ECE 461(3Cr) /462(1CR) Power System  
Fall 2014 Schedule and Grading  
Tues. August 26th to Thur. Dec 11th  
SEE http://www.calendar.colostate.edu/  

Class Time: Tuesday and Thursday 12:30 – 1:45 PM in D102 (Physics wing).  
Instructor: Prof. George Collins, Email: gcollins@engr.colostate.edu  
Divide yourselves into THREE student groups for doing HW, PSSE Labs, Pop Quizzes and Talks # 1 and #2. Do this ASAP and give the list of group members to both me and the TA. Our TA will set the assignment and due dates for 462 portion of the course.  
Send REVISED PPT slides for BOTH class talks to Prof Collins, again for both Talks  
GRADER: Fathalla Eldali: mfat1985@rams.colostate.edu  
Send all HW sets, Pop Quizzes, PSSE exercises, 462 motor labs and WORD Papers for both group in-class talks to him.  
If you are entertaining a job in Power here is a website for you with an 18 minute video from IEEE that provides an overview of power engineering: Happy Viewing http://www.ieee.org/portal/ieeetv/viewer.html?proglID=70345  
Text Book: Electrical Machines, Drives and Power Systems, Theodore Wildi  
Class website: http://www.engr.colostate.edu/ECE461  
COURSE OBJECTIVES  

This course will teach basic power generation, transmission and distribution, with the perspective of INCREASED energy efficiency in both generation and consumption of electrical energy. As motors consume >60 % of grid power more efficient motor designs and motor drives will be addressed. As well we will cover as the increased role of emerging alternative sources of electrical energies and the challenges to grid stability and load cycle problems these proven to be very variable sources bring to a stable grid. A move to all electric cars or even hybrid vehicles would save significant energy, due to the inefficiency of internal combustion engines, but only if we optimize car electric motors and motor drives. This course will discuss all these emerging issues and more.  
The materials in this class each year are 1/4 new. A lot of changes are occurring in the power industry and I want to inform you so you can better get a job. Hence I judge you should know the hidden sign “461 course under construction- pardon our appearance”
The class notes are password protected and user name and password are: 
Username: Student Password: Power!

462 Motor Lab Teaching Assistant (TA): mfat1985@rams.colostate.edu

462 Motor Labs
Motor labs occur later in the semester and there will be 5 of them in total.
Motor Lab # 1 Due; To be announced by TA
Motor Lab #2 Due; To be announced by TA
Motor Lab #3 Due; To be announced by TA
Motor Lab #4 Due; To be announced by TA
Motor Lab #5 Due; To be announced by TA

The TA will also assign motor labs after you form lab groups. That is times for each group to do the lab will be decided and due date for the lab as well. Form your 462 motor lab groups ASAP to get desired lab times. Hand both HW and Pop Quizzes in by email attachments and no later than 11:59 of the due date to the 461/462 TA

462 MOTOR LABS will be assigned and due dates created by the 462 TA: Fathalla Eldali: mfat1985@rams.colostate.edu

He will do so the first week of the semester. Form your groups for 462 labs and send group members to Fathalla ASAP and work out days you will do the labs. Lab set ups are in the electronics lab of the C wing.

GROUP EFFORTS are key to 461 and 462. Form groups of up to 4-8 students to complete:

1. HW assignments
2. Pop Quizzes
3. PSSE exercises
4. 462 Motor Labs are both managed and graded separately for the lab grade for the 1 credit lab course.
5. Two PPT based group talks and two WORD based papers, where you identify your portion clearly. IN SHORT you need actually do only a fraction of the 461/462 work listed above and be sure to understand the other portions done by your colleagues to pass job interviews in the power area. For Talk # 2 start

**GRADING.**

*Practice makes perfect*

Kaizen is a Japanese word for” continual improvement and is common in manufacturing as pioneered by Toyota.

Presentation skills too can be honed through repetition, listening to talks and critique of our own talks. My goal is to get you ready for a job in industry where communication skills are crucial.

**Grade Summary:**

1. HW assignments: 16%
2. Talk/paper #1: 20%
3. Talk/paper #2: 35%
4. Pop Quizzes: 20%
5. PSSE Labs: 9%

TOTAL 100 points and is the basis of the normal 461 grade. However I provide lots of EXTRA CREDIT assignments throughout the semester.

