

## ***EE 531: Power System Network Modeling and Analysis -(3 credits )***

### **College of Engineering Klipsch School of Electrical and Computer Engineering New Mexico State University**

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Date and Time: Fall 2004 Class T-Th 8:55AM-10:10AM  
Room: Milton 169 ← Note room change  
Instructor: Satish J. Ranade  
Office Hours: T&B112 T-TH 2PM-3PM or by appointment  
Phone: 505 646 3704  
e-mail: [sranade@nmsu.edu](mailto:sranade@nmsu.edu) Start subject line with EE533 please.  
Internet: <http://www.ece.nmsu.edu/~sranade>

#### **Course Description from the Graduate Course Catalog**

*Previously titled "E E 531. Formulation of Power System Problems 3 cr. Development and analysis of fast computational methods for efficient solution of large scale power-system problems. Algorithms for constructing the bus impedance matrix; sparse matrix techniques; partial-inverse methods; compensation of mutual coupling. Corequisite: E E 493."*

*New Title "Power System Network Modeling and Analysis" Development and efficient solution of large-scale computational problems relevant to power systems. Corequisite: EE 493*

#### **Co-requisite: EE 493 Textbook and other Required Materials:**

#### **Text and Resources:**

Mariesa Crow "Computational Methods for Electric Power Systems", CRC Press, Boca Raton, FL, 2002  
ISBN 0-8493-1352-x 9000

Access to software such as Matlab, Mathcad, or Visual Basic

#### **Course Objective:**

This is the first graduate course in power systems sequence. In this course we will bring together a lot of the theoretical material needed for advanced power system modeling, computation and analysis. We will develop more general models for system components and networks. Anticipating that the application domain is a *large* power network, we will introduce computational methods suitable for large-scale systems. We will tie the theoretical material back to power system analysis by applying the techniques to standard problems, namely, power flow, short circuit, stability and network transients. Although major software development will not be undertaken, projects will be assigned to illustrate how the techniques are applied in practice. Access to Matlab, Mathcad, or Excel/Visual Basic will be needed to complete these projects. Subsequent classes in the graduate power system sequence will build upon the knowledge gained here in both theoretical and applied settings.



**Course Outline:**

No.	Week	Topic	Chapter	Homework
1	1-3 (8/24)	ac power network problems – power flow and short circuit analyses, stability analysis, network transients – Definition and characterization of the nodal problems: formation of $Y_{bus}$ , $Z_{bus}$ and physical interpretation	Notes,1	
2	4-7 (9/13)	Phase domain modeling --transmission-line modeling using Carson's equations; three-phase transformer modeling; synchronous and induction machines. Relationship to symmetrical-component based methods.	Notes	
3	8-9 (10/11)	Solution of large sets of linear and nonlinear network equations for power network studies. Applications in power-flow and short-circuit studies.	2-3	
4	10-11 (10/25)	Overview of sparse matrix methods.	4	
5	12-13 (11/8)	Numerical Integration. Application to stability analysis and network transients.	5	
6	14-15 (11/23)	Optimization problems	6	

**Students with Disabilities:**

If you have or believe you have a disability, you may wish to self-identify. You can do so by providing documentation to the Office for Services for Students with Disabilities, located at Garcia annex (phone 646-6840). Appropriate accommodations may then be provided for you. If you have a condition which may affect your ability to exit safely from the premises in an emergency or which may cause an emergency during class, you are encouraged to discuss this in confidence with the instructor and/or the director of Disabled Student Programs. If you have general questions about the Americans with Disabilities Act (ADA), call 646-3635.

**Prepared by:** Satish J. Ranade, August 1, 2004

**Notes:**

- 0. Collaboration on Homework Assignments/Projects/Summaries is permitted.
- 1. Do not provide or seek help from others on Tests.

Violation of rule 4 will result in an automatic "F" grade and a recommendation for suspension.

GRADING POLICY

Homework	Assigned each lecture, due following Tuesday	20%
Tests	3	60%
Projects		20%

The grading scale is absolute 90 - 100 = A, 80 - 89 = B, 70 - 79 = C, 60 - 69 = D, < 60 = F

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 Late homework Policy: Unless prior arrangements are made, *Late Homework Will Not Be Graded*. However you will be given 50 % of the credit if you turn homework in prior to the next scheduled test.  
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