

Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Fourth Year Bachelor of Engineering (Electrical Branch)

With effect from: Academic Year 2020-21

Subject Code: EE703-N	Subject Title: Power System Protection
Subject Couer EE/05 IN	Subject fille: I Ower System I rotection

Course Objective:

- To address the concept behind need of Power System protection.
- To impart knowledge of advancements in the field of power system protection with insight experimental approach.
- The course starts with a review of working of various power systems protection equipment.
- To impart knowledge of various Apparatus protection schemes in power system.

A. <u>Teaching/Examination scheme</u>

	Teac	hing sch	eme				Evaluati			
L	т	Ρ	Total	Total Credit	Theory		IE Marks	CIA Marks	Pract. Marks	Total Marks
Hrs	Hrs	Hrs	Hrs		Hrs	Marks				
3	0	2	5	4	3	70	30	20	30	150

B. <u>Outline of the Course:</u>

1. Introduction:

Dependence of Modern Society on Electric Supply, Faults and Abnormal Operating Conditions, Classification of Shunt Faults, Abnormal Operating Conditions, Evolution of Power Systems, A Protection System and Various Principles of Power System Protection.

2. Over- Current Protection of Transmission Lines

Introduction, Fuse, Over- current Relay, Implementation of Over-current Relay, Application of Definite Time OC Relays for protection of Distribution Feeder, Application of Definite Minimum Time Relay on a Distribution Feeder, Protection of a Three-phase Feeder, Directional Over-current Relay, Drawback of Over-current Relays.

3. Differential Protection

Introduction, Simple Differential Protection, Applications of differential protection, Difficulties in differential protection, Zone of Protection of the Differential Relay



Kadi Sarva Vishwavidyalaya Faculty of Engineering & Technology Fourth Year Bachelor of Engineering (Electrical Branch) With effect from: Academic Year 2020-21

4. Distance protection of transmission lines

Drawback of Over-current Protection, Introduction to Distance Protection, Simple Impedance Relay, Reactance Relay, Mho Relay, Comparison between Distance Relays, Distance Protection of a Three Phase Line, Application of distance protection.

5. Transformer Protection & Induction Motor Protection

Introduction, Types of Faults in Transformers, Over-current Protection, Percentage Differential Protection of Transformers, types of faults in induction motors, protection of low voltage induction motor, overload protection of induction motors, protection against unbalance.

6. Generator Protection & Busbar Protection

Introduction, different fault in generator and abnormal condition & protection system. Differential protection of generator, Differential Protection of Busbars, External and Internal Fault, Protection of Three-phase Busbars.

7. Numerical Protection

Introduction, Block Diagram of Numerical Relay, Sampling Theorem, Correlation with a Reference Wave, Least Error Squared (LES) Technique, Digital Filtering, Numerical Overcurrent Protection, Numerical Transformer Differential Protection, Numerical Distance Protection of Transmission Line.

C. <u>Instructional Method & Pedagogy</u>(Continuous Internal Assessment (CIA) Scheme)

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments/ Projects based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quiz/Seminar/tutorial will be conducted as a part of an overall internal evaluation.



Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Fourth Year Bachelor of Engineering (Electrical Branch)

With effect from: Academic Year 2020-21

D. Lesson Planning

C	Lectures Hours.	Weightage			
Sr.		for exam	Course Contents		
INO.		in %			
1	7	15	Introduction: Dependence of Modern Society on Electric Supply, Faults and Abnormal Operating Conditions, Classification of Shunt Faults, Abnormal Operating Conditions, Evolution of Power Systems, A Protection System and Various Principles of Power System Protection.		
2	7	15	Over- Current Protection of Transmission Lines: Introduction, Fuse, Over- current Relay, Implementation of Over-current Relay, Application of Definite Time OC Relays for protection of Distribution Feeder, Application of Definite Minimum Time Relay on a Distribution Feeder, Protection of a Three-phase Feeder, Directional Over-current Relay, Drawback of Over-current Relays		
3	6	13	Differential Protection: Introduction, Simple Differential Protection, Applications of differential protection, Difficulties in differential protection, Zone of Protection of the Differential Relay		
4	7	15	Distance protection of transmission lines : Drawback of Over-current Protection, Introduction to Distance Protection, Simple Impedance Relay, Reactance Relay, Mho Relay, Comparison between Distance Relays, Distance Protection of a Three Phase Line, Application of distance protection.		
5	7	14	Transformer Protection & Induction Motor Protection: Introduction, Types of Faults in Transformers, Over-current Protection, Percentage Differential Protection of Transformers, types of faults in induction motors, protection of low voltage induction motor, overload protection of induction motors, protection against unbalance.		
6	7	14	Generator Protection & Busbar Protection Introduction, different fault in generator and abnormal condition & protection system. Differential protection of generator, Differential Protection of Busbars, External and Internal Fault, Protection of Three-phase Busbars		



Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Fourth Year Bachelor of Engineering (Electrical Branch)

With effect from: Academic Year 2020-21

7	7	14	Numerical Protection Introduction, Block Diagram of Numerical Relay, Sampling Theorem, Correlation with a Reference Wave, Least Error Squared (LES) Technique, Digital Filtering, Numerical Over-current Protection, Numerical Transformer Differential Protection, Numerical Distance Protection of Transmission Line.
	48	100	

E. Suggested List of Experiments:

- 1. Explain Electromagnetic relays.
- 2. To determine the operating characteristics of a given Electromagnetic type over current (IDMT) relay using relay test kit EMOC-A & PSCI-S-50A.
- 3. To perform testing of current transformer using CT test set PS-CT-100A.
- 4. To perform Radial Feeder protection using feeder protection study unit PS-RFPSU.
- 5. To perform transmission line protection using panel.
- 6. To perform 3-phase Transformer protection using study unit PS-TPSU.
- 7. To perform Buchholz relay.
- 8. To perform Bus Zone protection.
- 9. To perform Numerical protection
- 10. To classify relay testing methods and equipment.

F. <u>Students Learning Outcomes</u>

On successful completion of the course

- The students will learn the importance of power system protection.
- The students will learn different protection schemes used in transmission line and different apparatus protections in power system.
- The students would have awareness regarding the current techniques used in power system protection.

Reference Book:

- 1. Switchgear And Protection S. S. Rao, Khanna publication.
- 2. Power System Protection and Switchgear B. Ravindranath and M. Chander.
- 3. Fundamentals of Power System Protection Y. G. Paithankar and S. R. Bhide, 2nd Edition, PHI.
- 4. Power System Protection B. Ram, TMH Publication.
- 5. Protection and switchgear, by BhaveshBhalja, R.P.Maheshwari, Nilesh Chotani,1st
- 6. Modern Power System Protection DivyeshOza, TMH Publication.
- 7. Power System Protection Patra, Basu , Chaudhar.