WASHINGTON STATE UNIVERSITY
VANCOUVER
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School of Engineering and Computer Science

ECE 461: Power System Analysis and Design
Master Syllabus

Catalog Data:	**ECE 461: Power System Analysis and Design**; 3 credits This course introduces power flow analysis, power system economics, symmetrical faults, symmetrical components, unsymmetrical faults, transient stability, and power systems analysis using commercial computer simulation software to enhance understanding in the laboratory.
Class Schedule:	Two lecture hours per week, for one semester
Laboratory Schedule:	3-hour laboratory session per week, for one semester
Prerequisites by Course:	ECE 311 or ECE 411
Prerequisites by Topic:	1. Knowledge of phasors and steady-state circuit analysis. 2. Knowledge of transmission line modeling and analysis
Typical Text:	Power System Analysis and Design, 7th Edition, J. Duncan Glover, Mulukutla S. Sarma, Thomas Jeffrey Overbye, and Adam B. Birchfield, 2022, ISBN 13: 978-0357676189
Course Coordinator:	Dr. Josue Campos do Prado
Course Objectives:	Students will: 1. Conduct power flow analysis using iterative methods (Gauss, Gauss-Seidel, and Newton-Raphson) by computer simulation software, and understand the principle of each method. 2. Understand the basic formulation of economic dispatch for fossil-fuel generating units, including the effect of generator output limits and transmission line losses. 3. Understand basic theory on symmetrical faults in power systems, three-phase short circuits, bus impedance matrix, and conduct symmetrical faults analysis using computer simulation software 4. Understand definitions of symmetrical components, characteristics of sequence networks, series impedance, three-phase lines, rotating machines, and transformers. 5. Perform fault analysis for unsymmetrical faults (single-line-to-ground fault, line-to-line fault, double-line-to-ground fault) using computer simulation software, and understand the principle of the fault analysis. 6. Conduct the transient stability study using computer simulation software, and understand basic theory of transient stability, the swing equation, simplified synchronous machine model and system equivalents, equal area criteria. 7. Understand the concepts of power system control systems, including generator-voltage control, 8. load-frequency control, economic dispatch and optimal power flow 9. Obtain practical skills on power systems analysis using commercial computer simulation software through project assignments. 10. Practice report writing skills for power system analysis projects.

Topics Covered:		1. Power flows 2. Power system economics and optimization 3. Symmetrical faults 4. Symmetrical components 5. Unsymmetrical components 6. Power system stability 7. Power system controls		
Lab Experiments and Activities:		1. Introduction to Power World 2. Power flow analysis 3. Power system upgrades 4. Economic dispatch 5. Security-constrained optimal power flow 6. Electricity market auctions 7. Transient stability		
Course Outcomes:	Students will be able to:			
	Assessed for Program Outcomes	1.c. Use appropriate power system models to formulate solutions. 1.d. Apply circuit theory to solve power system problems. 2.d. Produce solutions that meet specified needs for engineering designs considering risks and trade-offs. 6.b. Use software tools for power system analysis and design. 6.c. Conduct analysis and interpretation of the data. 6.d. Draw conclusions by evaluating experimental results with respect to power systems knowledge.		
	Other	2.a. Define engineering problems from specified needs for power systems. 2.c. Analyze power systems with safety, social, environmental, and economic factors and constraints. 4.a. Evaluate power systems solutions considering the global, economic, environmental, and societal impacts.		
Relationship of Course to Program:		Meets: Educational Objectives 1, 2, 3, 4, 7 Program Outcomes 1, 2, 4, 6		
Prepared by:		Dr. Josue Campos do Prado	Date:	Apr. 20, 2022
Approved by CAC:				