ECE 3600 Final Exam Study Guide

Spring 2024

Review: Wednesday, _____ pm on zoom

Final Exam: Thursday, 4/25, 3:30 pm

First part of Exam is **Closed book, Closed notes, No calculator**, ~ 0 - 90 points. Could be a very large part.

The second part will be **Closed book,** except for the note sheets handed out in class for exams 1, 2, 3 and Final. You may add to these sheets. The second part will be problems. Total: 180 points, both parts.

The exam will cover	Possible questions
1. Material from Exam 1, 2, & 3	Study the questions from midterms
2. HW 1 AC steady-state review, used extensively throughout class	
3. HW 2 RMS & **Single-phase AC power**. Possibly part of 3ϕ problem $P \quad Q \quad S \quad \lvert S \rvert \quad pf$ correction of pf	Basic relationships and units
4. HW 3 Energy sources, plant efficiencies	Lots possible
5. **HW 4 & 5 3-phase AC power.** $V_L \quad V_{LL} \quad V_{LN} \qquad I_L \quad I_{LL} \quad I_Y \qquad S_{3\phi} \quad S_{1\phi}$ $Z_Y = \frac{Z_\Delta}{3} \qquad Z_\Delta = 3 \cdot Z_y \qquad pf$ correction of pf	Basic magnitude and phase relationships
6. HW 6 Magnetic circuits $B = \mu \cdot H \qquad H = \frac{N \cdot i}{l_m}$	Flux density, Field intensity, Permeability, B-H curve. effects of nonlinearity on some currents (3rd harmonic).
7. HW 7 - 9 Transformers	Basic relationships
Calculations	losses, ideal/non construction, ratings, magnetization reactance, core losses, winding losses, leakage reactance.
Impedance transformation	
OC & SC Tests --> model	
η & VR	
Autotransformers	Autotransformers
3ϕ Transformers Δ & 3rd harmonic	Y or Δ
8. One-Line Diagrams, variations and Per-Unit analysis	Common symbols, why PU
Base Values $S_{base} \quad V_{base} \quad I_{base} \quad Z_{base}$	Bases, why and when do they change
Basic per-unit modeling and calculations	Why per-unit?
9. Motor Basics	Terms, Stator, Rotor, etc. Armature, Field, back EMF Torque, Speed, Power Friction, Windage Slip rings, brushes
10. HW SG1 & SG2 Synchronous generators and motors	Basic relationships
Know the phasor diagram!	losses, construction, limits, operation

11. HW Ind1 - Ind3 Induction motors

    Know the model!

    Powers P_{AG} P_{conv} P_{out} etc. η

    Torque & speeds

    Types & effect of R_2

    Basic relationships

    Poles, slip, why, how

    Typ torque-speed curves

12. Single phase induction motors

    Types of starting methods

    Centrifugal switches

    Phase modification for start winding

    Calculation of Impedances and Capacitors

    Single phase starting

    Magnetic fields

    Starting direction

    Optimal Phase difference

13. DC motors

    Know the model!

    Powers P_{conv} P_{out} etc. η

    Torque & speeds

    Series-wound & universal motors

    Basic relationships

    Torque-speed curves

14. Motor Load types & Torque-speed curves

    Especially in relation to DC motors

15 **Transmission Lines**

    Short, **Med**, Long Z_C

    Series impedance $\mathbf{Z_{series}}$ Shunt admittance & $\frac{\mathbf{Y_{shunt}}}{2}$

    Shunt impedance & $2 \cdot \mathbf{Z_{shunt}}$

    Models and calculations

    Basic relationships

    Common line voltages

    Short, Med, Long mi, km

    What is & why use bundling

Not covered in previous exams

16. **Power Flow**

    Possibly a simple admittance matrix or part of one

    See notes that were handed out, many possible questions

    System requirements

    Assumptions

    Bus types

17. **Transmission line Faults**

    Types of faults

    Know the component sequences and how they are used to analyze unbalanced systems. I May give the basic matrix equations and then ask how one of the four faults is reduced to series and/or parallel component circuits (see Transmission Line Faults notes, p.3 - 9). May ask for some detail from those notes (say why something can be neglected in some case).

    Also review how the impedances differ for the 3 sequences.

18. **Protection** **questions**

19. All homeworks, but especially **TL2 through Prot**

20. All Labs questions

21. All Field trips questions