Please forgive this 15 page syllabus, schedule and grading missive, but with lectures and a lab there are lots of issues to cover. To keep it all clear and fresh, I will send out a weekly memo usually a week in advance the prior Friday detailing:

1. Last week’s efforts
2. This week’s efforts and what’s due that coming week (e.g. Pop Quiz)
3. Next week’s efforts and due dates for all new assignments

**Disclaimer Notice:**

Use it to guide you through the semester but realize that up to date in class announcements always supersede this preliminary guide.

**Group Efforts**
Notice that group/team efforts are required in this course. Power companies value communication skills (oral and written) HIGHLY so 461 will help prepare you for the real world. You will all have two talks and two papers during the semester done as group efforts. Your technical presentations will be GROUP efforts to simulate your next environment—industry. This group effort is purposeful to get students familiar with the team efforts that they will SOON encounter in industry. This to encourage team efforts and to better understand the dynamics of team work, as you will soon work in teams in industry. The team’s tasks include HW assignments, the two in class talks and two written papers as well as weekly POP quizzes. The goal is: to better appreciate how to act in teams, as will the case incidentally when you join industry. You will get a team grade for all of the above. Still each student will have their portion highlighted for extra credit when merited, as for example when giving class talks or in papers if properly documented.

in your TALK # 2. “Flexible AC Transmission (FACTS) or prior in talk # 1 "SCADA versus the smart grid technologies (SG)".

If you are interested in “Smart Grid”, sometimes referred to as “The Enernet”, I suggest you download the white paper “Top Design Considerations for Low Power Metering Applications” from www.silabs.com/meteringWP. A minimum you may be left wondering isn’t SCADA already smart—and what does smart grid really mean???Is it just politics selling/justifying more spending on the grid for the benefit of all (or just a few)? Is the need to do this’ Smart Grid” all at once really necessary or imagined? In this regard I judge renewable/green energy claims beyond 20-30 % total energy generation are starting to be more “pixie dust” than reality. For starters realize that “capacity factors” for wind and solar are typically <25%, meaning take KW rating and multiply by 6/24. Why? Because the sun shines only part of the day and the wind blows intermittently. You and your group can dispute that. But you make your own determinations.

ACADEMIC INTEGRITY

This course will adhere to Academic Integrity Policy of CSU General Catalog and Student Conduct code. It is expected in this course that all students will not give, receive or use any unauthorized or undocumented assistance in their group efforts as well as individual efforts. All appropriate sources need to be referenced and it’s best to do in IEEE format for references/sources. For details go to:
http://learning.colostate.edu/integrity/index.cfm

Problems will be handled according to CSU policies. See:
http://tilt.colostate.edu/integrity/guides/what to do.cfm

Preamble on several Web sites for background on electric power

Some Web videos on energy and power engineering are given below for your pleasure. This is optional and not required.

http://www.youtube.com/watch?v=vqgNrj6oEdc
A fun demonstration of the enormous POWER behind the grid as shown by switch opening on a 500,000 volt line when air breakdown is 30kV/cm, causing a meter long arc (a flash over) in open air that ignites the air with plasma. Workman/lineman have been seriously burned or blinded by these meter long arcs. Respect high voltage. When trees come close to power lines this also causes flash over events. Tree trimming near power lines is required by the federal government.

Here is an 18 minute video that provides an overview of power engineering: http://www.ieee.org/portal/ieeetv/viewer.html?progID=70345

Here is a website dedicated to the “smart grid” a term of some ambiguity: http://www.smartgridnews.com/artman/publish/index.html. See another website: http://antwrp.gsfc.nasa.gov/apod/image/0011/earthlights_dmsp_big.jpg to grasp the energy use situation on earth any given evening. Just increasing transformer operating efficiency in transmission and distribution by 1% would save trillions of dollars per year in energy costs, reduce green house gas and CO₂ emissions, and reduce the need to build new power plants. That is 1% of 3 TW= 30 GW or 30 GW power plants that would not have to be operating.

