City University of Hong Kong
Course Syllabus

offered by Department of Electrical Engineering
with effect from Semester A in 2020/2021

Part I Course Overview

Course Title:	Introduction to Electric Power Systems
Course Code:	EE3123
Course Duration:	13 weeks
Credit Units:	3
Level:	B3
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	MA1200 Calculus and Basic Linear Algebra I or MA1300 Enhanced Calculus and Linear Algebra I and EE1002 Principles of Electrical Engineering
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. 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 (iii) current development and future trends in power systems.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Identify the key physical quantities in power systems including voltages, currents, phase angles, power and impedances.		√	√	
2.	Analyze three-phase power systems and identify their role in distribution and delivery of electric power.		√	√	
3.	Perform standard power flow analysis and identify faults in electric power systems		√	√	
4.	Understand the role of renewable sources and future trends in power system developments		√	√	
** If weighting is assigned to CILOs, they should add up to 100%.*		100%			

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	Delivery of course materials, including theories, basic operating principles and applications of power systems	√	√	√	√	2 hrs/week

Tutorial	Strengthening the understanding of key concepts and working out problems	√	√	√	√	1 hr/week
Mini-project	Projects on microgrid and renewable energy developments, and practice on engineering design	√	√	√	√	3 hrs / week for 6 weeks

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4				
Continuous Assessment: 50%								
#Assignments (min: 3)	√	√	√	√			5%	
Tests (min: 2)	√	√	√	√			30%	
Lab/ Mini-project	√	√	√	√			15%	
Examination: 50% (Duration: 2 hrs, if applicable)								
Examination	√	√	√	√			50%	
** The weightings should add up to 100%.*							100%	

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

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Adequate (C+, C, C-)	Marginal (D)	Failure (F)
1. Continuous Assessment	Achievement in CILOs	High	Significant	Moderate	Basic	Below Marginal
2. Examination	Achievement in CILOs	High	Significant	Moderate	Basic	Below Marginal

6. Constructive Alignment with Major Outcomes

MILO	How the course contributes to the specific MILO(s)
1, 2, 5	Through the study of power systems and practice of analysis methods, students are expected to develop an ability to apply basic knowledge of mathematics, science and engineering principles for identifying the problems, formulating solutions, and implementing the solutions to solve engineering problems.
7, 10	The mini-project involves active sharing of ideas and applying engineering principles and tools to solve hands-on problems. Report write-ups, discussions, and demonstrations will directly contribute to the development of effective communication skills.

Part III Other Information (more details can be provided separately in the teaching plan)

1. 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.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

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

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

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.