

Course Number and Title:	Power System Protection		
Credit Hours:	3+1		
Pre Requisite	Fundamentals of Generation ,transmission and distribution		
Instructor (s):	Engr. Ilyas Ahmad		
Lab Engineer:	Engr Noman Qamar		
Compulsory/Elective:	Elective		
If Elective:Depth Core/Breadth Core:	Depth Core		
Course Schedule:	Lecture:	3 Hours/Week	
	Lab:	3 Hours /Week	
	Office hours:	4 Hours/Week	
Course Assessment:	Assignments/Course project:	3	
	Quizzes:	3	
	Lab work:	10 experiments	
	Exams:	Mid-Semester and Final	
Grading Policy:	Quizzes:	10%	
	Assignments/ Course project:	10%	
	Lab work:	20%	
	Mid-Semester:	20%	
	End-Semester:	40%	
Text Book:	(1)Protective Relaying : Principles and Applications . 3 <sup>rd</sup> Edition. J.Lewis Blackburn , Thomas J.Domin (2) Protective Relaying : Theory and Applications , 2 <sup>nd</sup> Edition , Walter A.Elmore.		
Reference Book(s):	“Fundamentals of Power System Protection” Paithanker & Bhide ,Prentice Hall.		
Course Objective:	To understand the fundamentals of protection and to apply for the various protective functions.		
Course Learning Outcome	CLO Statement	PLO	Bloom
CLO-1:	Knowledge of the various relaying concepts	PLO-1	C1 C2
CLO-2:	Understanding of the application and coordination of protective facilities on electrical power systems.	PLO-2	C3 C4
CLO-3:	To be familiar with the protection practice documents in common use.	PLO-2	C5
Topics covered in the course and level of coverage:	❖ Introduction to protection system	6 Hours	
	❖ System –Grounding and Protective Relaying	6 Hours	
	❖ Transformer and Reactor Protection	6 Hours	
	❖ Bus Protection	3 Hours	
	❖ Line Protection	9Hours	
	❖ Generator Protection	6 Hours	
	❖ Motor Protection	6 Hours	
	❖ Circuit Breakers	6 Hours	
Program learning outcomes and how they are covered by specific course outcomes:	Detailed Contents	CLO	PLO
	❖ Introduction to protection system, types of faults , effect of faults	CLO-1	PLO-1
	❖ Fuse as protective device, types of fuses, characteristics	CLO-1	PLO-1

	of fuses, selection, application, discrimination and coordination of fuses.		
❖	Current transformer and its operation.	CLO-1	PLO-1
❖	Relay construction , basic relay terminology,	CLO-1	PLO-1
❖	Electromagnetic relays ,thermal relays, static relays,	CLO-2	PLO-2
❖	And introduction to microprocessor based protective relays.	CLO-1	PLO-1
❖	Over current protection, distance protection, impedance relay, R-X diagram, operation of impedance relay in different zones, reactance relay.	CLO-1	PLO-1
❖	Differential protection of transformers	CLO-2	PLO-2
❖	Generator protection, bus bar protection	CLO-2	PLO-2
❖	Line protection and motor protection.	CLO-2	PLO-2
❖	Protection Practices / schemes	CLO-3	PLO-2
❖	Arc voltage ,arc interruption ,restricting voltage and recovery voltage	CLO-1	PLO-1
❖	Resistance switching , current chopping circuit breaker,	CLO-1	PLO-1
❖	Classification of circuit breakers, oil circuit breakers	CLO-2	PLO-2
❖	Air-blast circuit breakers , SF6 circuit breakers ,vacuum circuit breakers , operational mechanism and rating of circuit breakers	CLO-2	PLO-2

Mapping of CLOs with PLOs and Bloom's Taxonomy Cognitive Levels:

PLO	1	2	3	4	5	6	7	8	9	10	11	12
CLO-1	C1 C2											
CLO-2		C3 C4										
CLO-3		C5										

Mapping of CLOs with Assessment Methods:

CLOs/Assessment	CLO-1	CLO-2	CLO-3
Assignments:	√	√	√
Quizzes:	√	√	√
Mid-Semester:	√	√	
End-Semester:	√	√	√