Moreover surprising to some, inefficient energy use is becoming ILLEGAL, such as use of incandescent light bulbs in 2012. See for example: http://www.energy.ca.gov/commissioners/rosenfeld_docs/index.html and http://www.efficientpowersupplies.org/efficiency_news.asp

EPA, CEC (California energy commission) and DOE energy star programs are but several examples, as are the federal laws that require the states to get 7.5 % of electricity needs by 2013, peaking at 20% from renewable sources. Some wags say as renewables are still requiring subsidies, long term overuse of renewables is a form of “green energy suicide”. Finally, if you want get Cambridge Univ. professor’s skeptical /realistic but cold air attitude on the LIMITATIONS of “Green Energy” see: http://www.withouthotair.com/. Finally a website for all that describes energy in a cosmic perspective.


Cost “the four letter word’ plays a key role in this course. Cost is just an economic word for the common good. So all energy sources must be cost competitive and all “improvements” to the grid must have a discussion about cost/ benefit tradeoffs.

WHEW! If you visited all the background sites you are ready to engage with the real 461academic course. Part of that reality is grades!

461 GRADING (Remember, this is ALL group efforts, so individual work is much less)
We will emphasize group efforts with teams of students handing in weekly HW sets and take home POP quizzes as well as two talks and two papers. PLEASE FORM a GROUP for HW, POP QUIZZES and for talks/ presentations/ papers, described below, ASAP in the first week of the semester.

The grading is scored roughly as follows in 6 parts for a total of 100 points. Grade

Summary:

HW assignments: 16 % Send to Fathalla Eldali: mfat1985@rams.colostate.edu

(16% of final grade) Eight group Homework assignments @ 2 pts each will comprise 16 % of the final grade as further explained below. HW is due the week after it is assigned on Tuesday. HW is sent to the grader by email attachment to verify it meets the deadline. Late HW is losing points.

Talk/paper # 1: 20% Paper to Fathalla Eldali: mfat1985@rams.colostate.edu and Revised PPT to Collins only by email attachment

Talk/paper #2 : 35 % Paper to Fathalla Eldali: mfat1985@rams.colostate.edu Revised PPT to Collins only by email attachment

Pop Quizzes: 20% send to mfat1985@rams.colostate.edu

PSSE Labs: 9 % send to mfat1985@rams.colostate.edu

TOTAL 100 points
I hope by the end of the required talks/papers in 461 or even sooner, all students appreciate the old saw “to read without reflecting is like eating without digesting”. Or for the simple fools like me the shorter version “knowing the facts versus knowing the truth”. Beware that both talk # 1 on SCADA/ Smart Grid as well as talk # 2 on “FACTS” need you to start background preparations’ for this ASAP. For groups that choose “Variable frequency Motor Drives” you can split your efforts into both Talk # 1 ( basics)and talk # 2 ( details) .Note that the two talks and associated papers accounts for 55% of the final 461 grade.
1. **HOMEWORK ASSIGNMENTS** are Due Starting in Week # 2 on Tuesdays with due dates listed below.

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<thead>
<tr>
<th>CHAPTER</th>
<th>PROBLEMS</th>
<th>DUE DATES</th>
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<tbody>
<tr>
<td>HW #1</td>
<td>Ch 3: 22, 24, 26 Ch. 5: 19-23</td>
<td>Tues. 2 Sept</td>
</tr>
<tr>
<td>HW # 2</td>
<td>Ch 7</td>
<td>26-29</td>
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Is your group on schedule and on target for Talk # 1— sign up in class for date and time of your group presentations between

<table>
<thead>
<tr>
<th>HW #/CHAPTER</th>
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<tr>
<td>HW # 3 Ch. 8</td>
<td>28, 30, 34-35</td>
<td>Tues. 16 Sept</td>
</tr>
<tr>
<td>HW # 4 Ch 9</td>
<td>7-10</td>
<td>Tues. 23 Sept</td>
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**GROUP TALK # 1**

Weeks 5 to 7, (Tues. 23 Sept to Thur. 2 Oct), are reserved for Group SCADA (please keep SCADA to <20 % of the talk) and Smart Grid (topics on smart grid >80 %) talks. However, PSSE, HW and Pop Quizzes are still due during Talk #1 as shown below. Talk #1 introduces students to the reality of the sense, command and control of the grid preexisting before the “Smart Grid” hype was begun. The grid was never dumb.

