



University of Tehran
School of Electrical and Computer Engineering

Course:	Power Systems Digital Protection		
Course type:	Main Course for Power Systems and High Voltage branch	EE*	Credit: 3
Level:	Graduate		
Co-requisite(s):			
Prerequisite(s):			
Prerequisite by topic:	Basic knowledge of power systems protective relays		
Textbook(s):	<p><i>1- M. S. Sachdev (Coordinator), "Advancements in Microprocessor Based Protection and Communication", IEEE Tutorial Course Text, IEEE PES Publication 97TP120-0, 1997.</i></p> <p><i>2- A. G. Phadke and J. S. Thorp, "Computer Relaying for Power System", Wiley, 2009.</i></p> <p><i>3- Electricity Training Association, "Power System Protection, Vol. 4, Digital Protection and Signaling", IEE, London, 1995.</i></p> <p><i>4- W. A. Elmore, "Protective Relaying, Theory and Application", CRC Press, 2003.</i></p> <p><i>5- A. T. Johns and S. K. Salman, "Digital Protection for Power Systems", IEE Power Series 15, Peter Peregrinus Ltd., England, 1995.</i></p> <p><i>6- G. Ziegler, "Numerical Distance Protection, Principles and Applications", Wiley, 2011</i></p>		
Coordinator:	Majid Sanaye-Pasand		
Goals:	<p>Become familiar with the following topics:</p> <ol style="list-style-type: none"> 1. Digital relays' structure and configuration 2. Devising appropriate digital filters to extract signals' information during power system transients 3. Designing phasor estimation algorithms to obtain signal magnitude, phase and frequency 4. Minimizing CT and CVT transient errors through designing 		

	<p>novel digital filtering methods</p> <ol style="list-style-type: none"> 5. Improving OC, distance and differential relays' algorithms and performance 6. Learning PMU structure and its protection applications 7. Devising power system wide area protection algorithms to enhance power system stability/resiliency
Outcome:	<p>Students who pass the course successfully will be able to</p> <ol style="list-style-type: none"> 1. Become familiar with digital relays' hardware and structure 2. Learn different phasor estimation algorithms 3. Study digital filters' characteristics 4. Design various digital protection algorithms for power system elements 5. Design different smart and adaptive protection algorithms 6. Learn various PMU applications in power system protection 7. Devise power system wide area protection algorithms
Topics:	<ol style="list-style-type: none"> 1- Introduction 2- Signal processing and the related hardware 3- Microprocessor based relays 4- Digital measurement and estimation algorithms of power system signals 5- Adaptive protection algorithms 6- Protective relays' digital test methods 7- Digital protection of power system elements 8- PMU applications in power system protection
Computer usage:	Running simulations by EMTP, EMTDC/PSCAD and Matlab
Assignments:	Seven assignments
Projects:	One final project
Grading:	Exercises and final project: 50% Midterm and Final exam: 50%
Further readings:	Selected papers
Prepared by:	Majid Sanaye-Pasand
Date:	November 1, 2017

*EE: Electrical Engineering CE: Computer Engineering IT: Information Technology