Nashville State Community College  
Computer and Engineering Technologies Division  
Electrical Engineering Technology

Master Course Syllabus

EETH 1220 Transformers/Rotating Machines
2 Credits  
2 Class Hours
This is an intermediate level course that provides an understanding of electrical machinery. Topics include transformer theory and application, single-phase and three-phase connections, auto-transformers, special instrument transformers, the development of horsepower, torque, efficiency as related to the operation of D.C. motors and generators, single-phase and three-phase motors, alternators, stepper motors, resolvers, synchros, and comparisons in the performance of machines.  
Prerequisite: EETH 1110

Instructor Information:
Name:  
Email:  
Office Phone:  
Office Location:  
Office Hours:

Textbook and Other Materials:


Supplies:

Course Outcomes:
Upon successful completion of this course, students should be able to:

- Calculate transformer variables based on turns ratios  
- Draw electrical schematic of proper connection of single phase and three phase, wye and delta, transformer circuits.  
- Explain the parts, functions and characteristics of a DC machine.  
- Explain the parts, functions and characteristics of both single phase and three phase AC machines.
• Draw electrical schematic of proper connection of both DC and AC machines.

**Course Competencies:**
The following are detailed course competencies intended to support the course outcomes:

• Explain the theory of mutual inductance.
• Calculate transformer ratio relations.
• Compute transformer equivalent circuits.
• Calculate percent impedance, short circuit calculations.
• Make polarity test for transformer, identify leads.
• Make proper connections on transformers with multiple windings, three-phase delta and wye configurations.
• Correctly size transformers to match load demands.
• Identify the parts dealing with the construction of the DC machine.
• List the different type of winding used in the construction of the DC machine.
• Define the term "commutation".
• Define armature reaction, its effects and solution to the effects.
• Make proper connections (series, shunt and compound).
• Explain the loading characteristics of each connection.
• Explain counter-emf in the DC motor and counter-emf relationship to speed.
• Define speed, torque, and horsepower relationships.
• Define modes of operation, constant torque variable hp, constant hp variable torque.
• Identify the parts dealing with the construction of the three-phase induction motor.
• Explain the theory of operation of the squirrel cage and wound rotor induction motor, including how torque is developed and the relationship between torque, speed, and slip.
• Identify the type of single-phase induction motors, explain the theory of operation for each.
• Explain the operation of the stepper motor: list applications.
• Explain the theory of operation of the resolver, synchro, and demonstrate a knowledge in the application for each.
Course Assessments:
The following performance assessments will be used to demonstrate students’ understanding, knowledge and skills:
Three exams and final exam will be administered consisting of both quantitative questions based on assigned homework and conceptual essay type questions where the student will explain in his own words an understanding of the material. These essays are graded for both technical accuracy and clarity. A written technical report is required on a topic requiring more depth of information must additionally be presented to the class in a PowerPoint format to demonstrate his or her understanding of the material. This presentation is evaluated on a 100 point sheet that is standard for the Electrical Engineering Technology program.

Grading Policy

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
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<tr>
<td>Quizzes</td>
<td>45%</td>
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<tr>
<td>Presentation</td>
<td>15%</td>
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<tr>
<td>Final</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
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</tbody>
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Grading Scale:

A (90-100%), B (80-89%), C (70-79%), D (60-69%), F (less than 60%)

Topics to Be Covered:

1. The Ideal Transformer
   a. Voltage induced in a coil
   b. Turns ratio
   c. No load and full load conditions
   d. Shifting impedance, equivalent circuit
2. Transformers
   a. Polarity test
   b. Dual-voltage
   c. Special transformers
3. Review of Three-phase Systems
   a. 3 wire, 4 wire Wye configuration
   b. 3 wire, 4 wire Delta configuration
   c. three-phase power and power factor correction
4. Three-phase Transformers
   a. Wye connection
   b. Delta connection
c. Wye-delta, delta-wye connection
d. Open delta, 4 wire high leg connection

5. The DC Machine (construction)
a. Pole piece
b. Series, shunt and interpole windings
c. The armature winding
d. The commutator, brushes (maintenance)

6. DC Generators
a. Ratings
b. Shunt, Series, Compound connection, differential, cumulative connection

7. DC Motors
a. Development of torque, horsepower
b. Counter EMF
c. Shunt, Series, Compound connection, differential, cumulative connection

8. DC Motors (Continued)
9. Three-phase Induction Motors
a. Construction
   i. Stator windings
   ii. Rotor construction (scim, wrim)

b. Theory of operation
c. Synchronous speed, rotor speed and slip
d. Torque and slip
e. Effect of rotor resistance

10. Three-phase Induction Motors (Continued)
11. The Synchronous Generator
a. Construction, salient, cylindrical poles
b. Excitation
c. Frequency: number of poles, rpm
d. Synchronous impedance
e. Loading effects, hard load, active load
f. The infinite bus.

