EE3123: INTRODUCTION TO ELECTRIC POWER SYSTEMS

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Introduction to Electric Power Systems

Subject Code
EE - Electrical Engineering
Course Number
3123

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
MA1200 Calculus and Basic Linear Algebra I
or
MA1300 Enhanced Calculus and Linear Algebra I
and
EE1002 Principles of Electrical Engineering

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

To introduce (i) the general structure of power distribution and delivery systems in modern society; (ii) the operating principles of the key components of a power system; (iii) operational issues including power flow, faults and protection; and (iv) current development and future trends in power systems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Identify the key physical quantities in power systems including voltages, currents, phase angles, power and impedances.		x	x	
2	Analyze three-phase power systems and identify their role in distribution and delivery of electric power.		x	x	
3	Perform standard power flow analysis and identify faults in electric power systems.		x	x	
4	Understand the role of renewable sources and future trends in power system developments.		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 theories, basic operating principles and applications of power systems. Strengthening the understanding of key concepts and working out problems.	1, 2, 3, 4	3 hrs/week
2	Mini-project	Projects on microgrid and renewable energy developments, and practice on engineering design.	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	Lab/ 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 coursework and 30% in the examination. Also, 75% laboratory attendance rate must be obtained.

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

Key components of a power system: synchronous generators, transformers, rectifiers, transmission lines, and loads. Distribution in AC electrical power systems, high-voltage DC transmission, microgrids.

Three-phase system: balanced and unbalanced systems, symmetrical components, the “per-unit” system, active and reactive power, power factor, power quality, faults and fault current calculation.

Transformer: coupled inductors, general transformer model, power transformer, rating, construction.

Transmission: underground and overhead lines, short- medium- and long-distance transmission lines, transfer characteristics.

Power flow analysis: DC and AC power flow models, power balance, voltage and frequency variations, stability analysis.

Robustness and protection: cascading failure, outage, load shedding, restoration.
Development and trends: Centralized versus distributed energy sources, renewable sources, energy harvesters, nuclear power, energy storage and conversion, smart grids.

Reading List

Compulsory Readings

	Title
1	J. Grainger, W. Stevenson, and G. W. Chang, Power System Analysis, Second Edition, McGraw-Hill, New York, 2015.

Additional Readings

	Title
1	M. E. El-Hawary, Introduction to Electrical Power Systems, Wiley & IEEE Press, New York, 2008.
2	G. Turan, Modern Power System Analysis, CRC Press, Boca Raton, 2018.