Institute of Technology of Cambodia

Faculty: Electrical Engineering

Department: Electrical and Energy Engineering

Engineer's degree in Electrical Energy

Curriculum Improvement

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Academic 2021-2022

Contents

1. Description of Curriculum Improvement

Under Higher Education Improvement Project (HEIP), the Department of Electrical and Energy Engineering has MoU with the University of Toulouse (INP ENSEEIHT, France). The curriculum improvement in the Electrical Energy field is an important indicator of the project. Therefore, the department staffs develop a new curriculum due to some mismatched subjects or advanced subjects of the curriculum implemented in 2013 which is shown in the following table:

No.	Shortcomings of the old program	Percentage	Suggestions for the program improvement
1	The expected outputs do not meet the market demand	<30%	- Do a survey for the market needs - Prepare the expected outputs of the new curriculum by using the survey results
2	Duplicate subjects/ teaching content	30%	- Improve the subjects to support output results - Modify the teaching hour and Lab hour and the contents of each subject
3	Advance subject do not use in the current market	15%	- Improve the course learning output
4	Disorder subjects	20%	- Improve the order of the subjects
5	Few soft skills subjects	<5%	- Add soft skills subjects
6	The Course Learning Outcomes do not meet Program Learning Outcome	80%	- Improve Course Learning Outcome of each subject
7	Experimental subject: equipment matter, low-quality lab manuals, and less lab hours	50%	- Improve the experiment subject to support the expected output - Improve lab quality: manuals, equipment, lab hours

According to the matter of the existing curriculum, the department staffs identify the curriculum improvement of the Electrical Energy field as a priority by using the budget of the Higher Education

Improvement Project (HEIP). In order to determine the Program Educational Outcome (PEO) in responding to market needs, the department staffs have developed a survey questionnaire that can be analyzed and measured to support the new program.

2. Survey Results

The surveys were conducted in online (23 samples). Among the 23 samples, there are 20 electricity companies. The participants were 10 Engineers (43%), 5 Managers (23%), and 8 Human resources (34%). In the survey form, 9 skills in Electrical Energy have been developed for companies. The following table shows the survey results:

No.	Skills	Market Need				
		None	Low	Moderate	Fairly High	High
1	Energy Efficiency and Energy	0%	5%	20%	52%	23%
2	Energy Economics and Regulations	0%	10%	14%	51%	25%
3	Energy Management and Control	0%	0%	6%	22%	72%
4	Renewable Energy Technology	5%	5%	43%	28%	19%
5	Energy Modeling and Simulation	10%	5%	22%	53%	10%
6	Energy Conversion	5%	5%	48%	37%	5%
7	Energy Management and Planning	0%	10%	23%	38%	28%
8	Analytical and Critical Thinking	5%	5%	20%	52%	18%
9	Communication Skill	5%	0%	19%	52%	24%

According to the results, we observe that 6 skills with a need higher than 50% are important for designing a new curriculum to meet the market need. Additionally, this new program supports also the research and graduate program at the Institute of Technology of Cambodia.

Therefore, the new curriculum has three main objectives: 1- Technical skills (60% in industrial automation and embedded electronics), 2- Research and pursuing higher education skills (25%), and 3- Electrical entrepreneurship (15%).

3. New curriculum of Electrical Energy

The new curriculum was developed by using Outcome-Based Education (OBE). The figure below shows Program Educational Objectives (PEOs) that must be involved by all stakeholders such as feedback from the market, mission and vision of the department, and GEE alumni, etc.

The objectives of the educational program are evaluated by the institutional board on the expected outcomes of the program (Program Learning Outcomes - PLOs). The expected outcomes of the program are assessed by the program level and supported by Course Learning Outcomes (CLOs). Therefore, the standard evaluation of each subject is crucial to achieve the effective objectives of the program (PEOs).

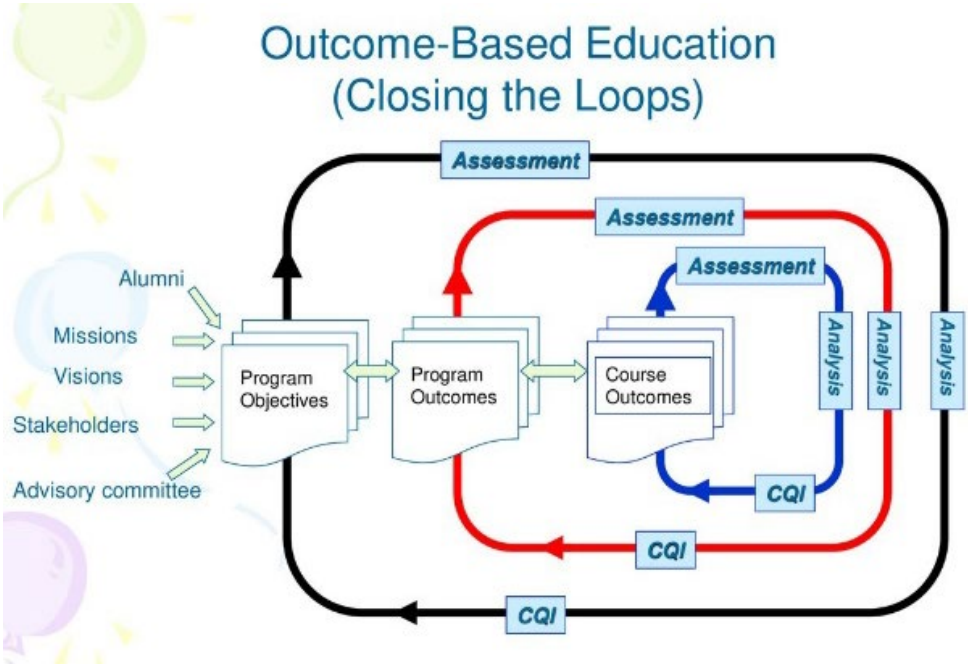

Figure 1: Outcome-Based Education Method Diagram

3.1. Program Aim

The program aims of the Department of Electrical and Energy Engineering, *Electrical Energy* field are as follows:

- Provide the capacity building to meet current and future work in the field of Electrical Energy.
- Provide the critical thinking skills to develop a smart grid based on research work for the current needs of industry 4.0.
- Provide analytical skills in Electrical Energy for industries.
- Provide the project design skills, including full capacity in leadership and teamwork
- Provide the psychomotor skills, testing electrical equipment, and training program
- Provide basic financial management, and leadership skills to become future entrepreneurs.

3.2. Program Educational Objectives (PEOs)

In response to the market and the Institutional need, the educations program has three main objectives:

- **PEO1**: Students will become fully qualified engineers in the Electrical Energy field to meet current and future market needs nationally and internationally.
- **PEO2**: Students capable of pursuing higher education abroad (Master's degree and Ph.D.), which will increase the number of researchers in the institute, and relevant institutions and ministries.

- **PEO3**: Students can become entrepreneurs in the future by providing basic techniques skills, financial management, and leadership in educational programs.