12. The Synchronous Motor
a. Starting procedures
b. Pull-in torque
c. No load, full load (torque angle)
d. Power-factor correction

13. The Single-phase Motor
a. The Split-phase Induction Motor
   i. resistance start
   ii. capacitor start
b. Capacitor Start, Capacitor Run
c. Universal Motor
d. Hysteresis Motor

14. Special Motors
a. Step-motor
b. Synchro unit, resolvers

15. Review and Final
Attendance Policy
A student is expected to attend all scheduled classes and laboratories. Each instructor will formulate an attendance policy and provide it on the course syllabus. Absences are counted from the first scheduled meeting of the class, and it is the responsibility of each student to know the attendance policy of each instructor in whose class he/she is enrolled. If a student is absent from a class, he/she should give an advanced explanation to the instructor. Absences in a course may affect a student’s final grade. The student is responsible for all assigned work in the course regardless of excused or unexcused absences. Tardiness may also affect a student’s final grade.

Failure to attend class will result in a final course grade of “FA” or “FN” (see explanation below) depending on the individual instructor’s course policy.

FA= failure, attendance-related (unofficial withdrawal) Last recorded date of attendance required.
FN= failure, never attended class (unofficial withdrawal)

Student Communication Channels
It is the student’s responsibility to check D2L and MyNSCC email on a regular basis. These are the official communication channels between the college and students. Students are responsible for the information communicated through these channels. D2L contains specific course information and MyNSCC contains information important for other purposes.

Early Warning System
Nashville State Community College has implemented an Early Warning System to notify students via e-mail about academic problems such as poor classroom attendance, poor performance on assignments/tests, poor communication skills, late/missing assignments, and/or lack of classroom participation. Please note that Early Warning Alerts do not affect a student’s academic standing.

ADA Compliance Statement
Nashville State complies with the Americans with Disabilities Act. Please contact the Access Services Coordinators at 615-353-3721 or 615-353-3741 if you would like to arrange ADA accommodations.

Classroom Misconduct
Nashville State Community College has a zero tolerance policy for disruptive conduct in the classroom. Students whose behavior disrupts the classroom will be subject to disciplinary sanctions. Please consult your Student Handbook for more specific details. The instructor has primary responsibility for control over classroom behavior and maintenance of academic integrity. He/she can order temporary removal or exclusion from the classroom of any student engaged in disruptive conduct or in conduct which violates the general rules and regulations of the College.

Disruptive behavior in the classroom may be defined as, but is not limited to, behavior that obstructs or disrupts the learning environment (e.g., offensive language, harassment of students and professors, repeated outbursts from a student which disrupt the flow of instruction or prevent concentration on the subject taught, failure to cooperate in maintaining classroom decorum, etc.), the continued use of any electronic or other noise or light emitting device which
disturbs others (e.g., disturbing noises from beepers, cell phones, palm pilots, lap-top computers, games, etc.).
Please be aware that children are not allowed in class or unattended on campus.

**Academic Dishonesty (Honor Code)**
Any form of academic dishonesty, cheating, plagiarizing, or other academic misconduct is prohibited. "Plagiarism may result from: (1) failing to cite quotations and borrowed ideas, (2) failing to enclose borrowed language in quotation marks, and (3) failing to put summaries and paraphrases in your own words (A Writer’s Reference 331). Academic dishonesty may be defined as, but is not limited to, intentionally trying to deceive by claiming credit for the work of another person, using information from a web page or source without citing the reference, fraudulently using someone else’s work on an exam, paper, or assignment, recycling your own work from another course, purchasing papers or materials from another source and presenting them as your own, attempting to obtain exams/materials/assignments in advance of the date of administration by the instructor, impersonating someone else in a testing situation, providing confidential test information to someone else, submitting the same assignment in two different classes without requesting both instructor’s permission, allowing someone else to copy or use your work, using someone else’s work to complete your own, altering documents, transcripts or grades, and forging a faculty/staff member’s signature.
In addition to other possible disciplinary sanctions that may be imposed through regular college procedures as a result of academic dishonesty the instructor has the authority to assign an “F” or a “Zero” for the exercise, paper, or examination or to assign an “F” for the course. Students may appeal through the appropriate college grade appeal procedures.

**Inclement Weather Policy**
In the event of an inclement weather event, check the Nashville State web site home page at www.nscc.edu for announcements on campus closures. Campus closures will also be announced on local television stations (channels 2, 4, 5, and 17).
When classes are cancelled, an online assignment will be posted in NS Online. Check your NS Online email for a message from your instructor regarding your online assignment requirements.
Even though classes may be cancelled, some areas, i.e. Testing Center, may be open.
However, you should check before commuting to campus.
The Vice President for Academic Affairs and the Director of Security are responsible for cancellation decisions during an inclement weather event for the Nashville State main campus and the Southeast campus. Cookeville, Waverly, and Dickson Campus Directors will make class cancellation decisions based on conditions in their respective areas. Decisions about class cancellations are based on actual conditions, not forecasts. The perspective used for making decisions is that of the college as an employer, not as a K-12 institution. Students should use their own best judgment in determining whether to report to campus during inclement weather when classes are not cancelled.

**NOTE:** This syllabus is meant simply as a guide and overview of the course. Some items are subject to change or may be revised at the instructor’s discretion. Each instructor will further clarify their criteria for grading, classroom procedures, attendance, exams and dates, etc. on his/her course syllabus.