

M.E Semester: 1
Electrical Engineering (Electrical Power System)
Subject Name: Advanced Power System Protection (Major Elective-I)

A. Course Objective:

- This course aims to upgrade the knowledge and skills of practicing engineers and technologies involved in the protection of power system.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
MEEPS105-B	Advanced Power system Protection	4	0	2	6	5	3	70	30	20	30	150

C. Syllabus

SR No.	Unit No	Topic	No. of Hours	Weightage In Exam.
1	Unit: 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.	12	25%
2	Unit: 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.	10	20%
3	Unit: 3	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,	20	30%

		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.		
4	Unit: 4	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.	18	25%

D. Instructional Methods

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory, which may carry five marks in overall evaluation.
- Two internal exams may be conducted and average of the same may be converted to equivalent of 15 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of five marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

E. Students Learning Outcomes

- The student can identify and appreciate concepts of different types of relaying algorithm and numerical relaying.

F. Recommended Study Materials**• Text & 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, NewYork, 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