3.3. Program Learning Outcomes (PLOs)

To support the above three main objectives (PEOs), 11 PLOs of the educational programs have been developed in accordance with the Cambodia Qualifications Framework (CQF):

a. Knowledge

PLO1. Able to have basic knowledge in the field of Electrical Energy for Power Transmission and Distribution Systems, and Electrical Systems in Buildings.
PLO2. Able to use the equipment in the field of Electrical Energy for troubleshooting.
PLO3. Able to make the maintenance schedule for Electrical Energy systems in accordance with technical standards.

b. Cognitive Skills

PLO4. Highly skilled in analyzing complex problems in the Electrical and Energy sector.
PLO5. Highly innovative in developing smart grids based on research work and current needs of industry 4.0
PLO6. Expertise in developing efficient electrical energy systems to meet current and future needs.

c. Interpersonal Skills and Responsibility

PLO7. Expertise in assessing social needs for professional development and participating in lifelong learning in technical and environmental skills.
PLO8. Have effective leadership skills for teamwork, company, and country.

d. **Communication Information Technology Numerical Skills,**

PLO9. Have efficient communication skills both writing and oral among technical communities and societies.
PLO10. Have the skills to create arithmetic in computer software for analysis and problem-solving.

e. Psychomotor Skills

PLO11. Able to use measurement tools, electronic device testers, and conduct effective training programs to others.

3.4. Admission

To enroll the engineering degree in Electrical Energy Engineering, students must:

- Have technical and vocational degrees level 5 or
- Have a high school graduation certificate or

- Have a foundation year certificate or
- Have an equivalent degree

3.5. Number of Credit

In the Electrical Energy Engineering program, students must study for 5 years and receive a total of 150 credits.

3.6. Curriculum Subjects

Basic Major Subjects	Core Major Subjects	Non-Major Subjects/ General subjects	Elective Major Subjects
1. Electrical circuit 2. Electronic analog and filter 3. Computer Programming 4. Feedback control system 5. Signals and systems 6. Digital Electronics 7. Microprocessor Architecture 8. Electrical machine 9. Numerical method and optimization 10. Statistics 11. Electrical engineering lab 12. Electronic lab 13. Electricity 14. Vibration and wave 15. Informatic	1. Power Electronics 2. Engineering Economics 3. Energy conversion 4. Electrical machine and power electronics lab 5. Electrical system design 6. Power system analysis and optimization 7. Power system architecture and protection 8. Power electronics for energy conversion 9. Power system lab 10. Energy efficiency and conservation 11. Power system quality and reliability 12. Technologies for sustainable energy 13. Energy lab	1. Communication and interpersonal relation 2. Research Methodology 3. English 4. French 5. Project management 6. Technopreneurship 7. Work-Life and social psychology 8. Final year internship 9. History 10. Philosophy 11. Environment 12. Management and accounting 13. Marketing 14. Chemistry 15. Geometry 16. Mechanics 17. Calculus 18. Thermodynamic 19. Technical drawing 20. Probability 21. Linear algebra	1. Student project - Part 1 2. Student project - Part 2 3. Internship Report

3.7. Curriculum Structure

❖ **1st year**

Semester 1		Semester 2	
Subject	**Credit**	**Subject**	**Credit**
French	3 (0.0.3)	French	3 (0.0.3)
Geometry	2 (1.1.0)	Calculus I	3 (2.1.0)
Mechanics I	3 (2.1.0)	Thermodynamic	3 (2.1.0)
Management and accounting	3 (3.0.0)	Technical drawing	2 (1.1.0)
Philosophy	2 (2.0.0)	Marketing	2 (2.0.0)
Environment	2 (2.0.0)	Informatic	2 (1.0.1)
		History	2 (2.0.0)
Total	**15**	**Total**	**17**

❖ **2nd year**

Semester 1		Semester 2	
Subject	**Credit**	**Subject**	**Credit**
French	3 (0.0.3)	French	2 (0.0.2)
English	2 (0.0.2)	English	3 (0.0.3)
Mechanic II	3 (2.1.0)	Linear algebra	3 (2.1.0)
Calculus II	3 (2.1.0)	Probability	3 (2.1.0)
Chemistry	3 (2.1.0)	Vibration and wave	3 (2.1.0)
Electricity	3 (2.1.0)		
Total	**17**	**Total**	**14**

❖ **3rd year**

Semester 1		Semester 2	
Subject	**Credit**	**Subject**	**Credit**
French	2 (0.0.2)	French	1 (0.0.1)
English	1 (0.0.1)	English	2 (0.0.2)
Computer programming	1 (1.0.0)	Feedback control system	2 (1.1.0)
Signals and systems	2 (1.1.0)	Numerical method and optimization	1 (1.0.0)
Electrical circuit	3 (2.1.0)	Digital electronics	2 (1.1.0)
Electronic analog and filter	3 (2.1.0)	Microprocessor architecture	1 (1.0.0)
Electrical engineering lab	3 (0.0.3)	Electrical machine	2 (1.1.0)
Statistics	2 (1.1.0)	Electronic lab	3 (0.0.3)
		Communication and interpersonal relation	1 (1.0.0)
Total	**17**	**Total**	**15**

❖ **4th year**

Semester 1		Semester 2	
Subject	**Credit**	**Subject**	**Credit**
French	1 (0.0.1)	French	1 (0.0.1)
English	1 (0.0.1)	English	1 (0.0.1)
Power electronics	3 (2.1.0)	Electrical system design	3 (2.1.0)
Engineering economics	2 (1.1.0)	Power system analysis and optimization	3 (2.1.0)
Energy conversion	3 (2.1.0)	Power system architecture and protection	2 (1.1.0)
Electrical machine and power electronics lab	3 (0.0.3)	Power electronics for energy conversion	2 (1.1.0)
Research methodology	1 (1.0.0)	Power system lab	3 (0.0.3)
		Student project – Part 1	1 (0.0.1)
Total	**14**	**Total**	**16**

❖ **5th year**

Semester 1		Semester 2	
Subject	**Credit**	**Subject**	**Credit**
French	1 (0.0.1)	Final year internship	9
English	1 (0.0.1)		
Energy efficiency and conservation	3 (2.1.0)		
Power system quality and reliability	2 (1.1.0)		
Technologies for sustainable energy	2 (2.0.0)		
Project management	2 (2.0.0)		
Energy Lab	2 (0.0.2)		
Student project – Part 2	1 (0.0.1)		
Work life and social psychology	1 (1.0.0)		
Technopreneurship	1 (1.0.0)		
Total	**16**	**Total**	**9**

Note:

- 3 (3.0.0) means that lecture has 3 credits
- 3 (2.1.0) means that lecture has 2 credits and the tutorial has 1 credit
- 3 (2.0.1) means that lecture has 2 credits and Lab has 1 credit

3.8. Conditions for Obtaining a Degree

Students can earn a degree in Electrical Energy Engineering with the following condition:

- Completed all subjects according to the number of credits in the program
- Completed the semester exam
- Completed the internship
- Successfully write and defend the final thesis

3.9. Name of Degree

Successful students will receive an Engineer's Degree in Electrical Energy Engineering.

4. Conclusion and Implementation of the New Program

Curriculum improvement was completed in 2021 with the results of fruitful discussions by Depatment staffs and experts from the University of Toulouse, France. In addition, this program was also evaluated and approved by the Board of Trustees of the Institute of Technology of Cambodia. The new program is implemented in the academic year of 2021-2022 with 130 students enrolled.