23 / 25 Sept. week 5 HW #4 Ch 9 due Tues 23th Pop Quiz # 4 due Thur.25th
30 Sept. / 2 Oct. week 6 PSSE # 1 due Tues. 30 Sept. PSSE # 2 Due Thur. 2 Oct.

Oct 8 / 10 week 7 PSSE # 3 due Tues. 7 Oct.

PSSE LAB # 4 is due Thur. 9 Oct. This is the last PSSE lab. No more.

**OCTOBER HW DUE DATES**

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<th>HW #/CHAPTER</th>
<th>PROBLEMS</th>
<th>DUE DATES</th>
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HW #5 Ch10 34-37  Tues. Oct 14
HW #6 CH11 12-15  Tues. Oct 21
HW #7 CH12 11-13, 15  Tues. Oct 28

HW #8 is to better prepare you all for the “FACTS Talk # 2”
HW #8 Ch. 21: Summarize sections 21.15 to 21.34 of our text, as preparation for “FACTS”. Pay special attention to the SCR trigger phasing to create a DC to AC converters or what some term an inverter. Due Tues. Nov. 4th

NO MORE HW ASSIGNMENTS for the semester after HW # 8

In Class Talks and companion papers
Talk #1/Paper #1 (20% of final grade) will occur Tues. 23 Sept to Thur. 2 Oct. To provide background materials and better guide your efforts in Talk # 1.

On Tues. 23 Sept. Prof. Collins will deliver one detailed lecture on SCADA and a few smart Grid highlights, prior to your Student Group Talk # 1.

From 25 Sept.Thur. to 2 Oct Thur. three student groups will present their talk # 1. It accounts for 20% of the final grade, as further explained below and to be done in the two areas for all student groups:

1. Talk/paper Choice # 1 SCADA( <20%) and SmartGrid ( >80%) Grid in two parts:

   Part One: “OLD (40 years of experience) SCADA SYSTEM (<20% of Talk # 1 grade) to set the stage for smart grid by realizing the grid is already very smart and automated too. SCADA has wide use in industry process control, outside the power industry as well.

   Part Two: Smart grid trends and promises (>80 % of Talk # 1 grade). Show how the smart grid does more than the old SCADA at lower cost and faster, if you can. Key here is to cover Phase Measurement Units (PMU), which are the only true new addition to the “smarter grid” as compared to SCADA. Separate promises from actual working Smart Grid Systems by examples. As an illustration the old serial port interfaces were RS or TIA 232 and 485, which are still legacy serial ports with great noise immunity (e. g 232 has 6 volt noise region between one and a zero bit allowing operation in a utility environment), however bit transfer speeds are low. In your paper/talk include the NEW I²C serial interface used in the smart grid, and discuss its application to utility environments.
2. Talk/paper Choice # 2: Variable Frequency Motor Drives

Alternatively groups for talk # 2 may present on “Variable Frequency Motor Drives”. Moreover, if group members are in 562 Power Electronics they can use the same talk in both courses.

Each week we will hear from two groups for a total of four group talks/week

Due the importance of variable frequency motor drives STUDENT groups can choose this topic for both Talk/paper # 1 and later in the semester talk/paper # 2. Moreover students enrolled in BOTH 461 and 562 can use the same talk in both classes. Groups need to cover the following:

a. (30 % of talk) AC @ 60 Hz to DC rectification with both:
   1. Passive power factor correction
   2. Active electronic power factor correction (boost converter methods)

b. (30 % of talk) Use the DC rail and CMOS tandem FETs with proper gate control to generate single phase AC power at a variable frequency

c. (40 % of talk) Use the same DC rail and three tandem FETS with properly phased gate control at 120 degrees separation to generate three phase AC power at variable frequency.

SEE the end of this memo to get more details on the special terms and conditions for students enrolled in both 461 and 562 doing the talks on variable frequency drives.

