

NEW YORK CITY COLLEGE OF TECHNOLOGY

The City University of New York

DEPARTMENT: Electrical and Telecommunications Engineering
Technology

SUBJECT CODE EET 2150

TITLE: Electric Machines Theory

COURSE DESCRIPTION: Principles and characteristics of DC and AC machines. Topics include: DC generators and motors, construction characteristics and ratings, alternators, transformers, Polyphase Induction motors, single-phase motors and Synchronous motors.

PREREQUISITES: EET1222, PHYS1433

TEXTBOOK: Electrical Machines, Drives, and Power Systems. 6th Edition by Theodore Wildi-Publisher, Pearson

**COURSE OBJECTIVES/
COURSE OUTCOMES:** Upon completion of this course the student will possess a working knowledge of the operation and construction of the following:

1. DC motors and generators. (ETAC/ABET Criteria 3.1, 3.5, PC b)
2. AC Motors and Alternators. (ETAC/ABET Criteria 3.1, 3.5, PC b)
1. Single and three phase transformers. (ETAC/ABET Criteria 3.1, 3.5, PC b)
4. The safe generation and distribution of power. (ETAC/ABET Criteria 3.1, 3.5, PC b)

TOPICS Topics include the relationships between the Magnetic Field, Electrical generation, mechanical motion in the modern electrical system.

CLASS HOURS: 3 Hours **3 CREDITS:**

Updated By: Professor Aron Goykadosh Spring 2022

COURSE Professor Aron Goykadosh

COORDINATOR: E-mail: Agoykadosh@citytech.cuny.edu

Contribution of course to meeting the ETAC/ABET requirements, Criterion 5:

EET2150 meets Criterion 5 by providing students with the knowledge of motors, and generators and transformers in electric systems. The course enables students to analyze and understand the physics & math applied to operation of the magnetic fields in AC & DC electric systems. Students will acquire the ability to identify, analyze, and solve well defined engineering technology problems related to generation and distribution of electrical power with commitment to quality, timeliness, and continuous professional development, as well as practicing ethical responsibilities, including respect and diversity.

GRADING POLICY:

Exam 1	30 %
Exam 2	30 %
Final Examination	40 %

<u>Letter Grade</u>	<u>Numerical Grade Ranges</u>	<u>Quality</u>
A	93-100	4.0
A-	90-92.9	3.7
B+	87-89.9	3.3
B	83-86.9	3.0
B-	80-82.9	2.7
C+	77-79.9	2.3
C	70-76.9	2.0
D	60-69.9	1.0
F	59.9 and below	0.0

<p style="text-align: center;"><u>Assessment</u></p> <p>The following assessment techniques are correlated to the course objectives as follows. In addition, each assessment technique incorporates one or more of the following ETAC/ABET Criteria 5 outcomes, (3.1, 3.5, PC a, PC b)</p> <p><u>Course Objectives</u></p> <ol style="list-style-type: none"> 1. Understand the operation and construction of the DC Generator and Motor. 2. Understand the operation and construction of the AC Motor 3. Understand the operation of the Single and three phase transformers. 4. Discuss the safe generation and distribution of power 	<p style="text-align: center;"><u>Assessment</u></p> <ol style="list-style-type: none"> 1.1 An ability to analyze the performance of the Shunt and Compound generators from 0 to 100% of rated output 1.2 To analyze the speed and torque characteristics of the Shunt, Compound, and Series Motor <ol style="list-style-type: none"> 2.1 An ability to analyze the construction and operation of the single phase generator and motor and describe the system output. 2.2 An ability to analyze the construction and operation of three phase motors Included will be the Slip, Torque, and the Efficiency calculations. 3.1 Understand the operation of the single phase transformer and calculate the transformer constants, voltage regulation and efficiency. 3.2 Analyze the various connections of the three phase transformer and their corresponding output 4.1 Discussions will include the National Power Grid, DC power transmission, Super Conductors, and OSHA.
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WEEK	TOPIC	READING ASSIGNMENT	HOMEWORK PROBLEMS
1	The IEEE Code of ETHICS. Safety considerations including OSHA considerations, when designing and using electrical Machinery. Unit Conversions Electromagnetic Induction Faraday's Law Voltage and Force on a conductor in a magnetic field. Hysteresis and Eddy Current Losses in a Conductor	Handout Chapter 1, Pgs. 3-11 & Appendix Pg. 913 Chapter 2 Pgs. 29- 32 Pgs. 33- 35	2-4 thru 2-6
2	Types of Rotating machinery. Armature and Field winding construction of DC and AC Generators. Commutation DC generator characteristics. The voltage builds up process. Critical resistance calculations.	Chapter 4 Pages 71- 82	4-4 thru 4-8
3	The series DC generator. The shunt DC generator. Compound generators. Voltage regulation calculations. Armature reaction.	Chapter 4 Pages 82- 93	4-9 thru 4-12, 4-16, 4-24
4-5	DC motor characteristics Force and torque developed by motors. Counter EMF of a motor. Starting a motor. The series dc motor. The Shunt DC motor. Compound DC motors . Efficiency calculations. Speed regulation. Stopping the DC motor. Exam # 1	Chapter 5 Pages 96-106	5-1 thru 5-12, 5-14, 5-15
6	Review of Exam # 1 Active, Reactive and Apparent Power, Review	Chapter 7 Pgs. 134- 154	7-1 thru 7-17
7	Single phase transformers. Transformer fundamentals and construction. Voltage and current ratios of an ideal transformer. Efficiency of an ideal transformer. Impedance reflections and equivalent circuits.	Chapter 9 Pages 183- 195	9-1 thru 9-8
8-9	Non ideal transformers. Equivalent circuits Short circuit test. Open Circuit test. Transformer Impedance Calculations. Voltage regulation and transformer efficiency calculations	Chapter 10 Pages 197-214	10-1 thru 10-15 10-22 thru 10-25 10-29 thru 10-31
10-11	Multiple secondary winding single phase transformers. Auto transformers., Three phase transformers Wye to Wye Delta to Delta, Delta to Wye Exam # 2	Chapter 11 Pages 225- 241 Chapter 12 Pages 243- 253	11-1 thru 11-9 12-1 thru 12-9
12-14	Principles of operation of: AC motors and alternators Single phase motors Series motor. Induction motor. Torque measurements. Slip calculations. Equivalent circuits. Efficiency calculations.	Chapter 18 Pages 377- 424	Read Chapter 18
15	Review and Final Examination		

New York City College of Technology Policy on Academic Integrity Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the college recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in the City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. The complete text of the College policy on the Academic Integrity may be found in the catalog.