09/10

SACRAMENTO STATE

Course Change Proposal
Form A

SACRAMENTO STATE
MAY - 6 2009
ACADEMIC AFFAIRS

Academic Group (*College*):	Academic Organization (*Department*):	Date:
Engineering and Computer Science	Electrical & Electronic Engineering	April 20, 2009
Type of Course Proposal: New _x_ Change ___ Deletion ___	**Department Chair:** Suresh Vadhva	**Submitted by:** Turan Gonen/ Mohammed Vaziri
Does this course fulfill a requirement for single-subject or multiple subject credential students? Yes ___ No _x_	**For Catalog Copy:** Yes _x_ No ___ **CCE (*Extension*):** Yes ___ No _x_	**Semester Effective:** Fall _x_ Spring ___, 2009

This course replaces experimental course Subject Area *(prefix)* **and Catalog Nbr** *(course number)*:	
If changing an existing course, should new version be considered a repeat of the original version? If so, the same Course ID will be maintained. If not, a new Course ID will be assigned. Note: In PeopleSoft terminology, the Course ID is the unique system identifier, not the Catalog Nbr.	Yes ___ No ___

Change from:

Subject Area *(prefix)* & Catalog Nbr *(course no.)*:	Title:	Units:

Change to:

Subject Area *(prefix)* & Catalog Nbr *(course no.)*:	Title:	Units:
EEE 255	Future Power Systems and Smart Grids	3

JUSTIFICATION:

This is a new course in future power systems and smart grids. This course will help students understand and design smart power grids for use in present and future power systems. In addition, students will learn skills needed to develop research projects in this field.

NEW COURSE DESCRIPTION: (Not to exceed 80 words, and language should conform to catalog copy. See http://www.csus.edu/umanual/acad.htm - Guidelines for Catalog Course Description

Future power systems from component and system perspectives. Smart grids, micro-grids, and interactive power systems using renewable resources and energy storage elements. National standards for certification of distributed generation involving machine-based and inverter-based technologies. Essential elements of advanced sensing, communications and information technology and their roles in adaptive automation, control, protection, and security.

Note:

Prerequisite: EEE 250, EEE 141, EEE 146, and EEE 180 or instructor permission
Enforced at Registration: Yes_x_ No___

Corequisite:
Enforced at Registration: Yes___ No___

Graded: Letter _x_ Credit/No Credit___	**Instructor Approval Required? Yes___ No_x_**
Course Classification *(e.g., lecture, lab, seminar, discussion)*: Lecture	**Title for CMS (not more than 30 characters)** Future Power Sys & Smart Grids
Cross Listed? Yes ___ No_x_	**If yes, do they meet together and fulfill the same requirement, and what is the other course.**

How Many Times Can This Course be Taken for Credit? _1_

Can the course be taken for Credit more than once during the same term? Yes ___ No _x_

FOR NEW COURSE PROPOSALS OR SUBSTANTIVE CHANGES ONLY:

Description of the Expected Learning Outcomes: Describe outcomes using the following format: "Students will be able to: 1), 2), etc." See the example at http://www.csus.edu/acaf/example.htm

Students will be able to:

1. **Describe the major objectives of power systems of the future.**
2. **Use distributed renewable resources, energy storage elements, smart metering, automatic and adaptive distributive protection, and system switching to design smart power systems.**
3. **Integrate peripheral elements of advanced sensors, communication links, computer, and secure internet technology.**
4. **Utilize and implement "Vehicle to Grid," Demand Response," and "Adaptive Control and Switching."**
5. **Analyze the benefits and driving incentives for implantation of proposed smart grids.**

**Attach a list of the required/recommended course readings and activities [Note: it is understood that these are updated and modified as needed by the instructor(s).] This attachment should be forwarded only to your Dean's office, not Academic Affairs.

Assessment Strategies: A description of the assessment strategies (e.g., portfolios, examinations, performances, pre-and post-tests, conferences with students, student papers) which will be used by the instructor to determine the extent to which students have achieved the learning outcomes noted above:

Students will be required to take quizzes, a midterm, and a final to assess their performance. A project consisting of a written proposal, research, and presentation will be required to encourage teamwork.

For whom is this course being developed?
Majors in the Dept _x__ Majors of other Depts ___ Minors in the Dept ___ General Education ___ Other ___
Is this course required in a degree program (major, minor, graduate degree, certificate? Yes __ No _x__
If yes, identify program(s):

Does the proposed change or addition cause a significant increase in the use of College or University resources (lab room, computer facilities, faculty, etc.)? Yes ___ No __x__
If yes, attach a description of resources needed and verify that resources are available.

Indicate which department or programs will be affected by the proposed course (if any). EEE

The Department Chair's signature below indicates that affected programs have been sent a copy of this proposal form.

Approvals: If proposed change, new course or deletion is approved, sign and date below. If not approved, forward without signing to the next reviewing authority, and attach an explanatory memorandum to the original copy.

