Program	Engineering
Specialty	Electrical Power Systems
Course Number	20304243
Course Title	Electrical Protection Systems
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

□ **Brief Course Description:**

This Course throws lights on; components of electrical power system, protective relays, protection of feeders, networks, generators, motors, transformers & bus bars ; calculations of faults.

□ **Course Objectives:**

The student should be able to ;

1. Know faults calculations.
2. Explain many kinds of protection systems of system components.
3. Describe the construction & operation of protection systems.
4. Determine relays .
5. Connect & supply relays through VTs & CTs.

□ **Detailed Course Description:**

Unit Number	Unit Name	Unit Content	Time Needed
1.	**Introduction**	▪ Basic principles of electrical systems ▪ Protection requirements ▪ Protection zone ▪ Primary & back – up protection	
2.	**Calculation of short-circuit currents**	▪ Modeling for short – circuit current calculations ▪ Effect of the system impedance. ▪ Effect of rotating machinery ▪ Types of fault duty ▪ Importance and construction of sequence networks ▪ Calculation of asymmetrical faults using symmetrical components. ▪ Supplying current & voltage signals to protection systems	
3	**current and voltage Transformers**	▪ Voltage transformers; equivalent circuit, burden, selection of VTs, capacitor voltage transformers ▪ Current transformers; equivalent circuit, AC saturation, burden, selection of CTs, precautions when working with CTs	

4	**Over current protection**	▪ General ▪ Types of over current relays; definite – current relays definite – time relays, inverse – time relays ▪ Setting over current relays ▪ Co –ordination across Dy transformers ▪ Co- ordination with fuses.	
5	**Fuses, Recluses and sectionalizes**	▪ Equipments; recluses; fuses; sectionalizes ▪ Criteria for co-ordination of time / current devices; (fuse- fuse; recluses – fuse; recluse - recloser; recloser- relay; recluse – sectionalize; recluse – sectionaliser –fuse) co-ordination	
6	**Directional over current relays**	▪ Construction. ▪ Principle of operation. ▪ Relay connection. ▪ Directional earth- fault relates. ▪ Setting of time – delay directional over current units.	
7	**Differential protection.**	▪ Classification of differential protection. ▪ Selection of CTs ▪ Using differential protection in; transformers; generators; lines; busbars	

8	**Distance Protection**	▪ Type of distance relay; impedance relay ; directional relay; reactance relay;mho relay ▪ Setting the reach and operating time of distance relay ▪ the effective cover of distance relays ▪ Distance relays on series – compensated lines ▪ Impedances seen by distance relays; phase units; earth- fault units	
9	**Protection of Industrial Systems.**	▪ Protection devices ; over current relays ; moulded case circuit breaker; combined thermal relay fuse and contactor. ▪ Criteria for setting over current protection devices associated with motors; thermal relays and low voltage breakers.	
10	**Protection schemes and substation Diagrams**	▪ Generators protection. ▪ Motors protection. ▪ Transformers protection. ▪ Lines protection.' ▪ Substation diagrams; single line diagrams, layout diagrams, AC connections diagrams, DC connection diagrams, wiring diagrams.	
11	**Installation , testing & maintenance of protection systems**	▪ Installation of protection equipments. ▪ Testing Protection schemes, factory tests, precommissioning tests, periodic maintenance.	

Evaluation Strategies

		Percentage	Date
1. Exams	First Exam	20%	--/--/----
	Second Exam	20%	--/--/----
	Assignments	10%	
	Final Practical Exam	50%	--/--/----

□ **Teaching Methodology:**

1. Lectures

□ **Textbook**:

1. Protection of Electricity Distribution Networks; J. Gers & E. Holmes, 2nd edition, 2005.

□ **References**:

1. Power system protection and switchgear ; B. Ravin – dranath, 2004.
2. Power System Protection (1) : Principle and Components; Edited by the Electricity Training Association , 1995 .
3. Power System Protection (2) : Systems and Methods; Edited by the Electricity Training Associated , 1995.
4. Power System Protection (3) : Application; Edited by the Electricity Training Associated , 1995 .