SYLLABUS

EE 5310, EE 6310 Power System Operations

Spring 2024

Instructor:
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Professor
Department of Electrical and Computer Engineering
Office A-339
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Class Hours and Location: Tuesday, Thursday 12 PM — 1:20 PM at Liberal Arts Building 211

Online Office Hours: **Monday 1 PM to 2 PM** (via MS TEAMS online)

(For other times, by email appointment. Always write in the subject line *"EE5310 or EE6310 PSO: your query"* while communicating using your UTEP email ID; also, see Section III)

- **AI and Machine Learning Coordinator:** Oscar Acosta osacosta@miners.utep.edu and Sajedeh Darvishi Niafenderi sdarvishin@miners.utep.edu.
  Office hours: **Oscar** (T, R, 10:30 am to 11:30 am at MS Teams, and for other times by email appointment), and **Sajedeh** (T, R, 3 pm to 4 pm at MS Teams, and for other times by email appointment). In-person office hours will be arranged upon request.

- **Power World Simulator Coordinator:** Travis Newbolt tmnewbolt@miners.utep.edu
  Office hours: Travis (T, R, 9 am to 10 am at MS Teams, and for other times by email appointment). In-person office hours will be arranged upon request.

I. COURSE GOAL AND DESCRIPTION

This course aims to (1) provide students with a perspective on today's modern power system structure, and (2) train the students to look at technical issues of power system operations simultaneously with the economic aspects. Starting with a background of electric power industry, this course will focus on topics related to *power system economics and deregulation, why is restructuring of electricity industry necessary? what are the components of restructuring? how is the new structure different from the old monopoly? short-term planning and operation issues, electricity market and market power analysis, power system forecasting, scheduling, and optimization problems, economic load dispatch, and wind power integration and market operations.*

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- **Prerequisites:** Engineering Mathematics, Calculus, Electric Circuits, Knowledge of MATLAB, Energy Conversion, or Departmental and/or Instructor approval.

II. COURSE LEARNING OUTCOMES

The students will have basic understanding of Power System Planning and Operations. The course learning outcomes will be:

- At the completion of the course, students should be able to understand the structure and techniques of market operations in deregulated electric power systems.
- Student will have an understanding of wholesale electricity markets including power system forecasting problems and techniques including fundamental of power system operations.
- Understanding of power system scheduling and optimization problems.
- Be able to apply fundamental concepts to solve application problems.
- Be able to independently study an advanced material and present the findings to others.
- Classroom discussion and final project submission will prepare the students to have a better understanding of power & energy systems engineering.
- Final report preparation will enhance the technical paper writing capability of the students.
- Knowledge of mathematical modeling, machine learning/artificial intelligence and optimization techniques.

III. HOW WILL STUDENT CONTACT INSTRUCTOR?

- Student can visit me during the online office hours via MS Teams.
- In-person meeting will be conducted upon request.
- If you are unable to visit during office hours, you need to send an appointment email and we will set up a meeting schedule, e.g., via MS Team.
- While sending email, always write in the subject line **"EE 5310 or EE 6310 PSO – your query".**
- **Note:** <u>you must use your UTEP email ID</u> while communicating with me to receive my response.

IV. COURSE RESOURCE AND REFERENCE

Lecture Notes provided by the instructor.

<u>References/Resource Material</u>

- Mohammad Shahidehpour, Hatim Yamin, and Zuyi Li, "*Market Operations in Electric Power Systems: Forecasting, Scheduling, and Risk Management*," 2002, Wiley-IEEE Press.
- A. J. Woods and B. F. Wollenberg, *Power Generation, Operation, and Control*, 2nd ed., John Wiley & Sons, 1996.
- Advances in Electric Power and Energy Systems: Load and Price Forecasting, Wiley-IEEE Press, July 2017, Edited by M. E. El-Hawary.
- Research papers assigned by the instructor.

V. COURSE FORMAT

The class is scheduled to meet twice a week from 12 PM — 1:20 PM every Tuesday and Thursday during the term. The course format includes lectures, project work, class discussions, presentations, quizzes, exercises, problem formulation, exams, video clip, etc.

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VI. GRADING POLICY

Grades will be given based on following distribution:

Assignments	30%
Quizzes	10%
Exams	30%
Individual Term Project/Simulation and Reports Submission	30%
Total	**100%**

As a general case, grades will be given as follows:

90-100 ➔ A
80-89 ➔ B
70-79 ➔ C
60-69 ➔ D
59 or below ➔ F

VII. COURSE TOPICS

- Overview of Power Grid
- Power System Deregulation
- Introduction to Power System Economics
- Market Overview in Electric Power Systems
- AI and Machine Learning (ML) Applications to Power System Forecasting Problems
- Short-Term Electricity Load Forecasting
- Power System Optimization and Economic Load Dispatch
- Electricity Pricing: Volatility, Risk and Forecasting
- Solar PV Power and Wind Power Forecasting and Market Operations
- EV load patterns and forecasting
- Price-Based Unit Commitment
- Market Power Analysis

Note: There will be several in-class presentations on related topics (papers chosen from Journal or Conference)

Disclaimer: Syllabus may subject to change within reasonable limits according to instructor's discretion. Any changes will be announced in the class.

