EE 5200 - Lecture 1 Mon Aug 31, 2009

Topics for Today:

- Introductions - about 24 enrolled (maybe a few more adding)
  - ~14 students on campus
  - ~10 online students
- Startup
  - Web page: http://www.ee.mtu.edu/faculty/bamork/ee5200/
  - Book, references, syllabus, more are on web page.
  - Software - Matlab*, ASPEN, ATP/EMTP, spreadsheets
  - EE5200-L@mtu.edu (participation is 5% of your grade)
  - Lectures - new videostreams, archived video tutorials
  - Daily lecture notes scanned and .pdf file archived
  - Exercises posted as pdf on web page.
  - Grading: grad students must achieve B (80%) or higher
  - Grader: TBD < @mtu.edu>

1-2pm M,W,F

* On-line students only. Ordering instructions sent via e-mail.

- REVIEW, remedial: - Circuit Analysis Basics (Pre-Req Lect. #1)
  - Do all exercises in Ch.1 (solutions are posted)
  - Active vs. passive sign convention
  - Dual-subscript notation, single-subscript (implied reference)
  - Closure of subscripts in mesh equation
  - Euler's Identity - basis for phasor analysis! See handout.
  - Drawing phasor diagrams, arrowheads
  - Three-phase, "open" vs. "closed" voltage phasor diagrams
  - Errata in text book - Figs. 1.16, 1.17.

- Study Chapters 1 and 2, view archive lectures 1-4
- No class on Friday Sep 11th (K-Day recess in afternoon)
- Classes resume on Monday.
- Note - I will be away on
  - Mon Sep 28th - Personal Travel (video lecture)
  - Nov 4th thru 6th - Minnesota Power Systems Conference
- Need schedules of on-campus students to set weekly timeslot for videotaping make-up lectures.

Prerequisite Material, Useful References (see course web page)

- Euler's Identity - The foundation of phasor analysis, as well as hyperbolic functions (used for long transmission lines)
- Basic Circuit Analysis, Thevenizing, Phasor Analysis, Impedance, P,Q,S, etc.: EE3120 pre-req practice problems | Solutions
- Basic 3-Phase Phasor Analysis - Review problem from EE3120
- Magnetic Circuits - quick review and introduction of how a transformer works
- Mutual Inductance - concept handout from EE3120 (refer to Section 2.2 of your text)
- Transformers 101 - Everything you wanted (or suddenly need to know) about transformers but were afraid to ask...
- Delta-Wye Transformer - detailed example with solution from EE3120
- EE 4221 Pre-Req Course Description
- EE 4222 Pre-Req Course Description
- Pre-Req Review Videos with Notes (from 2003 Archives)
  - Basic Circuit Analysis, Phasors, Three Phase Phasors: Lect 1 (skip first 12 mins) | Lect 1 Notes
  - Phasor Diagrams, Ideal Transformers, Nodal Analysis: Lect 2 (skip first 6:20) | Lect 2 Notes
  - Nodal Analysis, 3-phase circuits, Deltas and Wyes, Per Unit System: Lect 3 (skip first 3 mins) | Lect 3 Notes
  - Active & Passive Sign Convention for power flow, Per Unit, Transformers, Symmetrical Components: Lect 4 (skip first 2 mins) | Lect 4 Notes
  - Transformers, Induced Voltage & Polarity Marks, Phase Shift: Lect 5 (skip 3:45 - 5:20) | Lect 5 Notes
  - Phase Shift in Transformers, Phasor Diagrams, Application of Symmetrical Components: Lect 6 (skip first 3 mins) | Lect 6 Notes
- Matlab Programming (fundamentals). Tutorials: [Part 1 Notes | Part 1 Video]; [Part 2 Notes | Part 2 Video]
  - Sample .m files from above tutorials: | for_ex.m | r2p.m | for_if_ex.m | while_ex.m | ft.m |

Grad School – What to Expect

- Smaller size classes. Everybody is a top student, high expectations. Top students to study with, collaborate with.
- Take an active role in your education. Anticipate what needs to be done. Ask questions during lecture.
- Open-ended problems and projects, larger scope, longer deadlines.
- Professor will create an environment (lecture, lab, research) for you to succeed in, you do the rest.
- Stress concept-based approaches (instead of procedural), abstract thinking, reward for developing creative innovative approaches.
- Communications – develop excellent speaking and writing skills.
- Research – scientific method, conceptually sound, make an advancement on existing state of the art.

