



Course Title: Power System Protection

Credit Units: 3

Course Level: UG

Course Code: ELEC306

L	T	P/S	SW/F W	TOTAL CREDIT UNITS
3	0	0	0	3

Course Objectives:

To teach the fundamentals of power systems protection with basic theory of relays, circuit breakers & fuses.

Pre-requisites:

Basic electrical engineering, Electrical Machines-I, Electrical Machines-II, Power Systems-I

Course Contents/Syllabus:

	Weightage (%)
Module I: Introduction to Protection Scheme	
Need for Protective systems, Nature and causes of Faults, Types of faults, Effect of faults, fault statistics, Evolution of protective relays, Zones of protection, Primary and Back up Protection, Essential qualities of Protection, Classification of Protective schemes, Automatic reclosing, current transformer for Protection, potential transformer, summation transformer, phases sequence current, segregating network, basic relay terminology	20
Module II: Relays	
General considerations, sensing of faults, construction of electro magnetic. attraction and induction types relays, Buchholz and negative sequence relay, concept of reset, pick up, inverse time and definite time characteristics, over current, over voltage, directional, differential and distance relays on R-X diagram, Static Relays: Introduction, advantage and limitation of static relays, static overcurrent, directional, distance and differential relays	20
Module III: Protection	
Types & detection of faults and their effects, alternator protection scheme (stator, rotor, reverse power protection etc.), Power transformer protection (external and internal faults protection), generator transformer unit protection scheme, bus bar protection, Transmission line protection (current/time grading, distance), Pilot-relaying schemes, power line carrier protection.	20
Module IV: Switchgears	
Principles of arc interruption, DC Circuit breaking and AC circuit breaking, Recovery and re-striking voltage, Methods of arc extinction, Mathematical expression for re-striking voltage, Active recovery voltage, Switching, magnetizing and capacitive currents, Current chopping, Resistance switching, , Types of Circuit breakers- oil circuit breakers, Air circuit breakers, Vacuum Circuit breakers, SF6 circuit breakers, Construction, HRC Fuse link, Action of HRC fuse, Shapes of fuse element, Specifications of a fuse link, Characteristic of a fuse, Selection of a fuse link	20

Module V: Modern Protection

Electronic relays, static relays functional circuits: comparators, level detectors, logic and training circuits, microprocessor and computer based protection schemes, software development for protection, security and reliability

20**Student Learning Outcomes:**

After completing the Power Systems course, students will be able to

1. Understand the concept and constituent of power system protection.
2. Understand construction and working of Fuses, circuit breakers
3. Understand the need and concept of apparatus protection

Learn the modern static relays.

Pedagogy for Course Delivery:

Class Room Lectures, assignments, Quizes

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
100	-	100

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	A	CT	S/V/Q	HA	EE
Weightage (%)	5	10	8	7	70

Text Reading:

- S. S. Rao - Switchgear and Protection - Khanna Publishers, N.Delhi, 2011
- T.S.Madhava Rao - Power System Protection - TMH, 2011
- I. J. Nagrath and D. P. Kothari - Power System Engineering, TMH, 2005

References:

- Badriram and D. Vishwakarma - Power System Protection and Switchgear - TMH, 2010
- Ravindranath B. and Chander. M - Power System Protection and Switchgear - Wiley Eastern, 2009