

COURSE CODE: 1152EE102	COURSE TITLE: PROTECTION AND SWITCH GEAR	L	T	P	C
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COURSE CATEGORY:

Program Elective

PREAMBLE :

The functioning of a power system depends significantly on efficient and reliable protection schemes. This course covers a refreshed pedagogy of Power System Protection and Switchgear technology covering the contemporary protection system, relay & breaker principles, Types operations and applications infused with measuring, control and regulating arrangements for modern power system network.

PREREQUISITE COURSES:

- Transmission and distribution

RELATED COURSES:

Power System Operation and Control, Power Quality, Solid State Drives

COURSE EDUCATIONAL OBJECTIVES :

The objectives of the course are to make the students,

- Essential qualities of a reliable protective system, and protection terminologies
- Operating principles of various relays based upon
- Technology and functional requirements
- Protection of power apparatus in plant premises & Transmission line
- The arcing phenomena, arc quenching & breaking in circuit breakers
- Different Circuit breaker principles & working

COURSE OUTCOMES :

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
C01	List about essential qualities of a reliable protective system, and protection terminologies.	K1
C02	Contrast operating principles of various relays based upon technology and functional requirements.	K2
C03	Summarize about protection of power apparatus in plant premises & transmission line.	K2
C04	Interpret about the arcing phenomena, arc quenching in circuit breakers.	K2
C05	Compare different Circuit breaker principles & working	K2

CORRELATION OF COs AND POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L			M					L			
CO2	L		H	M					L			
CO3			M	M					L			
CO4			H	M	H		L	H	H		M	
CO5			M	L					L			

COURSE CONTENT:

UNIT I	INTRODUCTION	9
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Basic ideas of short circuit currents and relay protection; basic terminology; essential qualities of a protective relay; operating principles of relays; The universal relay; torque equation, RX diagram; CT, PT & applications

UNIT II	OPERATING PRINCIPLES AND RELAY FUNCTION	9
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Over current relays; directional over current relays; distance relays; differential relays; under frequency and negative sequence relays; Electromagnetic and solid state relays. Time – distance relay, mho relay, numerical relay

UNIT III	PROTECTION OF POWER APPARATUS	9
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Generator protection; transformer protection; bus zone protection; feeder protection; and ring main units, carrier current protection of transmission lines; Relay coordination of a sample system. Industrial power system protection, A.C.motor protection, rectifier protection.

UNIT IV	ARCING PHENOMENA AND ITS APPLICATIONS	9
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Arcing phenomena and arc quenching; circuit breaker rating RRRV; current chopping and capacitive current breaking characteristics of HRC fuses; DC circuit breaking.

UNIT V	CIRCUIT BREAKERS	9
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Oil minimum circuit breakers; air blast circuit breakers; vacuum and SF6 circuit breakers; testing of circuit breakers, oil switches, high voltage load breaking switches.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. B.Ravindranath and N.Chander, "Power Systems protection and switchgear", Wiley Eastern Ltd, 1977.
2. Badri Ram and Viswakarma, D.N., "Power System Protection and Switch Gear", Tata McGraw-Hill Publishing Company Ltd., 2001.

REFERENCE BOOKS:	
<ol style="list-style-type: none">1. C.L.Wadhwa, "Electric power systems", New Age International (P) Ltd publishers, 1983.2. S.P.Patra, S.K.Babu and S.Choudhuri, "Power systems protection", Oxford and IBM Publishing Co., 1983.3. Sunil S. Rao, "Switchgear and protection", Khanna publishers, New Delhi, 1986.4. Lewis Blackburn "Protective Relaying – Principles and applications", Second Edition, Dekker Inc., 1998.5. T.S.Madhava Rao, "Power System Protection Static Relays", Second Edition, Tata McGraw Hill, 2004	