Phnom Penh 27 June 2022

Head of the department

Dr. Chrin Phok

Seen and Approved

Phnom Penh June 2022

Deputy Director General of ITC

Mr. Soy Ty

5. Appendix A: Detail of Course Syllabus

Table 1: Comparison of the updated curriculum versus the old curriculum

No.	Academic year	Nb of subject (old curriculum)	Nb of subject (Updated curriculum)	New subject	Percentage of new subjects in the updated curriculum
1	Foundation study (Year 1 and Year 2)	20	20	--	0%
2	Year 3	13	15 (11 main subjects, 2 lab packages)	- Computer programming - Communication and interpersonal relation - Electrical machine	20%
3	Year 4	12	13 (9 main subjects, 2 lab packages)	- Research methodology - Student project – Part 1	16%
4	Year 5	9	11 (3 main subjects, 1 lab package, final internship)	- Work life and social psychology - Technopreneurship - Student project – Part 2	28%
Total		54	59	8	14%

6. Appendix B: Detail of Course Syllabus for 3rd to 5th Year

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

ANALOG ELECTRONICS

Subject: Analog Electronics, Year: 3 Semester: 1 Credit: 3
Lecturer: Mr. TEP Sovichea, Master Degree from N7-INP, France
Tel.: 061 645 160 E-mail: sovichea.tep@itc.edu.kh

1. Course Description

This subject is to provide the fundamental concept of analog electronics on semiconductor structure, operation, and its application. Moreover, this subject is also focus on conception of transistors and operational amplifier. Analog electronics is a main subject for digital electronics, power electronics, and feedback control system design.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to understand the operation of diodes, transistors (BJT, FET, MOSFET), and operational amplifier	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to analyze on the analog electronics circuit	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to invent the electronics device for the need of market	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	25	CLO2, CLO3
3	Quality oral presentation	25	CLO2, CLO3
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	2h	CLO1 CLO2 CLO3	- Ability to understand the application of analog electronics	Lecture 1: Introduction to analog electronic	- Lecture/Tutorial - Ask key question for students' reflection	- Taking note - Ask questions for clearly understanding	Attendance	- PPT Present - Lecture Note
2	2h	CLO1 CLO2 CLO3	- Ability to understand the general characteristics of semiconductor materials (P-Type, N-Type) - Ability to understand the basic operation of a P-N junction in the no-bias, forward-bias, and reverse-bias regions	Lecture 2: Introduction to semiconductor and P-N junction	- Lecture/Tutorial - Case Study 1 - Demonstration and explanation about the problem in case study. - Define scope of work for this case study	- Taking note - Actively participate in class activities - Ask question for understand the lecture, and for case study problem	Attendance Demonstration on case study	- PPT Present - Lecture Note
3 → 3	4h / 4h	CLO1 CLO2 CLO3	- Ability to understand the I-V characteristic of diode family (Diode, Zener, LED) - Ability to find the equivalent circuit of diode family - Ability to understand the operation of Diodes in: clippers, clampers, half-wave and full-wave rectification	Lecture 3: Diode and its application	- Lecture/Tutorial - Assignment 1 - Define scope of work for assignment - Demonstrate the software for simulation work	- Taking note - Ask questions for clearly understanding the lecture and the assignment - Start learning on how to use simulation tool	- Attendance - Quiz 1	- PPT Present - Lecture Note

5	2h / 2h	CLO1 CLO2 CLO3	- Ability to understand the construction of BJTs (NPN, PNP) - Ability to understand the characteristic and the operation of BJTs	Lecture 4: Bipolar Junction Transistor (BJT)	- Lecture/Tutorial - Demonstrate the software for simulation work	- Taking note - Ask questions for clearly understanding the lecture	- Attendance - Quiz 2	- PPT Present - Lecture Note - Computer, LCD, ink markers
6 → 7	4h / 4h	CLO1 CLO2 CLO3	- Ability to analyze the BJTs' operation (dc levels, saturation and cutoff region) - Ability to compute a load-line analysis of the most common BJT	Lecture 5: BJTs operation point analysis	- Lecture/Tutorial - Demonstrate the software for simulation work	- Taking note - Ask questions for clearly understanding the lecture	- Attendance - Homework 1	- PPT Present - Lecture Note - Computer, LCD, ink markers
8	2h	**Mid-term**						
9 → 10	4h / 4h	CLO1 CLO2 CLO3	- Ability to find the equivalent model ac parameters - Ability to compute the characteristic on BJT amplifier (small signal: overall gain, input/output impedance)	Lecture 6: BJTs small signal analysis	- Lecture/Tutorial - Assignment 2 - Define scope of work for assignment - Demonstrate the software for simulation work -	- Taking note - Ask questions for clearly understanding the lecture and the assignment - Start learning on how to use simulation tool	- Attendance - Quiz 3	- PPT Present - Lecture Note - Computer, LCD, ink markers
11	2h / 2h	CLO1 CLO2 CLO3	- Ability to understand the construction of FETs (JFETs, MOSFETs, MESFETs) - Ability to understand the characteristic and the operation of FETs	Lecture 7: Field-Effect Transistors (FETs)	- Lecture/Tutorial - Case Study 1 - Demonstration and explanation about the problem in case study. - Define scope of work for this case study	- Taking note - Actively participate in class activities - Ask question for understand the lecture, and for case study problem	- Attendance - Homework 2	- PPT Present - Lecture Note - Computer, LCD, ink markers

12	2h / 2h	CLO1 CLO2 CLO3	- Ability to analyze the FETs' operation (dc analysis, saturation, cutoff region, FET networks) - Ability to compute a load-line analysis of FET networks	Lecture 8: FETs operation point analysis	- Lecture/Tutorial - Assignment 3 - Define scope of work for assignment - Demonstrate the software for simulation work	- Taking note - Ask questions for clearly understanding the lecture and the assignment - Start learning on how to use simulation tool	- Attendance	- PPT Present - Lecture Note
13 → 14	4h / 4h	CLO1 CLO2 CLO3	- Ability to understand the construction of operational amplifier - Ability to distinguish the mathematic operation of AOP (Non-inverting, Inverting, Adder, differential, integral, derivative)	Lecture 9: Operational amplifier (op-amp)	- Lecture/Tutorial	- Taking note - Ask questions for clearly understanding the lecture - Preparation for presentation	- Attendance - Presentation 1	- PPT Present - Lecture Note
15 → 16	4h / 4h	CLO1 CLO2 CLO3	- Ability to distinguish the difference applications of op-amp - Ability to use op-amp as: comparator, integrator, Schmitt-trigger	Lecture 10: Op-amp applications	- Lecture/Tutorial	- Taking note - Ask questions for clearly understanding the lecture - Preparation for presentation	- Attendance - Presentation 2	- PPT Present - Lecture Note - Computer, LCD, ink markers
17	2h	Final Exam						

6. References

[1] Boylestad, R. L., & Nashelsky, L. "*Electronic devices and circuit theory*". Prentice Hall, 2012.

[2] Mancini, R. "Op amps for everyone: design reference." Newnes, 2003.

