrams, ensuring clarity and accuracy in engineering communication.	3.2	hands-on experiments, and simulations	Report Evaluation
V2	Assess the impact of integrating renewable energy sources on power system performance and stability.	4.5	hands-on experiments, and simulations	Mid and Final Exams
V2	Design and perform laboratory experiments on transmission lines, transformers, and protection systems, ensuring adherence to engineering standards.	4.1	hands-on experiments, and simulations	Report Evaluation

C. Course Content

No	List of Topics	Contact Hours
1	Familiarization with PowerWorld & Single-Line Diagrams	2
2	Transmission Line Modeling and Performance	2
3	Reactive Power Compensation & Power Factor Correction	2
4	Fault Analysis (Symmetrical & Unsymmetrical)	2
5	Cost-Optimal Generation Dispatch (Economic Dispatch)	2
6	Economic Load Dispatch with Losses	2
7	Optimal Power Flow with Constraints	4
8	Power System Reliability: Contingency Analysis (N-1 Security Check)	4
9	Transient Stability Analysis	2
10	Load Flow Analysis using IEEE 9-Bus System	2
11	Transformer Testing and Performance Evaluation	2
12	Voltage Control Using Tap-Changing Transformers	2
13	Integration of Renewable Energy into the Grid (Solar/Wind)	2
14	Protection of Equipment in Power Systems (generator, transformer, and transmission line)	2
15	Measurement of Power Quality and Harmonics	2
16	Mid & Final Exam	4
	Total	**34**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm 1	7th week	20%
2.	Reports	Every week	20%
3.	Pre-Lab Quiz	Weekly	10%
4.	Quiz	10th Week	10%
5.	Final Exam	Final Exam week	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Lab manual Given by University

Supportive References	Power System Analysis – J. Duncan Glover, Thomas Overbye, and Mulukutla S. Sarma,
Electronic Materials	Computer animations supplied by the instructor.
Other Learning Materials	Using Softwares is Encouraged for Simulation Purpose other than that of Lab.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	SR 145 in Lab Room with 10-15 Students per Section
Technology equipment (projector, smart board, software)	Lab Equipment, Computers, Internet connection, Blackboard LMS software, data-show, and white board.
Other equipment (depending on the nature of the specialty)	Provided in the lab.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Indirect**
Effectiveness of Students assessment	**Students**	**Indirect**
Quality of learning resources	**Relevant Focus Group**	**Indirect**
The extent to which CLOs have been achieved	**Dept. Quality Committee**	**Direct**
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	