Policy for Make-up exams/quizzes/presentations: There will be NO MAKE-UP exams, quizzes, presentations, assignments.

- **Students are expected to check the Blackboard and E-mail frequently (at least thrice a day) for course materials and related information to adopt with the online teaching material.**

VIII. ASSIGNMENTS AND CLASS PARTICIPATION

This is largely a skill course. So, it is important to attend class, read all assignments, and participate in class activities and discussions that include asking questions, answering other students' questions and ability to lead discussion in class. I will distribute a sign-in sheet to keep track of attendance and keep a diary to make note of your significant class participation. Students will be responsible for the material covered in the class in case of an absence.

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Assignments (or Homework) will be posted online or informed via email/blackboard. Assignments could be theoretical, or numerical problems, or reading research paper (on related topic), etc. Students are expected to complete the assigned work in a timely manner demonstrating a professionally high standard. Instructions for submission of assignments will be provided. Late homework submission is not encouraged. ***If you submit an assignment late (after the due date and time), it will be graded out of 60%, i.e., you will instantly lose 40% points or as per the information available on each assignment.*** If you fail to submit an assignment, you will receive zero *(no homework will be accepted after a week from the due date or as per the information available on each assignment).*

Students are highly expected to follow the assignment/homework format (or template) provided by the instructor.

IX. QUIZZES

- Students are expected to always be up to date with the lecture materials that are covered.
- There will be several quizzes, which will not be announced in advance.
- Always be ready for the surprise quizzes throughout the semester. No make-up for the missed quizzes. See Section X in case of pressing circumstances.
- **You may be expected to submit your quiz online (to blackboard) via scanning your document ➔** You can use **AdobeScan app or OfficeLens** (available for iphone and android), or **CamScanner** (good if you have iphone). The app allows to scan documents and e-mail or upload them in different format. Your handwriting should be clear and readable. If you take photo, make sure there is a clarity. If you have other means of scanning document, you are welcome.
- **Important Notes: carry your own scanner and stationary items. For fair assessment, you must carry your own device to scan your document as well as other necessary stationary items such as calculator, pencil, pen, eraser, etc.** In other words, you must carry these items to every lecture. You are NOT allowed to share your scanner and any items to your classmate(s). If you share, both giver and receiver will receive zero point on that particular quiz without any further discussion.
    - If you forget to bring your scanner to the class (for example, if your quiz solutions have to be electronically uploaded into the course blackboard), your hard copy of quiz solutions will be accepted, but with 5 points reduction, and you will be asked to upload your scanned solutions later into the blackboard.
- **Students should remain fully silent throughout the quiz period.** If any student(s) are seen talking to each other, irrespective of any reason, the involved students will receive zero point on that particular quiz without any further discussion. There will be NO MAKE-UP quiz.

X. EXAMS

There will be closed book exams. Detail will be provided prior to each exam. There will be NO MAKE-UP quizzes, exams, assignments, etc. However, in case of pressing circumstances, e.g., student having medical reason (evidence required from doctor) or military duties (with advanced notification) or compassionate reasons should inform the Instructor by sending email in advance prior to lecture **or** in emergency (i.e., in case a student is unable to inform the instructor in advance due to medical reason about his/her absence), the student must inform the instructor on the same week by Friday 5pm via email

with evidence (from doctor) as attachment. Compassionate reasons do not include student's business travel, personal travel, vacation, car problem, your work schedule, etc. *The main objective of assignment/HW/quizzes is to help students prepare towards the exams.*

- **Students should remain fully silent throughout the exam period.** If any student(s) are seen talking to each other, irrespective of any reason, the involved students will receive zero point on that particular exam without any further discussion. There will be NO MAKE-UP exam.

XI. INDIVIDUAL TERM PROJECT

This part of the course is very important as it demonstrates the student's ability to perform research based on the theoretical knowledge delivered in the class. *Research project (or Term Project)* will be in an individual effort. Students should be able to demonstrate a good understanding of power system planning and operations through the project using software (e.g., MATLAB, Python, PowerWorld Simulator) or students to receive approval from instructor if they want to use other software or power system tool. Your contribution could be in the form of developing algorithm, simulation results and analysis, or software deliverables. Details will be provided prior to term project.

Each student will also submit a hard copy of the final report as well as self-written software code, e.g., but not limited to, **.m file** of MATLAB. Your *Term Project's* grade will depend on the technical content of the report, simulation results and analysis, your understanding, your original contribution, and quality of the report. A template for writing the report will be provided.

The final report of the project (only the best chosen) might take the form of an IEEE conference paper. Students are highly expected to follow the Term Project format (or template) provided by the instructor in order to avoid any impact on the grade. More information on the *Term Project* will be distributed later in the semester.