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

ANALOG FILTER

Subject: Analog Filter, Year: 3 Semester: 1 Credit: 3
Lecturer: Mr. CHHORN Sopheaktra, Master Degree from CU, Thailand
Tel.: 010 668 465 E-mail: pheaktra@itc.edu.kh

1. Course Description

This subject is to provide the fundamental concept of analog filter which study on the structure, operation, and application of passive and active filter. Some parts of this subject are reserved for students capable to do research in that filed. This subject is a main subject to support other subjects such as digital electronics, power electronics, and control system.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to understand the operation of passive and active filter which use to decrease the disturbance	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to analyze the passive and active filter circuit	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to build filter for harmonics cancellation in analog circuit	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	25	CLO2, CLO3
3	Quality oral presentation	25	CLO2, CLO3
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	2h / 0h		- Ability to understand the application of analog filter in circuit, electronics, power electronics, control, …	Lecture 1: Introduction to analog filter, time and frequency domain of the system	- Lecture - Tutorial	- Note - Q/A	Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
2	2h / 2h		- Ability to derive the transfer function in frequency domain - Ability to plot Bode-diagram of different transfer function (0, 1st and 2nd order)	Lecture 2: Transfer function and Bode plot diagram	-Tutorial - Lecture - Case study 1	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
3	2h / 2h		- Ability to understand the basic component and structure of 1st order passive filter (low-pass and high-pass filter) - Ability to derive the transfer function and plot bode diagram of 1st order passive filter - Ability to compute the main parameter of the passive filter (cut-off frequency, phase margin and group delay) - Ability to design the 1st order passive filter	Lecture 3: 1st order passive filter	- Lecture - Tutorial	- Note - Q/A	- Attendance - Quiz 1	- PPT Present - Lecture Note - Computer, LCD, ink markers

4	2h / 2h		- Ability to understand the basic component and structure of 2^{nd} order passive filter (low-pass and high-pass filter) - Ability to derive the transfer function and plot bode diagram of 2^{nd} order passive filter - Ability to compute the main parameter of the passive filter (cut-off frequency, phase margin and group delay) - Ability to design the 2^{nd} order passive filter	Lecture 4: 2^{nd} order Passive filter	- Lecture - Tutorial - Assignment 1	- Note - Q/A	- Attendance - Quiz 2	- PPT Present - Lecture Note - Computer, LCD, ink markers

5 → 7	6h / 4h		- Ability to understand the basic component and structure of N^{th} order passive filter (low-pass and high-pass filter) - Ability to derive the transfer function and plot bode diagram of N^{th} order passive filter - Ability to compute the main parameter of the passive filter (cut-off frequency, phase margin and group delay) - Ability to design the N^{th} order passive filter - Ability to understand the applications of different filter coefficients such as, Bessel, Butterworth, Type-I and Type-II Chebyshev	Lecture 5: N^{th} order passive filter	- Lecture - Tutorial - Assignment 2	- Note - Q/A	- Attendance - Quiz 3	- PPT Present - Lecture Note - Computer, LCD, ink markers
8	2h	Mid-term						
9	2h / 0h		- Ability to understand the basic component and structure of 1^{st} order active filter (low-pass and high-pass filter) - Ability to derive the transfer function and plot bode diagram of 1^{st} order active filter	Lecture 7: 1^{st} order active filter	- Lecture - Tutorial - Case Study 2	- Note - Q/A	- Attendance - Homework 1	- PPT Present - Lecture Note - Computer, LCD, ink markers

			- Ability to compute the main parameter of the active filter (cut-off frequency, phase margin and group delay) - Ability to design the 1st order active filter (Sallen-Key and Multiple feedback filter)					
10→11	4h / 2h		- Ability to understand the basic component and structure of 2nd order active filter (low-pass and high-pass filter) - Ability to derive the transfer function and plot bode diagram of 2nd order active filter - Ability to compute the main parameter of the active filter (cut-off frequency, phase margin and group delay) - Ability to design the 2nd order active filter (Sallen-Key and Multiple feedback filter)	Lecture 8: 2nd order active filter	- Lecture - Tutorial - Assignment 3	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers

12	2h / 2h		- Ability to understand the structure of multiple stage filter - Ability to derive total transfer function to cascade filter - Ability to design multiple stage active filter	Lecture 9: Multiple stage active filter (cascade filter)	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
17		**Final Exam**						

6. References

[1] Winder, S. (2002). *Analog and digital filter design*. Elsevier.

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

COMPUTER PROGRAMMING

Subject: Computer Programming, Year: 3 Semester: 1 Credit: 1
Lecturer: Mr. CHIN Chandaraly, Master degree from CU, Thailand
Tel.: 077 722 887 E-mail: chandaraly.chin@itc.edu.kh

1. Course Description

This subject is to provide the fundamental concept of computer on hard part and soft part on C programming: Algorithm, Database, flow control, and standard library. Moreover, there will have a part on preparation of character into string, dynamic memory allocation, standard I/O, definition of micro, C runtime library, and key for problem solving. This subject is a main support subject for Microprocessor, PLCs system, Industrial Network Protocol, etc.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to understand the basic of computer and its devices	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to write code languages and computer operation	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to build algorithm and send to computer for solving	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	25	CLO2, CLO3
3	Quality oral presentation	25	CLO3
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	1h		- Ability to understand computer hardware, main parts and how to a build own desktop - Ability to understand software, interact between user and computer	Lecture 1: Introduction to computer hardware and software	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
2-3	2h		- Ability to understand program conception and execution - Ability to create a program using a command-line compiler	Lecture 2: Basic of program writing, compiling and debugging in C	- Lecture - Tutorial	- Note - Q/A	- Quiz 1 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
4-5	2h		- Ability to define variable, data types, size, constants and declaration - Ability to operate arithmetic, relational, logical, bitwise operator	Lecture 3: Type, Operator, Expression	- Lecture - Tutorial	- Note - Q/A	- Quiz 2 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
6-7	2h		- Ability to define statement, block, loop, goto, and error handling	Lecture 4: Control flow	- Lecture - Tutorial	- Note - Q/A	- Homework 1 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
8	1h	**Midterm**						
9-11	3h		- Ability to code function and modular programming	Lecture 5: Functions and Program Structure	- Lecture - Tutorial	- Note - Q/A	- Homework 2 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers

			- Ability to define variable scope, static and global variable, standard I/O, string I/O, and file I/O					
12-14	3h		- Ability to create pointers and memory addressing, arrays and pointer arithmetic, strings as arrays Pointers to pointers, and multidimensional arrays	Lecture 6: Pointers and Arrays	- Lecture - Tutorial	- Note - Q/A	- Quiz 3 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
15-16	2h		- Ability to create user-defined datatypes, structs, unions, bit fields, memory allocation, linked lists, and binary trees	Lecture 7: Structures	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
17		**Final Exam**						

6. References

[1] Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*. 2nd ed. Upper Saddle River, NJ: Prentice Hall, 1988.

