University of Macau

Faculty of Science and Technology

Department of Electrical and Computer Engineering

Part A: Course Outline

Course Title:	Power System Design and Implementation		
Course Code:	ECEB455	Year of Study:	4
Course Mode:	Theoretical with substantial laboratory/ practice content		
Compulsory/Elective:	Elective		
Course Prerequisites:	ECEB122 Circuit Analysis		
Prerequisite Knowledge	Circuit Analysis, Linear Algebra		
Class/Laboratory Schedule:	2-hour lecturer, 2-hour simulation/tutorial per week		
Duration	One semester	Credit Units	3
Text Books and References:	[1] Power System Analysis, John Grainger, Jr.,William Stevenson, McGraw-Hill [2] Notes from lecturer		
Course Description:	This course is designed to prepare senior undergraduate students with knowledge for employment in the electrical industry. Topics include introduction to HV/MV/LV equipments, installation and maintenance of transformer, MV/LV distribution, protection system and Un-interruptible Power Supply, batteries & chargers.		
Topics Covered	1. Power System Electrical Equipment 2. Industrial Electrical Network. 3. Power System Protection 4. Un-interruptible Power Supply 5. General Electrical Testing 6. Power Quality and Passive Filter Design		
Course Objectives:	● To introduce the definitions, functions and characteristics of different power system electrical equipment, such as transformers, voltage regulators, switches, power circuit breakers, ……etc. [a, e] ● To develop students with an understanding of basic design principles in the operation of electric power systems. [a, e] ● To prepare the students to understand the basic concept of protection in distribution system. [a, e] ● To introduce the operation of uninterruptible power supply system, installation inspections, possible failures, corrective actions and maintenance. [a, e] ● To introduce the general ideas/steps to test some important components, such as transformer, switchgear, …… etc. [a, e] ● To prepare the students to understand the power quality problems and the		

<table>
<tr><td></td><td>concepts for passive filter design. [a, e]</td></tr>
<tr><td>Course Assessment:</td><td>Quiz: 10%
Notes+assignment: 10%
Mid-Term Test: 30%
Final Exam. : 50%</td></tr>
<tr><td>Relationship to Program Objectives and Outcomes</td><td>This course primarily contributes to ECE program outcomes that develop students abilities to:
a. Ability to apply knowledge of mathematics, science and engineering.
e. Ability to identify, formulate and solve engineering problems.</td></tr>
<tr><td>Course Contents and Relationship to Program Criteria:</td><td>
<table>
<tr><th>Week no.</th><th>Topics</th><th>Program Criteria</th></tr>
<tr><td>1</td><td>Power System Electrical Equipment
Definitions, functions and characteristics of different power system electrical equipment, such as transformers, voltage regulators, switches, power circuit breakers, …… etc</td><td>ES,LA,CV</td></tr>
<tr><td>4</td><td>Industrial Electrical Network.
General structure of the private distribution network, HV consumer substations, MV power supply, MV consumer substations, MV network structures, LV networks, General rules of electrical installation design</td><td>ES,LA,CV</td></tr>
<tr><td>3</td><td>Power System Protection
System Protection Methods, Short-Circuit Currents, Relays, Applied Protective Relaying. Fuses, Low-Voltage Circuit Breakers</td><td>ES,LA,CV</td></tr>
<tr><td>2</td><td>Un-interruptible Power Supply
Description of uninterruptible power supply (UPS) system, Operation of uninterruptible power supply system, installation inspections and component testing of the UPS system , possible failures and corrective actions</td><td>ES,LA,CV</td></tr>
<tr><td>2</td><td>General Electrical Testing
Introduction to component testing, such as testing on circuit switchers, transformers, LV switchgear, MV switchgear, motors, ……etc.</td><td>ES,LA,CV</td></tr>
<tr><td>2</td><td>Power Quality and Passive Filter Design
Power quality problems, common standards, methods to improve power quality, filter design to suppress the harmonics.</td><td>ES,LA,CV</td></tr>
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</td></tr>
<tr><td>Contribution of Course to meet the professional component:</td><td>This course prepares students to work professionally in the area of power and power related fields. Students should be able to apply knowledge of mathematics and engineering, and identify formulas to solve power engineering problems.</td></tr>
<tr><td>Course Instructor(s):</td><td></td></tr>
<tr><td>Prepared by:</td><td>Dr. Chi Kong Wong</td></tr>
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Part B: General Course Information and Policies