XII. CALCULATOR POLICY

Students can use only a **basic scientific or non-programmable calculator** during the quizzes and exams. The **programmable and/or large screen calculator,** which usually has stored program (or storing functions), programmable functions, graphing functions, etc., **is NOT allowed during the quizzes and exams.**

For any confusion about calculator policy, students can check with the Instructor to confirm about the use or permission of their calculators, however, it is recommended to do so as early as possible. If a student comes to the Instructor just a few minutes before the Exam/Quiz in order to confirm the use of his/her calculator, and if his/her calculator does not comply with the calculator's policy, it is his/her responsibility to manage the calculator complying the policy. Furthermore, a particular Exam/Quiz will be voided if a student is violating the calculator policy. In such case, that particular student will receive either zero on that Exam/Quiz or may have to retake Exam/Quiz, which will be decided by the instructor. Moreover, it is also the students' responsibility to check the battery and the functioning of the calculator before they appear to the quizzes and exams. NOTE: you are recommended to bring your own calculator to every lecture.

XIII. Effort, Etiquette, and Classroom Environment and Policies

- Arrive in the class before the lecture starts.
- Part of being a professional is being on time and being prepared to do your job.
- Arriving in class late and leaving early will be considered disruptive. Inform the instructor ahead of time if you must leave early and sit near the door to minimize disruptions.
- Bring a basic scientific calculator. You will need it frequently.
- Have an active participation in class activities. Ask questions, your fellow students will also benefit. Read the course materials in regular basis.
- **There is a NO FOOD POLICY** *(except for water, coffee or soft drinks)* in the classroom. Student found eating solid food will be politely asked to leave the class. Do your personal business before or after the lecture hours.
- **NO CELL PHONE POLICY:** During the lecture hours, please keep your cell phone completely switched off or in silent mode if urgent. In case of urgency (during lecture hours), you can leave the classroom to make a phone call, text messages, etc., and can rejoin the class, however, do not use your cell phone inside the classroom. If a student is found leaving and entering the class several times during the lecture, it will also not be acceptable. It is highly recommended to do your personal things before the lecture starts or after the lecture. Student violating cell phone policy will receive 10-point reduction at the final grade.
- **LAPTOP and E-Tablet Policy:** In the classroom, you can use your laptop or IPAD or e-tablet for browsing lecture materials or for writing notes or anything purely related to the course only. However, any student caught facebooking, texting, chatting, browsing irrelevant material, etc., will be asked to leave the class immediately, and the student will also receive 10-point reduction in the final grade

NOTE: Student who is not following the aforementioned policies will be asked to leave the class immediately and can also be dropped from the course.

XIV. Institutional Policies

Academic Honesty:

Cheating is unethical and not acceptable. Plagiarism is using information or original wording in a paper without giving credit to the source of that information or wording: it is also not acceptable. Do not submit work under your name that you did not do yourself. You may not submit work for this class that you did for another class.

If you are found to be cheating or plagiarizing, for example, but not limited to, in quiz, exam, software codes in MATLAB or other software, report submission, etc., you will be subject to disciplinary action, per UTEP catalog policy.

- Plagiarism, Cheating, and Academic Dishonesty are unacceptable and will NOT be tolerated.
- Student who is caught cheating/plagiarizing will receive a **failing grade** as well as additional disciplinary measures by the University.
- Any case involving academic dishonesty will be referred to the Engineering Dean's Office and the Office of the Dean of Students. See the Office of the Dean of Students' home page.
- Please review the statements below and UTEP's web page on Policy on Academic Integrity and Academic Dishonesty at http://sa.utep.edu/osccr/academic-integrity/

Center for Accommodations and Support Services (CASS):

If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

XV. ILLNESS PRECAUTIONS

Please stay home if you have symptoms of a communicable illness. If you are feeling unwell, please let me know as soon as possible so that we can work on appropriate accommodation.

XVI. SOME OTHER IMPORTANT NOTES

- **Disclaimer:** Syllabus (that includes any content) may subject to change within reasonable limits according to instructor's discretion. Any changes will be announced in blackboard or in the class.
- **Students are expected to check the blackboard frequently** *(at least **three times** daily)* for course materials (e.g., Syllabus, Lecture Notes, announcements, etc.) and related information.
- **Students should also be checking emails frequently** *(at least **three times** daily)* as instructor can communicate via email.
- Usually, the instructor sends email to all students keeping them in Bcc if it will be a group email.
- **Email Communication with a particular student: (1)** Instructor may send an email to a particular student to set up an online meeting or for any course related matter, and that student is supposed to answer the instructor's email as soon as possible *(which is Email-1)*. **(2)** If the student does not reply to Email-1 within 24-hour period *(as students are expected to check email thrice a day*), the instructor will send a reminder email *(which is Email-2)*. **(3)** If that student still does not reply to Email-2 within 2-business-day, there may be an impact on that student's grade.
- **Important note about Grade:** Grades are earned by students.
- Students are supposed to contact instructor in advance for any query.

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