[2] Steve Oualline. Prictical C Programming. 3rd ed. O'Reilly, 1997

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

DIGITAL ELECTRONICS

Subject: Digital Electronics, Year: 3 Semester: 2 Credit: 2
Lecturer: Mr. TEP Sovichea, Master Degree from N7-INP, France
Tel.: 061 645 160 E-mail: sovichea.tep@itc.edu.kh

1. Course Description

This subject is to provide the students the digital electronics structure, operation, and its application (such as digital circuit design for computer, phone, watch, etc.). Some parts of this subject are reserved for enhancing students' research capability. This subject is a main support subject for microcontroller, digital circuit design, digital signal processing, and embedded systems.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to understand the operation and construction of Digital Electronics for computer and automation system	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to analyze the operation of digital electronics circuit	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to build the digital electronics system for the need of society	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	25	CLO2, CLO3
3	Quality oral presentation	25	CLO3
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	1h/2h	- Ability to explain the basic differences between digital and analog quantities - Ability to represent signed number in binary by reviewing the decimal, octal, and hexadecimal number system, count in the binary number system and convert between the number systems - Ability to understand floating-point numbers, range of numbers and precision in binary system.	Lecture 1: Number systems	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers
2	1h/2h	- Ability to understand the commonly used binary codes such as BCD codes, Excess-3 codes, Gray codes, Alphanumeric codes and Seven-segment codes	Lecture 2: Binary codes	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers
3	1h/2h	- Ability to understand the basics of binary addition and subtraction, BCD addition and subtraction using Excess-3 codes binary multiplication and division, and floating-point arithmetic	Lecture 3: Digital arithmetic	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers

4	1h/2h	- Ability to understand logic 0/1, truth table, logic gates (NOT, AND, OR, NAND, NOR, XOR, XNOR, AND-OR-INVERT (AOI)), universal gates, Schmitt gate, common applications of logic gates	Lecture 4: Logic gates and related devices	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers
5	1h/2h	- Ability to apply the basic laws and rules of Boolean algebra, DeMorgan's theorems to Boolean expressions - Ability to describe gate combinations with Boolean expressions - Ability to evaluate Boolean expressions - Ability to simplify expressions by using the laws and rules of Boolean algebra	Lecture 5: Boolean algebra and simplification techniques - Part 1	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers
6	1h/2h	- Ability to convert any Boolean expression into a sum-of-products (SOP) form - Ability to convert any Boolean expression into a product of-sums (POS) form - Ability to understand the canonical form of SOP and POS - Ability to converter a related Boolean expression to a truth table by using Karnaugh map - Ability to use "don't care" conditions to simplify logic functions	Lecture 6: Boolean algebra and simplification techniques - Part 2	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers

7	1h/2h	- Ability to implement combinational circuit for basic building blocks of arithmetic circuit, namely: half-adder, full-adder, half-subtractor, and full-subtractor, adder-subtractor circuit, and BCD adder circuit	Lecture 7: Combinational logic - arithmetic circuit 1	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers
8	1h/2h	- Ability to distinguish between ripple adder and look-ahead carry adder - Ability to implement multiplier circuit, magnitude comparator: less than, equal and greater than condition	Lecture 8: Combinational logic - arithmetic circuit 2	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers
9	Mid-Term						
10	1h/2h	- Ability to understand the construction of 2-to-1 mux - ability to implement n-to-1 mux using 2-to-1 mux, conditional circuit using 2-to-1 mux, boolean functions with multiplexers - Ability to understand data selector circuit, priority encoder - Ability to implement 1-to-2 and n-to-1 demux - Ability to understand decoder circuit	Lecture 9: Combinational logic - multiplexers and demultiplexers	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers

11	1h/2h	- Ability to use logic gates to construct basic latches - Ability to explain the difference between an S-R latch and a D latch - Ability to recognize the difference between a latch and a flip-flop - Ability to explain how D and J-K flip-flops differ - Ability to understand the significance of propagation delays, set-up time, hold time, maximum operating frequency, minimum clock pulse widths, and power dissipation in the application of flip-flops - Ability to apply flip-flops in basic applications - Ability to explain how retriggerable and nonretriggerable one-shots differ - Ability to build a 555 timer to operate	Lecture 10: Latches and Flip-Flops	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers
12	1h/2h	- Ability to identify the basic forms of data movement in shift registers - Ability to explain how serial in/serial out, serial in/parallel out, parallel in/serial out, and parallel in/parallel out shift registers operate - Ability to describe how a bidirectional shift register operates - Ability to compute the sequence of a Johnson counter,	Lecture 11: Shift registers	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers

		the ring counter to produce a specified sequence - Ability to Construct a ring counter by using a shift register (serial-to-parallel data converter)					
13	1h/2h	- Ability to describe the difference between an asynchronous and a synchronous counter - Ability to analyze counter timing diagrams and counter circuits - Ability to explain the propagation delays affect counter operation - Ability to compute and modify the modulus of a counter - Ability to distinguish the difference between a 4-bit binary counter and a decade counter - Ability to use an up/down counter to generate forward and reverse binary sequences for determining the sequence of a counter	Lecture 12: Counters	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers
14	1h/2h	- Ability to understand the types of programmable logic, SPLDs and CPLDs, and explain their basic structure - Ability to describe the basic architecture of two types of SPLDs—the PAL and the GAL - Ability to analyze the operation of macrocells	Lecture 13: Programmable logic	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers

		- Ability to distinguish between CPLDs and FPGAs - Ability to explain the basic operation of a look-up table (LUT) - Define intellectual property and platform FPGA - Ability to analyze the embedded functions by implementing a basic software for design flow of a programmable device					
15	1h/2h	- Ability to explain the basic memory characteristics, RAM, static RAMs (SRAMs), dynamic RAMs (DRAMs), ROM, various types of PROMs, the characteristics of a flash memory. - Ability to describe the expansion of ROMs and RAMs to increase word length and word capacity - Ability to analyze special types of memories such as FIFO and LIFO	Lecture 14: Data storage	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers

16	1h/2h	- Ability to understand the computer architecture, practical computer system - Ability to describe the purpose of buffers, decoders, and wait-state generators in a computer system - Ability to define and explain the advantage of DMA - Ability to provide the basic elements of a microprocessor - Ability to explain the basic architecture of a microprocessor (CPU) and its operation. - Ability to list-down some microprocessor addressing Modes, microprocessor polling, interrupts, exceptions, and bus requests - Ability to analyze the operating system of a computer - Ability to explain pipelining, multitasking, Multiprocessing, and simple assembly language program	Lecture 15: Computer concepts	- Give lecture - Whiteboard demonstration - Ask questions	- Taking notes - Working individually on exercises - Group research and discussion	- Exercises - Quiz - Attendance	- Lecture slides presentation - Lecture notes - Computer, LCD, ink markers
17	**Final Exam**						

6. References

[1] Maini, A. K. (2007). *Digital electronics: principles, devices and applications*. John Wiley & Sons.

[2] Floyd, T. L. (2010). *Digital Fundamentals, 10/e*. Pearson Education India.