Instructor: Office:
Office Hour: Phone:
e-mail:

Programme Educational Objectives

1. **Problem Solving:** Graduates have the ability to think in a critical and evaluative manner and to consider a broad perspective, in order to solve technical and nontechnical problems.
2. **Leadership and Communication:** Graduates will provide effective leadership, act in an ethical manner and skills will include the ability to communicate well and to work successfully within diverse groups.
3. **Market Acceptance:** Graduates will have successful careers in the academic environment, industrial and government organizations.
4. **Technical Competence:** Graduates will be technically competent and have a thorough grounding in the fundamentals of math and science in electrical and computer engineering and experience in engineering design. They will be able to use modern engineering techniques, skills, and tools to fulfill societal needs.

Scale: 1 (Highest) to 4 (Lowest)

	Problem Solving	**Leadership and Communication**	**Market Acceptance**	**Technical Competence**
Power System Design and Implementation	1	4	1	2

Remark:

- Objective for “Problem Solving” can be achieved by assignments, quiz, final examination.
- Objective for “Leadership and Communication” can be achieved by report writing. However, leadership training is not given by this course.
- Objective for “Market Acceptance” can be achieved by the course subject that is related to power system.
- Objective for “Technical Competence” can be achieved by using fundamentals of math and science in electrical and computer engineering and experience in computer simulation.

Program Criteria Policy:

Course VS Program Criteria

Scale: 1 (Highest) to 4 (Lower)

Course	PS	DIC	BS	CS	ES	DE	LA	CV	DM
Power System Design and Implementation					1		3	2	

Terms:

Probability and Statistics (PS), Differential and Integral Calculus (DIC), Basic Science (BS), Computer Science (CS), Engineering Science (ES), Differential Equation (DE), Linear Algebra (LA), Complex Variables (CV), Discrete Mathematics (DM)

Program Outcome Policy:

Course VS Course Outcomes

(H= Highly Related, S = Supportive, N = None)

Course	a	b	c	d	e	f	g	h	I	j	k	l
Power System Design and Implementation	H	N	N	N	H	N	N	N	N	N	N	N

The electrical and computer engineering program outcomes are:

a. Ability to apply knowledge of mathematics, science and engineering.

b. Ability to design and conduct experiments.

c. Ability to design a system, component or process to meet desired needs.

d. Ability to function on multidisciplinary teams.

e. Ability to identify, formulate and solve engineering problems.

f. Understanding of professional and ethical responsibility.

g. Ability to communicate effectively.

h. Broad education necessary to understand the impact of engineering solutions in global and societal context.

i. Recognition of the need for and an ability to engage in life-long learning.

j. Knowledge of contemporary issues.

k. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

L. an ability to use the computer/IT tools relevant to the discipline along with an understanding

Curriculum Detail

ECEB 455 Power System Design and Implementation

Timetabled work in hours per week			No of teaching weeks	Total hours	No /Duration of exam papers	Max marks available from:	
Lecturer	**Tutor**	**Practice**				**Exams**	**Course**
2	2	0	14	28	1/2 hours	50	50

Term: 7th

Hours			Percentage content of					
Lecture	Lab/tut	Other	Maths	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies
28	0/28	0	20	10	50	20	0	0

Design Elements

% of Design Content	Design Content in Course Work	Design Project	Design Content in Laboratories
20%	X	0%	0%

Course Assessment Policy:

- Homework assignments will be given to students according to the course progress, no late submission is accepted. Zero mark will be given when homework is copied.
- Notes will be corrected, no late submission is accepted.
- 2 to 4 quizzes will be held during the semester.
- 1 mid-term test and 1 final exam will be performed.