



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

POWER SYSTEM PROTECTION								
VII Semester: EEE								
CourseCode	Category	Hours/Week			Credits	Maximum Marks		
AEEC34	Core	L	T	P	C	CIA	SEE	Total
		3	1	0	4	30	70	100
Contact Classes:45		Tutorial Classes:15		PracticalClasses:Nil		TotalClasses:60		
Prerequisite: DC Machines and Transformers, Electrical Power Transmission Systems								
<p>I. COURSEOVERVIEW: The main objective of the course is to provide an overview of the principles and schemes for protecting power lines, transformers, buses, generators. It provides in depth knowledge of various types of relays and circuit breakers. It includes protection against over voltages in power system using lightning arrestors and insulation co-ordination</p> <p>II. COURSEOBJECTIVES: The students will try to learn: I. The different types of circuit breakers. II. Relays into various types such as of electromagnetic, static and numerical relays. III. The performance of protection schemes of generator and transformer. IV. The performance of feeder and bus-bar protection. V. The protection schemes against over voltages.</p> <p>III. COURSE SYLLABUS: MODULE-I:CIRCUIT BREAKERS (08) Circuit Breakers: Elementary principles of arc interruption, restriking and recovery voltages, restriking phenomenon, average, maximum and rate of rise of restriking voltage, current chopping and resistance switching, circuit breaker ratings and specifications, auto reclosures, description and operation of various types of circuit breakers, minimum oil circuit breakers, air blast circuit breakers, vacuum and SF6 circuit breakers, numerical problems.</p> <p>MODULE-II:ELECTROMAGNETIC, STATIC AND NUMERICAL RELAYS (10) Electromagnetic relays: Principle of operation and construction of attracted armature, balanced beam, induction disc and induction cup relays; Relays classification: instantaneous, definite minimum time and inverse definite minimum time relays over current / under voltage relays, direction relays, differential relays and percentage differential relays, universal torque equation; Distance relays: Impedance, reactance, mho and offset mho relays, characteristics of distance relays; Static relays: Overview of static relay, block diagram, operating principle and comparison, static relays versus electromagnetic relays; Numerical relays: Introduction, block diagram of numerical relay, sampling theorem, anti-aliasing filter, block diagram of phasor measurement unit and intelligent electronic device, data acquisition systems and numerical relaying algorithms, applications and numerical problems.</p> <p>MODULE-III:SUBSTATIONS AND PROTECTION OF FEEDER / BUS BAR (09) Indoor and outdoor substations: Substation's layout, bus bar arrangements like single, sectionalized, main and transfer bus bar system with relevant diagrams; Gas insulated substation (GIS): Types, single line diagram, constructional aspects of GIS, Installation, maintenance, advantages, comparison of GIS with air insulated substations.</p> <p>Protection of lines: Over current, carrier current and three zone distance relay protection using impedance relays, translay relay; Protection of bus bars: Differential protection, grounded and ungrounded neutral systems, effect of ungrounded neutral on system performance, methods of neutral grounding, solid, resistance, reactance arcing grounds and grounding practices, application of numerical relays.</p>								

MODULE-IV:GENERATOR AND TRANSFORMER PROTECTION (10)

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 protections, numerical problem on design of current transformers ratio, buchholz protection

MODULE-V:PROTECTION AGAINST OVER VOLTAGES (08)

Over voltages in power systems: Generation of over voltages in power systems, protection against lightning over voltages, valve type and zinc oxide lightning arresters, insulation coordination, basic insulation level, impulse ratio, standard impulse test wave, volt time characteristics.

IV. TEXTBOOKS:

1. Sunil S Rao, "Switchgear and Protection", Khanna Publishers, 1st Edition, 2013.
2. Badari Ram, D N Viswakarma, "Power System Protection and Switchgear", TMH Publications, 1st Edition, 2001.
3. A R van C Warrington, "Protective Relays: Their Theory and Practice", Springer Science & Business Media, Volume 2, 2nd Edition, 1977.
4. B L Soni, Gupta, Bhatnagar, Chakrabarthy, "Power System Engineering", Dhanpat Rai & Co, 3rd Edition, 2007.
5. T S Madhava Rao, "Power system protection: static relays", McGraw-Hill Companies, 2nd Edition, 1989.

V. REFERENCE BOOKS:

1. Paithankar, S R Bhide, "Fundamentals of Power System Protection", PHI, 1st Edition, 2003.
2. C L Wadhwa Electrical Power Systems", New Age international (P) Limited, 6th Edition, 2010.
3. VK Mehta," Principles of power systems", S Chand Publications, 4th Edition, 2009.

VI. WEB REFERENCES:

1. <https://www.textbooksonline.tn.nic.in>
2. <https://www.freeengineeringbooks.com>
3. <https://www.eleccompengineering.files.wordpress.com>
4. <https://www.books.google.co.in>

VII. E-TEXT BOOKS:

1. <https://www.jntubook.com>
2. <https://www.freeengineeringbooks.com>
3. <https://www.bookboon.com/en/mechanicshttps://www.freeengineeringbooks.com>