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

COMMUNICATION AND INTER-PERSONNAL SKILL

Subject: Communication and Inter-personal Skill, Year: 3 Semester: 2 Credit: 1
Lecturer: Dr. CHRIN Phok, PhD. from N7-INP, France
Tel.: 096 9790999 E-mail: pchrin@itc.edu.kh

1. Course Description

This subject is to provide the students on how to communicate with other in the manner of professionalism. This subject is also very important for students to adapt themselves into work-life.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to communicate with other with and without technical area	PLO7, PLO8, PLO9
CLO2	Able to know the important of inter-personal skill for work-life	PLO7, PLO8, PLO9

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4, CLO5
2	Assignment (quality reports)	25	CLO2, CLO3, CLO4
3	Quality oral presentation	25	CLO5
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	LLOs	Lecture	Teaching Method	Learning Method	Assessment	Material
1	- Ability to define a communication and inter-personal skill for work-life	Lecture 1: Understanding interpersonal styles and techniques of communication	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
2	- Ability to change yourself for improving overall teamwork	Lecture 2: Self-awareness and exploring differences	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference -
3	- Ability to use the skill for work-life	Lecture 3: Assertiveness skill	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance -	- Lecture note (slide) - Book reference -
4	- Ability to communicate correctly with other people	Lecture 4: Communicating feeling and nonverbal communication	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance -	- Lecture note (slide) - Book reference -
5	- Ability to use effective communication	Lecture 5: How to achieve effective communication	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
6	- Ability to be a good listener	Lecture 6: Effective listening techniques	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their	- Taking note - Group discussion - Role plays	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference

			understanding of the lecture	- Case studies		
7	Ability to upgrade the communication level	Lecture 7: Communication in relationships	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
8	Ability to know the power and its influence	Lecture 8: Personal power and influencing skills	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
9	Ability to receive the critique for growing	Lecture 9: Attribute, values and perceptions	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
10	Ability to use the feedback strategies to improve communication skill	Lecture 10: Feedback strategies	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
11	Ability to identify the interpersonal power in the working environment	Lecture 11: Interpersonal power	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
12	Ability to solve the problem	Lecture 12: How to deal with different situation and conflict	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
13	Ability to solve the conflict	Lecture 13: Conflict management	- Explain the content of lectures	- Taking note	- Oral test - Quiz	- Lecture note (slide)

		strategies and techniques	- Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Group discussion - Role plays - Case studies	- Attendance	- Book reference
14	Ability to negotiate with other	Lecture 14: Negotiating conflict in relationships	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
15	Ability to deal with different people	Lecture 15: Dealing with difficult people and with people under stress	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference
16	Ability to work in group	Lecture 16: Working together	- Explain the content of lectures - Provide examples which related to the lecture - Asking question to the student to observe their understanding of the lecture	- Taking note - Group discussion - Role plays - Case studies	- Oral test - Quiz - Attendance	- Lecture note (slide) - Book reference

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

CLECTRICAL CIRCUIT

Subject: Electrical Circuit, Year: 3 Semester: 2 Credit: 2.5
Lecturer: Dr. CHRIN Phok, PhD. from N7-INP, France
Tel.: 096 97 90 999 E-mail: pchrin@itc.edu.kh

1. Course Description

This subject is to provide the fundamental concept of electrical circuit such as theory of Kirchhoff Thevenin, and Norton. Moreover, this subject will also give the analyze concept of equivalent circuit for DC and AC circuit. This is a main subject in studying of Electrical and Energy Engineering.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to apply Ohm law, current flow, voltage, and other parameters in circuit	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to knowledge on theory of Kirchhoff and Thevenin/Norton	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to analyze the operation of electrical circuit for DC and AC (1-phase and 3-phase)	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Quiz	25	CLO1, CLO2, CLO3
3	Homework	25	CLO1, CLO2, CLO3
4	Mid-Term exam	20	CLO1, CLO2, CLO3
5	Final Exam	20	CLO1, CLO2, CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	2h/2h		- Ability to use mathematic for electrical circuit analysis - Ability to distinguish the circuit variables and its units	Lecture 1: Introduction to electrical circuit	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
2-3	4h/4h		- Ability to compute the current and voltage by using Ohm's Law - Ability to compute current and voltage by using node/branches/loops, Kirchoff's Laws.	Lecture 2: Basic Law of Circuit	- Lecture - Tutorial	- Note - Q/A	- Quiz 1 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
4-5	4h/5h		- Ability to compute current and voltage of the complex circuit by using Nodal/Mesh analysis.	Lecture 3, Method of Analysis	- Lecture - Tutorial	- Note - Q/A	- Quiz 2 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
6-7	4h/5h		- Ability to find the equivalent circuit by using Thevenin /Norton. - Ability to convert current/voltage sources transformation - Ability to compute current and voltage of multiple sources circuit by	Lecture 4: Circuit Theorem	- Lecture - Tutorial	- Note - Q/A	- Homework 1 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers

			superposition theorem.					
8	2h	**Midterm**						
9-10	2h/4h		- Ability to apply the complex number for AC circuit elements	Lecture 5: Sinusoidal and Phasor	- Lecture - Tutorial	- Note - Q/A	- Homework 2 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
11-12	2h/4h		- Ability to compute AC current/voltage for steady-state condition by using nodal/mesh analysis	Lecture6: Sinusoidal Steady State Analysis	- Lecture - Tutorial	- Note - Q/A	- Quiz 3 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
13-14	2h/4h		- Ability to find instantaneous/ average/maximum power transfer /effective power of AC circuit.	Lecture7: AC Power Analysis	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
15-16	2h/4h		- Ability to compute current/voltage/power for 3-phase electrical circuit (Network configuration: Star-Star, Delta-Star, …)	Lecture8: 3-Phase Circuit	- Lecture - Tutorial	- Note - Q/A	- Homework 3 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
17		**Final Exam**						

6. References

[1] Matthew Sadiku, Charles Alexander “Fundamentals of Electric Circuits,” 5th edition, Kindle Edition , July 1, 2012

[2] William, Kemmerly, Jack, Durbin, Steven “Engineering Circuit Analysis,” 8th edition McGraw-Hill, 2011

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

NUMERICAL METHOD AND OPTIMIZATION

Subject: Engineering Optimization Tools, Year: M1 Semester: 1 Credit: 2.5
Lecturer: Dr. AM Sok Chea, PhD. from UGA, France
Tel.: 096 34 55 449 E-mail: Sokchea_am@itc.edu.kh

1. Course Description

Engineering Optimization Tools provides students the concept of using optimization design to solve engineering problem. The genetic algorithms based on MATLAB script will be used as a main tool for teaching and learning in this subject. After learning this course, students will gain capacity on modeling the engineering problem as well as defined function objective for optimization design.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the optimization problem and modeling	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO12, PLO13
CLO2	Develop optimization model by using simulation tool (MATLAB/Simulink): Genetic Algorithm	PLO1, PLO2, PLO3, PLO4, PLO6, PLO7, PLO12, PLO13
CLO3	Able to perform research in the filed of optimization design for engineering problem	PLO9, PLO10, PLO11

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Develop simulation model
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	25	CLO1, CLO2, CLO3
3	Quality oral presentation	25	CLO1, CLO2, CLO3
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment Methodology	Materials
1-3	6h/3h	- Ability to understand the optimization problem of engineering - Ability to define function objective: one objective or multi-objective.	Lecture 1: Optimization Problem: Function Objective	- Lecture - Tutorial	- Note Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
4-6	6h/3h	- Ability to define optimization constraints. - Ability to define variables and parameters. - Ability to define boundary for each variable.	Lecture 2: Optimization Constraint	- Lecture - Tutorial - Case Study 1	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
7-9	6h/3h	- Ability to compute the solution of system equation by using Linear Systems, Gauss Elimination Method, LU Factorization Methods, Gauss-Seidel (algorithm)	Lecture 3: Optimization Problem Solving: Mathematical Model	- Lecture - Tutorial - Assignment 1	- Note - Q/A	- Attendance - Quiz 1	- PPT Present - Lecture Note - Computer, LCD, ink markers
10	1h	Mid-Term					
11-16	12h/6h	- Ability to understand the genetic algorithm tool for solving the	Lecture 4 : Genetic Algorithms by using MATLAB script	- Lecture - Tutorial	- Note - Q/A	- Attendance - Quiz 2	- PPT Present - Lecture Note - Computer, LCD, ink markers

		optimization problem. - Ability to apply the genetic tool for solving the engineering problem such as electrical system optimization, civil engineering optimization, … - Ability to analyze the optimization result under Front Pareto form. - Ability to obtain numerical result of optimization script.					
17	2h	Final Exam					

