GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Electrical Engineering

Subject Name : Modern Power System Protection (Power Group)

Sr.No	Course content
1.	Basic Elements of Digital Protection: Application of Numerical relays for Interconnected power system networks, Basic Components of a Digital Relay, Signal Conditioning Subsystems, Transducers ,Surge Protection Circuits, Analogue Filtering, Analogue Multiplexers, Conversion Subsystem, The Sampling Theorem, Signal Aliasing Error, Sample and Hold Circuit, Digital Multiplexing ,Digital-to-Analogue Conversion,Analogue-to-Digital Conversion ,Digital Relay Subsystem, Benefits of digital relays
2.	Relay coordination of Interconnected Power System: Protection of an interconnected system, Link net structure, Flowchart of primary/Backup relay pairs, Flowchart of Time Multiplier Setting. Examples based on existing power system network
3.	Load-Shedding and Frequency Relaying: Introduction, Rate and Frequency Decline, Load-Shedding, Frequency Relays, Induction-Cylinder under frequency Relays, Digital Frequency Relays, microprocessor-Based Frequency Relay, Formulating a Load-Shedding Scheme, Maximum Anticipated Overload, Number of Load-Shedding Step, Size of the Load Shed at Each Step, Frequency Settings, Time Delay, Special Considerations for Industrial System
4.	Reclosing and Synchronizing: Introduction, Reclosing Precautions, Reclosing System Consideration, One-Shot vs. Multiple-Shot Reclosing Relays, Selective Reclosing, Deionizing Times for Three-Pole Reclosing, Live-Line/Dead-Bus, Live-Bus/Dead-Line Control, Instantaneous-Trip Lockout, Intermediate Lockout, Factors Governing Application of Reclosing Considerations for Applications of Reclosing , Feeders with No-Fault-Power Back-Feed and Minimum Motor Load, Single Ties to Industrial Plants with Local Generation, Lines with Sources at Both Ends, Reclosing Relays and Their Operation, Review of Breaker Operation, Single-Shot Reclosing Relays, Multishot Reclosing Relays, Synchronism Check, Phasing Voltage Synchronism Check Characteristic, Angular Synchronism

	Check Characteristic.
5	.Developments in New Relaying Principles Introduction, Traveling Wave Based Protection of Transmission Lines, Frequency Based Relaying , Series Compensated Line Protection, Introduction, The Degree of compensation, Voltage Profile of Series Compensated Line, Faults with Unbypassed Series Capacitors, Relay Problems Due to compensation, Voltage and Current Inversion, Problems in reach measurement, Protection of Series compensated line, Concept of Adaptive Relaying , Fault Location Algorithms
6.	Concept of Different Relay Algorithms Introduction of different techniques, Least square based methods, Introduction, Integral LSQ fit, Power series LSQ fit, Differential equation based techniques, Basic principles, Digital harmonic filtering by selected limits, Fourier analysis based techniques, Introduction, The full cycle window algorithm, The half cycle window algorithm.

List of Reference books:

1. Digital Protection- L P. Singh
2. Protective Relaying Theory and Applications, Walter A. Elmore, Marcel Dekker Inc; New York,
3. "Protecting Relaying," Marcel Dekker Inc; New York, 1998- J. L. Blackburn
4 "Power System Relaying," John Wiley & Sons, New York, 1996- S. H. Horowitz and A. G. Phadke
5 Power System Protection, IEEE Press, Wiley Interscience, A John Wiley & Sons Inc; New York, 1999- P. M. Anderson