

Review: _____ Probably on Zoom at 6:00 pm

The Final will be on Wednesday 12/10/25 In regular Lab MEB 2365 from 1:00 - 3:00+

First part of Exam is **Closed book, Closed notes, No calculator**, ~ 20 - 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

1. Material from Exam 1, 2, & 3
2. HW 1 Energy sources, plant efficiencies
3. HW 2 AC steady-state review, used extensively throughout class
4. HW 3 RMS & **Single-phase AC power**. Possibly part of 3φ problem
P Q S |S| pf correction of pf
5. **HW 4 & 5 3-phase AC power**.

$$V_L \quad V_{LL} \quad V_{LN} \quad I_L \quad I_{LL} \quad I_Y \quad S_{3\phi} \quad S_{1\phi}$$

$$Z_Y = \frac{Z_{\Delta}}{3} \quad Z_{\Delta} = 3 \cdot Z_Y \quad \text{pf correction of pf}$$

6. HW 6 Magnetic circuits

$$B = \mu \cdot H \quad H = \frac{N \cdot i}{l_m}$$

7. HW 7 - 9 Transformers

- Calculations
- Impedance transformation
- OC & SC Tests --> model
- η & VR
- Autotransformers
- 3φ Transformers Δ & 3rd harmonic

8. One-Line Diagrams, variations and Per-Unit analysis

$$\text{Base Values} \quad S_{\text{base}} \quad V_{\text{base}} \quad I_{\text{base}} \quad Z_{\text{base}}$$

Basic per-unit modeling and calculations

9. Motor Basics

10. HW SG1 & SG2 Synchronous generators and motors

Know the phasor diagram!

Possible questions

Study the questions from midterms

Lots possible

Basic relationships and units

Basic magnitude and phase relationships

Flux density, Field intensity, Permeability, B-H curve. effects of nonlinearity on some currents (3rd harmonic).

Basic relationships

losses, ideal/non construction, ratings, magnetization reactance, core losses, winding losses, leakage reactance.

Autotransformers

Y or Δ

Common symbols, why PU

Bases, why and when do they change

Why per-unit?

Terms, Stator, Rotor, etc. Armature, Field, back EMF Torque, Speed, Power Friction, Windage Slip rings, brushes

Basic relationships

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 Line Problems

Short, **Med**, Long Z_C

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

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

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 and some basics about the method and math behind it. I May give the basic matrix equations and then ask how one of the five 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 **PF1 through Prot**

20. All Labs and Field trip

questions