6. References

[1] Ramin S. Esfandiari "Numerical Method for Engineers and Scientists Using MATLAB®," 2nd edition, 2017

[2] Steven C. Chapra, Raymond P. Canale "Numerical Methods for Engineers," 7th edition, 2015

[3] Steven T. Karris "Numerical Analysis Using MATLAB® and EXCEL®" 3rd edition, Orchard Publications 2007

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

ELECTRICAL MACHINE

Subject: Electrical Machine, Year: 3 Semester: 2 Credit: 2
Lecturer: Dr. VAI Vannak, PhD. from UGA, France
Tel.: 012 617 364 E-mail: vannak.vai@itc.edu.kh

1. Course Description

This subject is to provide the fundamental concept of electrical transformer, electrical machine, AC motors, DC motors, etc. Moreover, this subject focuses on the operation of synchronous and induction machine as well as DC machine.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to knowledge on operation of transformer, motor, AC machine (synchronous and induction), and DC machine	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to identify the different between generator and motor	PLO1, PLO2, PLO3, PLO4, PLO5
CLO3	Able to model the machine for suitable application	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4, CLO5
2	Assignment (quality reports)	25	CLO2, CLO3, CLO4
3	Quality oral presentation	25	CLO5
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	2h/2h		▪ Ability to understand the basic concepts of Machinery. ▪ Ability to demonstrate the machinery's principle. ▪ Ability to apply general concepts to a linear Machine.	Lecture 1: Introduction to Machinery Principles	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
2-3	3h/4h		▪ Ability to understand the behavior of ferromagnetic Materials ▪ Ability to introduce the induced voltage from time-changing magnetic field, induced on a living wire, induced voltage on a moving conductor in magnetic field, and the linear DC machine. ▪ Ability to understand the real, reactive, and apparent power in AC circuit.	Lecture 2: AC Machinery Fundamentals	-Tutorial - Lecture - Case study 1 -	- Note - Q/A	- Attendance -	- PPT Present - Lecture Note - Computer, LCD, ink markers
4-5	2h/4h		▪ Ability to understand the notion of Laplace transform and the region of convergence. ▪ Ability to compute the Laplace transform of a given signals, and	Lecture 3: Laplace transforms for continuous-time system	- Lecture - Tutorial	- Note - Q/A	- Attendance - Quiz 1	- PPT Present - Lecture Note - Computer, LCD, ink markers

			its inverse Laplace transform. ▪ Ability to convert the Laplace transform to transfer function. ▪ Ability to understand the use of unilateral Laplace transform for circuit analysis. ▪ Ability to use Laplace Transform to solve differential equations.					
6-7	2h/4h		▪ Ability to understand the notion of z-transform and the region of convergence for discrete-time signal. ▪ Ability to solve the z-transform of a given discrete-time signal, and its inverse z-transform.	Lecture 4 (1): The z-Transform for discrete-time system	- Lecture - Tutorial - Assignment 1	- Note - Q/A	- Attendance - Quiz 2	- PPT Present - Lecture Note - Computer, LCD, ink markers
8	2h	**Midterm**						
9-10	2h/4h		▪ Ability to compute the properties of the z-transform. ▪ Ability to understand the concept of transfer function of a discrete-time system using z-transform. ▪ Ability to implement a discrete-time system in a computer program based on the transfer function in Z.	Lecture 4 (2): The z-Transform for discrete-time system	- Lecture - Tutorial - Assignment 2	- Note - Q/A	- Attendance - Quiz 3	- PPT Present - Lecture Note - Computer, LCD, ink markers
11-12	2h/4h		▪ Ability to understand the spectral	Lecture 5:	- Lecture	- Note	- Attendance	- PPT Present

			representation of the signals with Fourier series. ▪ Ability to determine the Fourier series of a periodic signal, the Fourier transform of any signal, the frequency response of continuous-time LTI systems. ▪ Ability to understand the concept of filtering and bandwidth.	Fourier Analysis of continuous-time signals and systems	- Tutorial - Case Study 2	- Q/A	Homework 1	- Lecture Note - Computer, LCD, ink markers
13-14	2h/4h		▪ Ability to compute the discrete Fourier series. ▪ Ability to determine the discrete Fourier transform of any signal.	Lecture 6 (1): Fourier Analysis of discrete-time signals and systems	- Lecture - Tutorial - Assignment 3	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
15-16	2h/4h		▪ Ability to understand the difference between discrete Fourier transform and discrete Fourier series. ▪ Ability to determine the frequency response of a discrete-time LTI systems.	Lecture 6 (2): Fourier Analysis of discrete-time signals and systems	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
17		**Final**						

6. References

[1] Schaum's Outline of Signals and Systems, 3rd Edition (Schaum's Outlines), by Hwei Hsu.

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

SIGNALS AND SYSTEMS

Subject: Signals and Systems, Year: 3 Semester: 1 Credit: 2
Lecturer: Dr. KIM Bunthern, PhD. from N7-INP, France
Tel.: 077 512 157 E-mail: kimbunthern@itc.edu.kh

1. Course Description

This subject is to provide the fundamental concept of electrical signals and electrical systems. This subject will detail about analog and digital signals which is a main tool for control system design. The study focuses also on analysis of signal in time-domain and frequency-domain.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to understand the various signals and systems which used in electricity and electronics	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to analyze the analog and digital signal	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to build the model for signals and systems in analog and in digital	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	25	CLO2, CLO3
3	Quality oral presentation	25	CLO3
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	2h/2h		▪ Ability to understand the notion of signal and system utilized in the study of electrical systems. ▪ Ability to understand the different type of signals/systems and its real application. ▪ Ability to formulate a system by identifying the input and output signals.	Lecture 1: Introduction to Signals Systems	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
2-3	3h/4h		▪ Ability to understand the notion of LTI system and convolution integral, discrete LTI system and convolution sum. ▪ Ability to compute the systems which described by differential equations.	Lecture 2: LTI systems and Convolution	-Tutorial - Lecture - Case study 1 -	- Note - Q/A	- Attendance -	- PPT Present - Lecture Note - Computer, LCD, ink markers
4-5	2h/4h		▪ Ability to understand the notion of Laplace transform and the region of convergence. ▪ Ability to compute the Laplace transform of a given signals, and its inverse Laplace transform.	Lecture 3: Laplace transforms for continuous-time system	- Lecture - Tutorial	- Note - Q/A	- Attendance - Quiz 1	- PPT Present - Lecture Note - Computer, LCD, ink markers