For group efforts Microsoft has versions of Word and Power Point that reside on servers at Microsoft Office Live — moreover this allows MULTIPLE users to log on and work on the SAME document together. I strongly recommend Microsoft SkyDrive for student cooperative projects/talks/papers that many students in a group can share edits as they occur. It is deeply integrated with Microsoft Office on both Windows and Mac’s

After talk # 1 on Tues. Oct 7 Collins returns to lecture on Chapter 10 of our text

3. (35% of final grade) Talk #2/Paper #2 on FACTS, occurs from Tues. 11 Nov to Thur. 20 Nov and again in Dec. the first week after Thanksgiving break if needed. I will deliver an overview lecture on “FACTS” Tues. 11 Nov. so your group can focus on the smart grid issues.

FACTS together with talk # 1 on SCADA and the smart grid give you an overview of the modern grid and issues that are driving change.

Each of your groups will then present Talk # 2 from Thur. Nov. 13 to Thur. 20 Nov. It will count for 40% of the final grade, as further explained below and to be done as a
group effort for all groups in the area of Flexible AC Transmission “FACTS”. This is the “capstone portion of 461 and is to be started ASAP due to its complexity.

I again will deliver an overview INTRODUCTORY lecture on “FACTS” Tues. 11 Nov. that will cover:

a. Chapter 21 of our text, especially sections 21.15 to 21.34. Read and study this material carefully. See also H. Narain and L. Gyugyi “Understanding FACTS AC Transmission Systems” IEEE press 2000

b. Thyristor switching to achieve either Three Phase AC to DC rectification as well as DC to Sinusoidal AC grid frequency conversion with arbitrary amplitude and phase control of the AC at the fixed grid frequency only. By injecting this AC in either series or shunt on a transmission line we can control the flow of AC power as well as voltage levels at various nodes.

c. Two types of power flow optimization will be covered:
   a. AC Source to AC Source power flows
   b. AC source to passive loads power flow
   c. A breakdown of the two types of compensation:
      1. Series Compensation
      2. Shunt compensation

A “Facts” overview is then already given so your groups can focus on topics below in your talks.

NOW for what your group MUST include in Talk # 2 “FACTS”, which provides real time dynamic compensation of AC transmission lines for increased power flow, better voltage control and improved grid stability.

PART ONE OF GROUP TALK #2

a. (20 % of talk #2 grade) 3 Phase inverters/converters and how power electronic drives allow independent control of amplitude and phase to provide desired compensation. Show how Voltage Source Converters (VSC) provide grid frequency AC voltage injection, in either series or shunt, with both variable amplitude and phase using a DC source and switches ( SCR’s or IGBT’s).

b. (20% of talk #2 grade) Static Synchronous Series Compensators (SSSC), which have as the key building block a VSC, covered in part b.
c. (20 % of talk #2 grade) Shunt Compensation, which also has as a key building block a VSC.

d. (40 % of talk #2 grade) Explain in detail how a UPFC combines a VSC driven series compensation (SSSC) and a VSC driven shunt compensator (STATCOM) to form a UPFC, which is able to:

1. Independently control simultaneously either active or reactive power injected to the line.
2. Act as a shunt compensation and phase shifting device simultaneously.

We do have an alternative Talk/ paper # 2 opportunities, which can be used in both 461 and 562 classes if you are taking both.

Variable Frequency Drives for AC and DC motors: Talk # 2

Special Requirements for Special Talk # 2 on “Variable Frequency Motor Drives” for those students registered in BOTH 461 and 562. Yes you can give the same talk in both classes and for both required talks. The first talk should be basic concepts and the second detailed coverage of one or more applications.

Motors and motor drives are key technologies for a variety of reasons. First >60% of grid energy goes to motors. Moreover, improvements in efficiency from grid power to Torque- RPM mechanical energy at loads is an on-going green revolution as it creates “Negawatts” of saved energy that need not be generated. Electric cars will also be more competitive with these motor/motor drive improvements.

In short the goal of the new technologies is increased efficiency motor operation, smaller size and lighter weight electric motors and eliminating the need for mechanical gear trains to meet the applications specific T_{OUT} – N_{OUT} mechanical load requirements by electrical means alone.

So a special opportunity is offered to students in both 461 and 562 courses to do talk # 2 on motors/motor drives. An emphasis list of items to cover is given below for 461 presentations and a different list of items for 562 student presentations. Students MUST add to this according to their group’s interests.

