

22EE402 POWER SYSTEM PROTECTION

Hours Per Week :

L	T	P	C
3	2	0	4



Source: <https://www.linkedin.com/pulse/objective-power-system-protection-mohamed-ali>

PREREQUISITE KNOWLEDGE: Basic of Power Transmission and Distribution.

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces basic concepts of Relays, Protection schemes, Switch gear and Modern trends in protection of power system equipments. The objective of the course is to understand the operation and application of power system protection equipments such as relays, circuit breakers and fuses; master various protection schemes for generators, transformers and transmission lines against faults.

MODULE-1

UNIT-1

12L+8T+0P=20 Hours

INTRODUCTION AND COMPONENTS OF A PROTECTION SYSTEM AND CIRCUIT BREAKERS:

Introduction and Components of a Protection System: Principles of Power System Protection, Overview of switchgear equipments.

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restricting voltage, Restricting phenomenon, Average and maximum RRRV, Numerical problems, current chopping and resistance switching, CB ratings and specifications, Auto reclosures. Structure and working of minimum oil circuit breakers, Air blast circuit breakers, and Vacuum and SF6 circuit breakers.

UNIT-2

12L+8T+0P=20 Hours

ELECTROMAGNETIC RELAYS, RELAYS CLASSIFICATION, DISTANCE RELAYS AND STATIC RELAYS:

Electromagnetic Relays: Principle of operation and construction of attracted armature, balanced beam, induction disc and Induction cup relays.

Relays Classification: Characteristics of instantaneous, DMT and IDMT, over current relays, Direction relays, Differential relays and percentage differential relays, Universal torque equation.

Distance Relays: Characteristics of impedance, Reactance and Mho type distance relays and their comparison. Effect of Power Swings on Distance Relaying.

Static Relays: Construction of static relays and compare with electromagnetic relays.

PRACTICES:

- Characteristics of over load relay.
- Testing of Differential relay.
- Characteristics of over current relay for Earth fault.

MODULE -2

UNIT-1

12L+8T+0P=20 Hours

EQUIPMENT PROTECTION AND NEUTRAL GROUNDING:

Feeder and Bus-Bar Protection: Relay Protection, Protection of lines using over current, Carrier current and three-zone impedance type distance relays, Translay relay, Protection of bus bars, Differential protection.

SKILLS:

- ✓ Select circuit breakers for given specifications.
- ✓ Identify proper settings for relays to protect given equipment.
- ✓ Suggest the protection schemes for alternator, transformers and bus bars.
- ✓ Create and manage safe and reliable switch gear system.

Neutral Grounding: Grounded and ungrounded neutral systems, Methods of neutral grounding - Solid, Resistance, Reactance; arcing grounds and grounding practices.

UNIT-2**12L+8T+0P=20 Hours****GENERATOR PROTECTION, TRANSFORMER PROTECTION AND PROTECTION AGAINST OVER VOLTAGES:**

Generator Protection: Protection of generators against stator faults, Rotor faults and abnormal Conditions, Restricted earth fault and Inter-turn fault protection, Numerical problems on percentage winding unprotected.

Transformer Protection: Percentage differential protection, numerical problem on design of CT Ratio, Buchholtz relay.

Protection against over Voltages: Generation of over voltages in power systems, Protection against lightning over voltages - Valve type, Zinc-Oxide lightning arresters; Insulation coordination, BIL, Impulse ratio, Standard impulse test wave, Volt-time characteristics.

PRACTICES:

- Characteristics of over load relay.
- Testing of Differential relay.
- Characteristics of over current relay for phase fault.
- Characteristics of over current relay for earth fault.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify the different components of a protection system.	Apply	1	1, 2, 9, 11
2	Select various methods of over voltage and over current protection in power systems.	Apply	2	1, 2, 3, 9, 11
3	Specify the ratings for fuses according to application.	Analyze	1	1, 2, 9, 11
4	Elucidate various protection schemes for various power system components like alternators, transformers and bus-bars.	Analyze	2	1, 2, 3, 9, 11

TEXT BOOKS:

1. Sunil S. Rao, "Switchgear and Protection" 12th edition, KhannaPublishers, 2007.
2. Badari Ram, "Power System Protection and Switchgear" 1st edition, D.N Viswakarma, Tata Mc-Graw Hill, Publications, 2005.

REFERENCE BOOKS:

1. CL Wadhwa, "Electrical Power Systems", 4th edition, New Age international (P) Limited, 2008.
2. Paithankar and S.R.Bhide., "Fundamentals of Power System Protection" 1st edition, Prentice Hall of India, 2007.