Kingdom of Saudi Arabia Ministry of Higher Education **Qassim University** College of Engineering		**المملكة العربية السعودية** وزارة التعليم العالي **جامعة القصيم** **كليه الهندسه**

Power Systems Operation

College: Engineering

Department: Electrical

First: Course Definition

1- Course Code: EE 643

2- Units: 3 credit hrs

3- Level: 3rd

4- Prerequisite:

5- Co-requisite:

6- Location (if not on main Campus):

Second: Course Objectives

- Be acquainted with the main concepts of power system operation.
- Understand how to operate a power system economically
- Understand the operation of AGC, EMS & Control Centers
- Be able to assess the power system security level.
- Understand the methods of optimal power flow.
- Understand the basic concept of voltage stability
- Be acquainted with the methods used to enhance the power system operation against voltage instability

Third: Course Description

1- Topics to be covered

Subject	No of Weeks	Units
1. Introduction to the Concepts of Power System Operation	1	3
2. Optimal Dispatch problem: - Formulation of economic dispatch problem	٢	6

- Solution Methods (Lagrange method, Lambada, iterative method)		
3. Optimal Power Flow -Formulation of optimal power flow -Solution of the optimal power flow • Linear Sensitivity analysis • Linear programming methods - Security-constrained optimal power flow	3	9
4. Operation of AGC, EMS & Control Centers: - Models of Generator, Load , Prime Mover and Governer - Generation Control and AGC Implementation - An Introduction to EMS and Control Centers Operation	3	9
5. Power Flow Control: - An overview of power system control - Introduction to FACTS Devices - Methods used for power flow control	3	9
6. Power System Voltage stability. - Basic Concept of voltage stability - Voltage stability indices - Preventive and corrective control against voltage instability	3	9

2- Course components (Total hrs in the Semester): 45

Lectures	Exercises	Other
45	----	----

3- Intended Learning Outcomes of the Course (ILO's)

a. *Knowledge*

i) Description of the knowledge to be acquired:

- Basic concepts of power systems operation.
- Fundamentals of economical Operation and control of power generation systems.
- The basic operation of AGC, EMS and control center.
- The role of OPF in the enhancement of system operation in normal and emergency states
- Practical analytical indices used to assess voltage stability
- Preventive and corrective control strategies for the power system secure operation
- Types of FACTS devices and their role in the power flow control

ii) Teaching strategies to be used to develop that knowledge

- Lectures.
- Group discussion in the Class

- Assignments at home
- Case study Report (internet search, and reporting)

iii) Methods of assessment of knowledge acquired

- Exams.
- Quizzes.
- Case study reports**.**
- Group Discussion

b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

- Ability to use the exiting simulation tools to analyze and simulate an operation power system network.
- Ability to solve economical and practical problems, using mathematical optimization tools

ii) Teaching strategies to be used to develop these cognitive skills

- Lectures
- Discussions in the Class
- Case study Report (data collection, Internet search, and reporting)

iii) Methods of assessment of students' cognitive skills

- Seminars and presentations.
- Term projects.
- Written reports.

c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be developed

- Having responsibility for own learning
- Ability of group participation, leadership (Team work)
- Ability to act responsibly-personal and professional

ii) Teaching strategies to be used to develop these skills

- Reports.
- Term team projects.
- Presentations and seminars

iii) Methods of assessment of students' interpersonal skills and capacity to carry responsibility

- *Evaluation of the team* projects.
- Written reports.

- Students' seminars and presentations.

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

- Literature search.
- Problems numerical modeling.
- Utilization of computer applications in analysis and design.

ii) Teaching strategies to be used to develop these skills

- Class lectures.
- Case studies analysis.
- Computer lab sessions.
- Term projects.

iii) Methods of assessment of students numerical and communication skills

- Term projects.
- Written reports.
- Students' seminars and presentations.

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required

- NA

ii) Teaching strategies to be used to develop these skills-

- NA

iii) Methods of assessment of student's psychomotor skills

- NA

4- Student Assessment Schedule

Serial	*Assessment tool (test, group project, examination etc.)*	*Week due*	*Weight*
1	Quizzes	5th, 10th	10 %
2	Mid Term Exam -1	7th	15 %
3	Case study report	10th	10 %
4	Term Project – 1	13th	15 %
5	Final Exam	16th	50 %

5- Student Support

- Providing electronic library for references and scientific periodicals.
- Providing the necessary computer applications for the course.
- Arrangements for availability of faculty for individual student consultations and academic advice.

6- Learning Resources

i) Essential Books (References)

- X Allen J. Wood and Bruce F. Wollenberg (1996): Power Generation Operation and Control (2nd Edit), John Willey & Sons, Inc.

2. John J. Grainger and William D. Stevenson, Jr. (1994): Power System Analysis, McGraw-Hill. Inc.John

ii) Course Notes Course materials are uploaded on the College Web-Site (www.qec.edu.sa) to be available for the students.

iii) Recommended Books

- Saadat, " Power System Analysis", McGraw Hill.

iv) Electronic Books & Web Sites:

- Scientific journals and forums.

v) Periodicals

IEEE power engineering society concerned periodicals

7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Students' Questionnaires,
- Observing the students opinions recorded in the college student site
- Appeal box

- Carrying out extensive questioners by a sample of the distinguished students just after the graduation from the college.-

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Instructor report
- Public faculty seminars.
- Periodical review of the teaching methods by both the department council and the education affairs vice dean.-

iii) Processes for Improvement of Teaching

- Evaluation of the course outlines by external staff member from outside the university.
- Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.

iv) Processes for verifying standards of student achievement

- Check marking by an independent faculty member of a sample of student work.
- Periodic exchange and remarking of a sample of assignments/exams with a external evaluator.

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university),
- Consequently, actions are to be taken to improve the course delivery when necessary.
- Review of the course objectives, outcomes and curriculum every 2 years.