EE3124: INTRODUCTION TO ELECTRIC MACHINES AND DRIVES

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Introduction to Electric Machines and Drives

Subject Code
EE - Electrical Engineering
Course Number
3124

Academic Unit
Electrical Engineering (EE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
EE3123 Introduction to Electric Power Systems

Precursors
EE2005 Electronic Devices and Circuits

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

To introduce (i) the operating principles of electric machines and drives, including AC and DC machines; and (ii) the applications of various types of drives in automation systems, electric vehicles, and robotics.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the fundamental parts of electrical drives including converter, electrical machine and load.		x	x	
2	Describe the operating principles of induction machines, synchronous machines and dc machines.		x	x	
3	Apply appropriate methods for machine design and analysis, including phasor methods and equivalent circuit models.		x	x	
4	Explain the various practical issues in machine operation, including losses, harmonics, and efficiency.		x	x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Delivery of course materials, including analysis, models and operating principles of machines. Strengthening concepts and working out problems.	1, 2, 3, 4	3 hrs/week
2	Mini-project	Projects on comparing the use of different types machines in electric vehicles and other applications.	1, 2, 3, 4	3 hrs/week for 6 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	#Assignments (min.: 3)	1, 2, 3, 4	5	
2	Tests (min.: 2)	1, 2, 3, 4	30	
3	Mini-project	1, 2, 3, 4	15	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Remark:
To pass the course, students are required to achieve at least 30% in course work and 30% in the examination.

may include homework, tutorial exercise, presentation

Assessment Rubrics (AR)

Assessment Task

Continuous Assessment

Criterion

Achievement in CILOs

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Below Marginal

Assessment Task

Examination

Criterion

Achievement in CILOs

Excellent (A+, A, A-)

High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Below Marginal

Part III Other Information

Keyword Syllabus

Basic components in electrical drives: converter, electric machine and load. Basic principles of energy conversion in electromechanical systems.

AC machines: Windings and construction, poly-phase machine; induction machine, key parameters, model, characteristics, torque control; permanent-magnet (PM) synchronous machine, model, analysis by phasor diagrams, control; design for power generation, synchronisation.

DC machines: field and armature interaction, series and shunt motors, brushless motor, separately excited machine, brushless construction, models, speed drive control.

Applications and trends: variable speed drives in automation systems and robotics, induction and PM machines in electric vehicles, regenerative braking, use of computer control and power electronics.

Reading List

Compulsory Readings

	Title
1	S. Filizadeh, Electric Machines and Drives, 1st Edition, CRC Press, 2017.

Additional Readings

	Title
1	A. E. Fitzgerald, C. Kingsley, and S.D. Umans, Electric Machinery, 6th Edition, McGraw-Hill, New York, 2003.
2	P. C. Sen, Principles of Electric Machines and Power Electronics, Wiley, New York, 1997.