

# EE 3120 - Final Exam Review Checklist

**Coverage:** Everything covered this semester. See Test 1 and Test 2 review lists, plus material covered since Test 2. This includes material in text, info posted on web page, course handouts, homework, quizzes, and circuit analysis concepts used throughout this course. Likely topics are a) those which have not yet appeared on a test, and b) key topics on past tests that are not yet mastered. A large listing (which is not necessarily complete) is provided as follows:

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**Concepts:** be able to explain and apply

- Induction machines
  - Physical construction, features
  - Slip, rotor speed, rotor frequency
  - Stator (armature) B-field, synch speed
  - Rotor B-field, relative and absolute speed
  - Explain how it works
- Induction Generator vs. Induction Motor
- Losses in Induction Machine
  - SCL (armature losses, core losses)
  - RCL
  - Rotational losses (friction, windage)
  - Stray losses (assumed zero in EE3120 calcs)
- Leakage effects in Induction Machine
- Speed-torque curve of Induction Motor
- 3-ph rotating machines develop constant torque
- Single-phase rotating machines do not
- Mutual Inductance
  - Mutual flux
  - Mutual flux linked
  - Self Inductance, Mutual Inductance
- Induction Motor Starting Current
  - 3 ways to estimate starting current
  - Voltage drop, Flicker
- Variable Frequency Drives
  - PWM to get desired frequency,  $V_{PEAK}$
  - Matching speed-torque point of load
  - Efficiency Improvement
- Synchronous Generators
  - Round rotor vs. salient rotor
  - Field, rotor, exciter, armature, stator
  - Air gap, torque angle
  - Overexcited vs. underexcited
  - Synchronous speed, torque, power

**Calculations, Determinations (see also Test 1 and Test 2 review sheets):**

- Phasor Analysis Methods Used Throughout:
  - Calculations involving  $V$ ,  $I$ ,  $P$ ,  $Q$ ,  $S$ ,  $Z$ ,  $R$ ,  $X$ ,  $\theta$ ,  $\phi$  for single phase 60-Hz circuit
  - Calculate  $V$ ,  $I$ ,  $PF$ ,  $S$ ,  $P$ ,  $Q$ , using phasor diagrams and power triangles as visual aid.
  - Calculate phasor line currents flowing into single-phase or 3-phase sources and loads.
  - Determine phasor line currents flowing into "black box" load.
  - Per phase analysis of 3-phase circuits
- Induction Machine
  - Slip, speed of rotor, speed of stator field, speed of rotor field wrt rotor, speed of airgap field.
  - SCL, armature losses, core losses, RCL, airgap power, developed power
  - Input power (electrical), output power (mechanical), efficiency
  - Calculate phasor value of line current for a given value of slip.
  - Starting current
- Synchronous Machines - synchronous speed, torque, power, torque angle  $\delta$ ,  $E_A$ ,  $I_A$ ,  $V_T$
- Synchronous Machines -  $P_{out}$  and  $Q_{out}$  as function of delta

**Format:** ~6-7 pages plus cover sheet. The test is designed to be a 90-minute test for those who are prepared and proficient. Exactly 2 hrs are allotted. Come a few minutes early and get settled in. Problems may be either calculation or short essay. Space for working problems is provided on the test - no additional sheets of paper (except for your own hand-written notes/equation sheets) are allowed on your desk. Besides your test sheet, notes, and a calculator, remove everything from your desk. Three sheets of notes are allowed: you may reuse your note sheets from Tests 1 and 2, plus create one more sheet for material covered since Test 2. Your note sheet can contain equations and notes about important concepts, but may not include complete worked-out solutions.

**Proctoring:** Turn off your cell phone and put it away. Go ahead and fill out the exam cover sheet but do not open the test booklet, look at problems, or begin to work on it until everyone has received one and you are told to begin. Sit in columns, empty desk to right and left. If you must sit beside someone, sit toward the front of the classroom. To avoid any MTU Academic Integrity concerns (i.e. cheating) it is best to avoid questionable situations. So, please focus on your own paper as much as possible, do not talk to others, and avoid straying eyes. It's ok to wear a baseball cap, but turn the brim backwards. Avoid wearing dark glasses. If you have a question, raise your hand and clear your throat and I'll come directly to your desk. Questions are encouraged – if there is a typo or a clarification, we need to immediately share it with the whole class. A stapler will be provided - when you hand in your test, staple all of your note sheets to the back.