For those students who will give the same talk in both classes both emphasis lists must be covered in the presentation that will given twice once in each class.

BELOW I list the points that must be covered later in the semester in talk # 2, for those groups that choose variable frequency motor drives 461

Special Requirements for Special Talk # 2 on “Variable Frequency Motor Drives” for those students registered in BOTH 461 and 562. Yes you can give the same talk in both classes and for both required talks. The first talk
Motors and motor drives are key technologies for a variety of reasons. First >60% of grid energy goes to motors. Moreover, improvements in efficiency from grid power to Torque-RPM mechanical energy at loads is an on-going green revolution as it creates “Negawatts” of saved energy that need not be generated. Electric cars will also be more competitive with these motor/motor drive improvements. In short the goal of the new technologies is increased efficiency motor operation, smaller size and lighter weight electric motors and eliminating the need for mechanical gear trains to meet the applications specific $T_{out} - N_{out}$ mechanical load requirements by electrical means alone.

So a special opportunity is offered to students in both 461 and 562 courses to do talk # 2 on motors/motor drives. An emphasis list of items to cover is given below for 461 presentations and a different list of items for 562 student presentations. Students MUST add to this according to their group’s interests.

For those students who will give the same talk in both classes both emphasis lists must be covered in the presentation.

Motor Drive Presentations Required High Points: Again this talk can be given in both 461 and 562 if you are registered in both.

1. Describe the $Z_{in}$, $V_{in}$ and $I_{in}$ seen by the power electronics drives (e.g. the motor’s electrical input characteristics) versus the varying $T_{out} - N_{out}$ curves of the mechanical load for:
   a. Brushless DC Motor (BDCM)
   b. Synchronous motor
   c. Permanent magnet Synchronous motor (PMSM)
   d. Induction motors

In short review the $T_{out} - N_{out}$ vs. $V_{in} - I_{in}$ curves for the four most used motors.

2. Provide web links to manufacturers spec and application notes and their major arguments to justify the separate claims that “PMSM” technology is the best motor technology versus “BDCM” technology is best versus Synchronous or induction motors. This is easily resolved by distinguishing what mechanical loads each technology is best suited for. Do this for the four the chosen motors at the three mechanical load levels of:
   a. Low HP < 1 HP
   b. Medium HP < 10HP
   c. High HP > 100 HP

3. Commercial motor control systems consist of: sensors, command and control IC chips and power train drives.
   a. Describe in detail spatial location, type and output levels from the sensors for rotor position and other motor parameters needed for control decisions on motors.
b. Give three commercial motor control chips or board level hardware control systems.

c. Compare and contrast the advantages and limitations as well as cost of high power switch hardware in the drive train employing:
   a. Thyristors and Triacs
   b. IGBT’s
   c. IGCT’s and it’s variants of MOS gate control of a switch

Go to manufacturer’s websites and get specs for the high power switches as well as application sheets for motor drive applications with these same switches and their control drive electronics.

d. Provide two examples of commercial power train electronics from switch drives to variable 3 phase output V (f) from power switches.

562 Presentations Required High Points:

1. Explain the cost and reliability considerations for the motor centric items listed in 461 point #1 as well as the best of the breed for applications at the three HP levels for the four motor varieties:
   a. Brushless DC Motor (BDCM)
   b. Synchronous motor
   c. Permanent magnet Synchronous motor (PMSM)
   d. Induction motors

2. Explain in detail the differences and advantages as well as disadvantages of DSP vs FPGA vs microprocessor control methodologies and switch algorithm flexibility as well as cost.

3. Discuss the R-L-C components both within and external to motors as regards their maximum operating voltages, currents and frequencies.

Again if the same talk is given in both classes all of both high points at minimum must be covered as well as the student group’s own topics.

That completes the first 3 of six parts of the grade in 461.

Next up are grading opportunities 4-6.

4. (24% of final grade) I count 24% for eight weekly 461 class pop quizzes @ 3 pts each, to be done as a group. Pop Quizzes will be assigned every week and due Thur. the following week.

5. (9% of final grade) 4 % of the final grade will be for completing the four PSSE Laboratories at 1 pt each, during the two weeks of Talk # 1 talks on the Smart Grid.