Signatures:	**Date**
Department Chair: John Olalekan (For S.V.)	5/5/09
College Dean or Associate Dean: John Olalekan	5/5/09
CPSP *(for school personnel courses ONLY)*	
Associate Vice President and Dean for Academic Programs CONDITIONAL APPROVAL	5/11/09

Distribution: Academic Affairs (original), Department Chair and College Dean. Dean's Office to send original after approval to Academic Affairs, at mail zip 6016. An electronic copy must also be sent.

9/10/2008

EEE 255 – Introduction to Future Power Systems and Smart Grids

Catalog Description:

Future power systems from component and system perspectives. Smart grids, micro-grids, and interactive power systems using renewable resources and energy storage elements. National standards for certification of distributed generation involving machine-based and inverter-based technologies. Essential elements of advanced sensing, communications and information technology and their roles in adaptive automation, control, protection, and security.

Prerequisites: EEE250, EEE141, EEE146, EEE180 or instructor permission

Text:

Power Electronics in Smart Electrical Energy Networds (Power Systems), Ryszard Strzelecki, Grzegorz Benysek – Springer, 2008. Required

Instructor's notes and handouts, and published journal articles, IEEE publications and conference papers will be used.

Additional Resources:

1 - Power Generation, Operation, and Control, 2nd Edition, Allen J. Wood, Bruce F. Wollenberg – J. Wiley & Sons Inc. 1996 - Optional

2 – Power Electronics – Converters, Applications, and Design, 3rd Edition, Ned Mohan, Tore M. Undeland, William P. Robbins, J. Wiley & Sons Inc. 2003 - Optional

Course Objectives:

The course introduces the main objectives of the power systems of the future. Concepts of self-healing, use of distributed renewable (clean energy) resources, energy storage elements, smart metering, automatic and adaptive distributed protection, control, and system switching based on the latest national standards are introduced and analyzed. Integration of peripheral but essential elements of advanced sensors, communication links, computers, and secure Internet technology are discussed and utilized for proposed modeling and analyses. The latest proposed plans for utilization and implementation of "Vehicle to Grid," "Demand Response," and "Adaptive Control and Switching" for sample systems of the participating utilities are solicited, investigated, and studied. Major benefits and driving incentives for implantation of proposed smart grids are defined and identified through comparative analyses with current systems.

Prerequisites by Topic:

1. Basic circuit theory and transient analysis.
2. Analysis of balanced 3-phase power systems.
3. Basics of power electronics and inverter based generation units.
4. Basics of communication systems and signal processing .
5. Basics of controls and logic design
6. Basics of computer programming and data processing.

Topics Covered:

1) Review of current designs and objectives of present-day power systems.
2) Analysis of the concepts and standards for utilization of distributed renewable (Clean Energy) resources and energy storage.
3) Review and analyses of major objective for smart grids, such as "Self Healing, & Adaptive," "Demand Response via Consumer and Market choices," "Real Time Sensing, Control, and Operations," "System Security and Attach Tolerance," "Predictive and Dynamic Equipment Ratings for Optimal Real Time Power Flows," "Interconnection, Control, and Operation of Distributed Generation," "Automatic VAR and Voltage Controls via Synchronized Sensors and Stochastic Forecasting tools."
4) Review of substation automatic schemes, remedial action schemes (RAS), load shedding schemes, and automatic fault detection and system isolation schemes. Review and analysis of sample schemes used by major utilities in western United States and Canada.
5) Review and analysis of design and operational criteria requirements for large power systems set by major regulatory agencies such as Federal Energy Regulatory Commission (FERC), North American Electric Reliability Corporation (NERC), Western Electricity Coordinating Council (WECC), etc. and their impacts on the power systems of the future.

Evaluation:

Homework (10%)
Quizzes (10%)
Mid-term (30%)
Final (30%)
Project (20%) consisting of a written proposal, research, and a presentation, where team work is encouraged and promoted.

Course Outline/Schedule

Week	*Topic*
1	Review of basic theory & general concepts
2	Review of balanced 3-phase power flows and operations
3	Review power system generation interconnections and controls
4	Present -day load-frequency controls (LFC) and operations
5	Review of sym. components and power system protection and present day "anti islanding" schemes and certifications
6	Fault detection and automatic reclosing practices
7	Interconnection criteria and operations of micro-grids as building blocks for smart grids
8	Midterm examination
9	National standards for interconnection and operation of renewable (clean energy) resources
10	Inverter-based distributed generation and energy-storage devices
11	Advanced sensing/measuring, phasor measurement units (PMU), and related applications,
12	System stability concerns, remedial action schemes (RAS), adaptive VAR control & switching, based on real time power flows
13	Supervisory control and data acquisition (SCADA) systems
14	Communication systems, computing requirements, and application software for implementation
15	Review of FERC, NERC, WECC, etc. reliability criteria and associated impacts on implementation of future smart grids