MTU ECE Department - Energy Conversion & Power Systems Graduate Course Offerings

Year / Sem	Fall	Spring
2008/09	**EE 5200** - Advanced Methods in Power Systems **EE 5290** - Power Electronics **EE 6210** - Power System Dynamics	**EE 5223/5224** - Power System Protection / Lab **EE 5240** - Computer Applications
2009/10	**EE 5200** - Advanced Methods in Power Systems **EE 5260** - Wind Power Grid Integration	**EE 5220** - Power System Transients **EE 5250** - Distribution Engineering
2010/11	**EE 5200** - Advanced Methods in Power Systems **EE 5230** - Power System Operations	**EE 5223/5224** - Power System Protection / Lab **EE 5240** - Computer Applications
2011/12	**EE 5200** - Advanced Methods in Power Systems **EE 6210** - Power System Dynamics	**EE 5220** - Power System Transients **EE 5250** - Distribution Engineering

EE4300

*** Notes:** 1) Students are also required to participate each semester in **EE5920 - Power Systems Seminar.**
2) http://www.ece.mtu.edu/RemoteMSEE/ lists course rotation for online MSEE offerings.

Other Possible Offerings, Depending on Need or Interest:

EE 5290 - Selected Topics in Power Systems
EE 5805 - Directed Study in Electrical & Computer Engineering
EE 6290 - Selected Topics in Power Systems

Some Possible Topics for EE5290/6290:

- Power Electronics/FACTS
- Power Quality
- Rotating Machines
- Nonlinear Dynamics Applications
- Reliability
- State Estimation, Optimal System Operation
- High Voltage
- Other Topics of Interest

Notations:

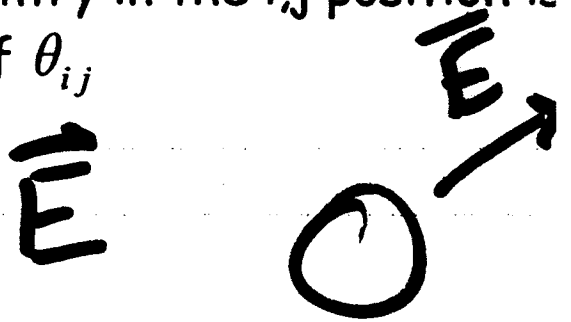
The voltages and currents we are dealing with are RMS phasor values. In the equations we develop, it is necessary to refer to their magnitudes and angles. For example, the voltage at bus k with respect to reference is:

RMS phasor value: $\tilde{V}_k$ or V_k or $V_k \angle \delta_k$

RMS magnitude: $|\tilde{V}_k|$ or just V_k Angle of $\tilde{V}_k$: δ_k

We also need to refer to individual elements of $[Y_{BUS}]$. The entry in the i,j position is a complex number $\bar{y}_{ij}$ with a magnitude of y_{ij} and an angle of θ_{ij}

$$Y_{BUS} = \begin{bmatrix} \bar{y}_{11} & \cdots & \bar{y}_{1j} & \cdots \\ \vdots & & \vdots & \\ \bar{y}_{i1} & \cdots & \bar{y}_{ij} & \cdots \\ \vdots & & \vdots & \\ & & & \bar{y}_{nn} \end{bmatrix}$$