**SUMMARY OF PSSE DUE DATES**

30 Sept/ 2Oct week # 6 : PSSE # 1 due Tues. 30 Sept

PSSE # 2 Due Thur. 2 Oct.
Oct 7 / 9  week # 7  PSSE # 3 due Tues. 7 Oct.

PSSE LAB # 4 is due Week # 8 Tues. 14 Oct. This is the last PSSE lab.

Grade Summary:

6. HW assignments: 16 %
7. Talk/paper # 1: 20%
8. Talk/paper #2 : 35 %
9. Pop Quizzes: 20%
10. PSSE Labs: 9 %

TOTAL 100 points and is the basis of the normal 461 grade.

You can earn extra points as outlined in class and below, as some students need a better 461 grade for various reasons—here is a chance to earn it, by doing 6 below.

6. Positive Class Participation up to a possible 10 % of final grade. Up to an additional 10 extra points on the final grade are available, for special projects, related to variable frequency drives only. An example would be the company inverter product line from “Enphase” which on an IC sense/command and control chip with few additional external pieces, can convert the output of a DC solar cell array to single phase AC at grid frequencies. This allows one to purchase a solar panel and plug it directly into the homes AC wiring.

Our final grading approach will be more traditional with both + and - letter grades to achieve a sliding curve and a distribution of grades. In an ideal statistical world we would seek in a class grade distribution as follows. Grading will be curved with students above one standard deviation above median receiving an “A”, students below the median and above one standard deviation below the median receiving a “C”. 2 standard deviations below the median will receive a “D”, 3 standard deviations below will receive a “F”, and anything lower will receive an “F”.

Generally this means:

A > 95
B > 85
C > 75
D > 65
A-F GRADING SUMMARY with plus minus fine tuning for 461
Letter grades for ECE 569 are on an F to A scale with plus minus fine tuning on all letter grades.
> 98 A+
> 95 A
> 90 A−
87 B+
> 85 B
> 80 B−
77 C+
> 70 C−
Etc. to < 49 F

462 Motor/ Variable Frequency Drive Lab portion
462 MOTOR LABS will be assigned and due dates posted by the TA: Fathalla Eldali: mfat1985@rams.colostate.edu

PLEASE FOLLOW HIS INSTRUCTIONS. I guess that the first motor lab will be due 23 Oct Thur. but please follow his schedule.

Form your groups for 462 labs and send lists of all group members to Fathalla ASAP. She and your group will work out days and times you will do the labs.

END of BRIEF 462 INFO

BELOW I list the weeks of the semester and dates along with the times Pop Quizzes and HWs are due. That means the assignments were given the week before the due dates. The course work is front loaded, with more work at the onset than at the end of the course as shown below.

SUMMARY OF KEY ASSIGNMENT DUE DATES

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<th>Date</th>
<th>Week #</th>
<th>Tues. due</th>
<th>Thur. due</th>
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<tr>
<td>2/4 Sept</td>
<td>2</td>
<td>HW #1 Ch 3 and 5</td>
<td>Pop Quiz # 1</td>
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<td>9/11 Sept</td>
<td>3</td>
<td>HW #2 Ch 7</td>
<td>Pop Quiz # 2</td>
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<tr>
<td>16/18 Sept</td>
<td>4</td>
<td>HW #3 Ch 8</td>
<td>Pop Quiz # 3</td>
</tr>
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STUDENT GROUP TALK # 1

Weeks 5 to 6, (Tues. 23 Sept to Thur. 2 Oct), are for Group SCADA and Smart Grid talks.

I will endeavor to give an introductory lecture on SCADA and the Smart Grid before talk # 1 on Tues. 23 Sept. Three student groups talk from Thur. 25 Sept to Thur. 2 Oct.

However, PSSE, HW and Pop Quizzes are still due as indicated below.