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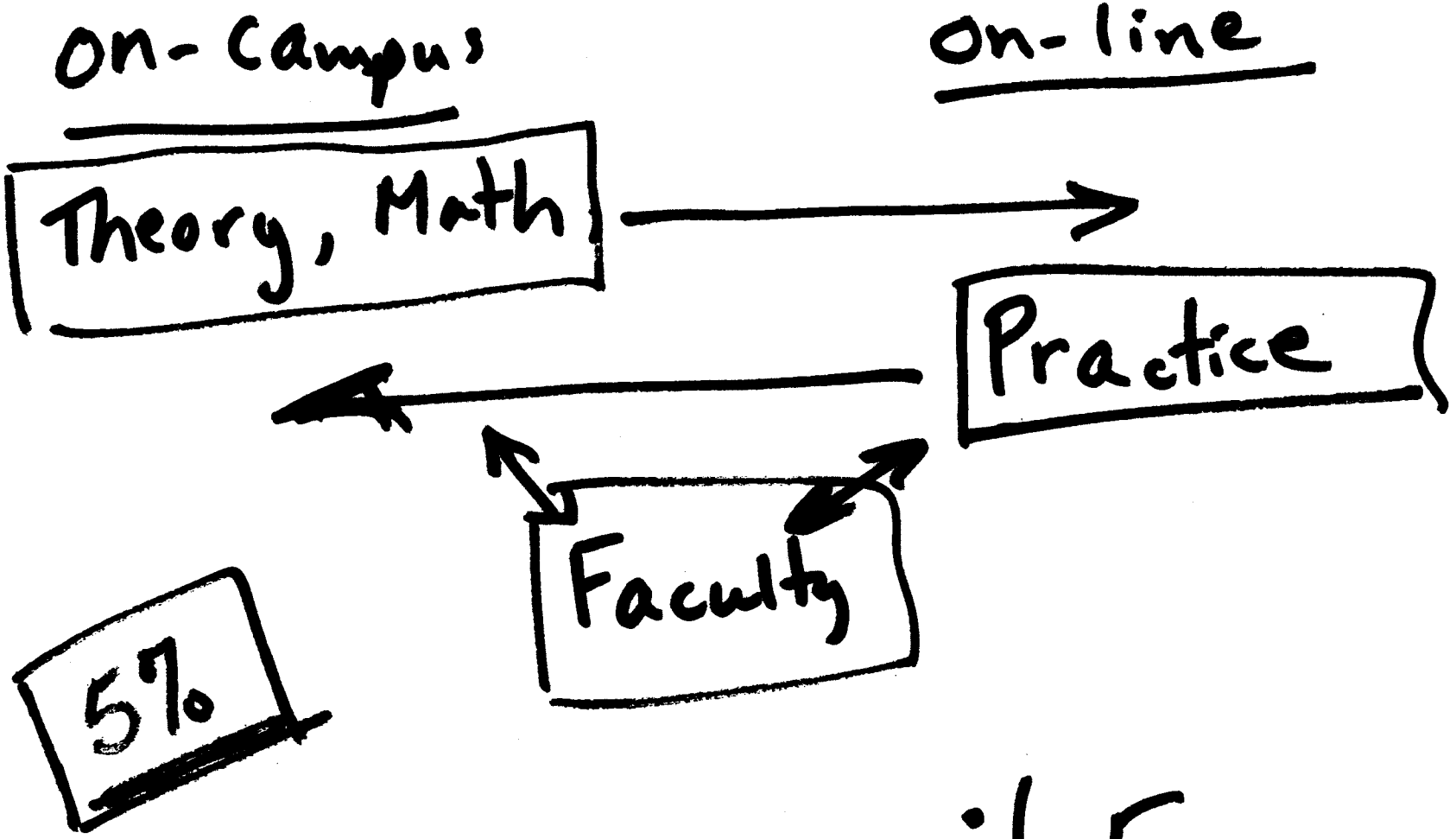
EE 5200 TEXT

"closed" vs. "open" V phasors.

6 review videos



Use the e-mail Forum

EE5200-L@mtu.edu !