PSSE #1 due Tues. Tues. 30 Sept. Send solutions to HW to: Fathalla Eldali: mfat1985@rams.colostate.edu

PSSE #2 due Thur. Thur. 2 Oct. Send solutions to HW to: Fathalla Eldali: mfat1985@rams.colostate.edu

PSSE # 3 due Tues. 7 Oct Send solutions to HW to: Fathalla Eldali: mfat1985@rams.colostate.edu

PSSE #4 due Thur. Oct 16 along with first 462 motor lab Send solutions to HW, motor labs and PSSE to : Fathalla Eldali: mfat1985@rams.colostate.edu

Chapter 9 HW # 4 problems 7-10 is assigned on Tues. 16 Sept. and is due Thur. 25 Sept during talk #

Pop Quiz # 4 is assigned Tues. 16 Sept and due Thur. 2 October

<table>
<thead>
<tr>
<th>Date</th>
<th>Week #</th>
<th>Tues. due</th>
<th>Thur. due</th>
</tr>
</thead>
<tbody>
<tr>
<td>23/25 Sept</td>
<td>#5</td>
<td>HW # 4 Ch 9 is</td>
<td>due Tues. 23 rd</td>
</tr>
<tr>
<td>30 Sept./2 Oct</td>
<td>6</td>
<td>PSSE # 1 due 30 Sept</td>
<td>PSSE # 2 Due 2 Oct.</td>
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</table>

AFTER TALK #1 Collins returns to full time lecturing Date

<table>
<thead>
<tr>
<th>Week #</th>
<th>Tues. due</th>
<th>Thur. due</th>
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</thead>
<tbody>
<tr>
<td>Oct 7/ 9</td>
<td>week 7</td>
<td>Both HW #4 Ch. 9 and PSSE # 3 due Thur. 9 Oct.</td>
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<tr>
<td>Oct 14/16</td>
<td>8</td>
<td>HW # 5 Ch 10</td>
</tr>
<tr>
<td>Oct 21/23</td>
<td>9</td>
<td>HW # 6 Ch 11</td>
</tr>
<tr>
<td>Oct 28/30</td>
<td>10</td>
<td>HW # 7 Ch 12</td>
</tr>
<tr>
<td>Nov 4/6</td>
<td>11</td>
<td>HW #8 CH 27</td>
</tr>
</tbody>
</table>

No more 461HW after HW #8 AND No more Pop Quizzes for the semester in 461 after Pop Quiz # 8 too. This is so you can focus on Talk # 2.
STUDENT GROUP TALK # 2

Talk # 2 on “Facts versus the Smart Grid” occurs week # 12 from 11 Nov to 20 Nov. I will endeavor to give an introductory lecture on “FACTS” 11 Nov before the groups give talk # 2 so that ALL are on the same page and focus on the topics indicated above in talk # 2 descriptions. Three student groups present from Thur. 13 Nov. to Tues. 2 Dec., with each group talking for one entire class period.

Reserve the departmental projector now for the group talks, if you will use it.

TALK #2 SCHEDULE

Tues 11 Nov. Prof Collins

Thur. 13 Nov. one group

Tues. 18 Nov. one group

NOTE WELL: Thur. 20 Nov before Fall break, we have no 461 class to make up for prior class overruns.

22 to 29 Nov. is fall break

Tues. 2 Dec. last student group Talk #2 on “FACTS”.

Final two weeks schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Week #</th>
<th>Tues. due</th>
<th>Thur. due</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/4 Dec</td>
<td>14</td>
<td>HW Ch 27</td>
<td></td>
</tr>
<tr>
<td>9 / 11 Dec</td>
<td>15</td>
<td>Special 461 Lectures and Final grade estimates 11 Dec</td>
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</tr>
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</table>

LAST DAY OF CSU CLASSES 12 Dec.

Disclaimer Notice:

Use this syllabus to guide you through the semester but realize that up to date in class announcements always supersede this preliminary guide.

Thank you for reading though this 17 page missive. If you have further questions ask me in class so everybody benefits.
**ECE Students** are the most important people at CSU.
Not dependent on faculty.  
Faculty is dependent on them.  
Not an interruption of our work.  
They are the purpose of being at CSU.  
Students are doing us a favor when they come to our office.  
We are not doing them a favor by serving them.  
Students are part of our business, not outsiders.  
Not just a CSU ID number.  
They are flesh and blood human beings with feelings and emotions.  
Students come to us with their needs and wants.  
It is our job to address them with courteous and attentive treatment.  
Students are the life blood of this and every university.  
Without them we would close our doors. *DON'T EVER FORGET THIS!*