			▪ Ability to convert the Laplace transform to transfer function. ▪ Ability to understand the use of unilateral Laplace transform for circuit analysis. ▪ Ability to use Laplace Transform to solve differential equations.					
6-7	2h/4h		▪ Ability to understand the notion of z-transform and the region of convergence for discrete-time signal. ▪ Ability to solve the z-transform of a given discrete-time signal, and its inverse z-transform.	Lecture 4 (1): The z-Transform for discrete-time system	- Lecture - Tutorial - Assignment 1	- Note - Q/A	- Attendance - Quiz 2	- PPT Present - Lecture Note - Computer, LCD, ink markers
8	2h	**Midterm**						
9-10	2h/4h		▪ Ability to compute the properties of the z-transform. ▪ Ability to understand the concept of transfer function of a discrete-time system using z-transform. ▪ Ability to implement a discrete-time system in a computer program based on the transfer function in Z.	Lecture 4 (2): The z-Transform for discrete-time system	- Lecture - Tutorial - Assignment 2	- Note - Q/A	- Attendance - Quiz 3	- PPT Present - Lecture Note - Computer, LCD, ink markers
11-12	2h/4h		▪ Ability to understand the spectral representation of the	Lecture 5: Fourier Analysis of continuous-time	- Lecture - Tutorial - Case Study 2	- Note - Q/A	- Attendance Homework 1	- PPT Present - Lecture Note

			signals with Fourier series. ▪ Ability to determine the Fourier series of a periodic signal, the Fourier transform of any signal, the frequency response of continuous-time LTI systems. ▪ Ability to understand the concept of filtering and bandwidth.	signals and systems				- Computer, LCD, ink markers
13-14	2h/4h		▪ Ability to compute the discrete Fourier series. ▪ Ability to determine the discrete Fourier transform of any signal.	Lecture 6 (1): Fourier Analysis of discrete-time signals and systems	- Lecture - Tutorial - Assignment 3	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
15-16	2h/4h		▪ Ability to understand the difference between discrete Fourier transform and discrete Fourier series. ▪ Ability to determine the frequency response of a discrete-time LTI systems.	Lecture 6 (2): Fourier Analysis of discrete-time signals and systems	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
17		**Final**						

6. References

[1] Schaum's Outline of Signals and Systems, 3rd Edition (Schaum's Outlines), by Hwei Hsu.

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

FEEDBACK CONTROL SYSTEM

Subject: Feedback control systems Year: 3 Semester: 2 Credit: 2.5
Lecturer: Dr. Chrin Phok
Tel.: 095504499 E-mail: pchrin@itc.edu.kh

1. Course Description

This subject provides the basic knowledge of control system, math's modeling of physical, (time domain and frequency) Dynamic response of system, Stability of System, opened-loop/closed-loop control, controller design. This subject is also designed to support others subject: Modern Control, PLC, Industrial Automation, Power Electronics and Motor Drive.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to understand the basic knowledge of control system (Electrical System, Mechanical, electromechanics)	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to derive the mathematical model of physical system, system stability for both time domain and frequency domain	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to compute the analog controller Lead compensator, Lag compensator, P, PI, PID	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Case Studies
- Group work (Assignment)

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Case studies	20	CLO2, CLO3
3	Assignment	20	CLO2, CLO3
4	Mid-Term exam	20	CLO1, CLO2, CLO3
5	Final Exam	30	CLO1, CLO2, CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed LLOs

Weeks		CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	**2h/2h**	CLO1	- Ability to understand the concept of control theory such as its application in real world / History / Open loop and closed loop control for both electrical and mechanical systems	Lecture 1: An Overview and Brief History of Feedback Control	- Lecture - Tutorial	- Listen/Note - Asking question	- Attendance	- Lecture Note /PPT - LCD
2-4	**4h/6h**	CLO1 CLO2	- Ability to find the mathematical model (electrical and mechanical system) for representing in state space model	Lecture 2: Mathematical models of systems.	- Lecture/ Tutorial - Demonstrate the model of the electrical system / mechanical system	- Participate in modeling the system - Do the case studies and submit	- Attendance - Case studies	- Lecture Note/PPT - Hardware of a physical system - LCD
5-6	**4h/4h**	CLO1 CLO2 CLO3	- Ability to convert a feedback control system model into mathematically response - Ability to compute Time-Domain Specifications (Overshot, rise time, setting time, steady state error) for designing controller - Ability to analyze the $1^{st}/2^{nd}$ /N^{th} order systems by using impulse, step, ramp and sine response.	Lecture 3: Dynamic Response	- Lecture/ Tutorial - Demonstrate of the system response - Compute the time domain Specs - Compute the time response for different inputs	- Participate in computing: time domain specs, system response - Group works on: time domain specs, system response	- Attendance - Do the simulation model in Matlab/Simulink - Assignment on closed loop system response	- Lecture Note/PPT - Matlab tool - Own PC

7	**2h/2h**		- Ability to obtain the transfer function of close loop system - Ability to compute the initial value and final value of closed-loop system response - Ability to analyze steady state error of feedback system	Lecture 4: A First Analysis of Feedback control system	- Lecture/ Tutorial - Compute the CLTF - Compute of initial/final value/ steady state error - Demo simulation of CLTF in Matlab	- Compute initial/final value/ steady state error - Do simulation in Matlab: steady state error of CLTF	- Attendance - Simulation result - Individual report of the CLTF	- Lecture Note/PPT - Matlab tool - Own PC
8	**2h**	**Midterm**						
9-10	**2h/4h**	CLO2 CLO3	- Ability to simulate the mathematical model of system: linear/nonlinear differential equation using numerical method - Ability to use Matlab /Simulink for verifying theory	Lecture 5. Modeling and Simulation of Feedback Systems	- Lecture/ Tutorial - Model of a given physical system, model and do the simulation in Matlab Environment	- Derive the model by themself - Build the simulation model - Present the results	- Attendance - Completed report with simulation results of a feedback system	- Lecture Note/PPT - Matlab - Own PC
11-12	**2h/4h**	CLO2 CLO3	- Ability to analyze the stability of linear feedback systems using Routh's criterion / Root locus	Lecture 6. Stability of Linear Feedback Systems.	- Lecture/ Tutorial - Provide the real practice of system stabilities	- Define the stabilities of linear system - Case studies of system stabilities	- Attendance - Individual report of linear feedback systems stabilities	- Lecture Note/PPT - Hardware demo for the stabilities
13-14	**4h/4h**	CLO2 CLO3	- Ability to design closed loop system controller such as Lead-Lag / Compensation, PID Using mathematical model / Electrical circuit / Mechanical system	Lecture 7. The Design of Feedback Control Systems	- Lecture/ Tutorial - Calculate the analog controller of a feedback control system - Build the simulation of feedback control system	- Derive the controller of a given system by themself - Build the simulation model	- Attendance - Present in classroom	- Lecture Note/PPT - Matlab - Own PC

15-16	**4h/4h**		- Ability to convert the complex transfer function to log magnitude and phase diagram - Ability to analyze the stability of closed loop system using bode plot / Nyquist Criterion - Ability to design closed loop controller in frequency response	Lecture8, Frequency Domain	- Lecture/ Tutorial - Compute TF in frequency domain - Stability in frequency domain - Compute controller in frequency domain	- Derive model in frequency domain - Compute: stability + controller in frequency domain - Group Assignment in frequency domain	- Attendance - Report + presentation	- Lecture Note/PPT - Matlab - Own PC
17		**Final Exam**						

6. References

[1]. FranklinPowell and Emami-Naeni, “Feedback control of dynamical systems,” Prentice Hall, 2006.

[2]. Richard C. Dorf, Robert H. Bishop, “Modern Control Systems,” 12th Edition, 2011

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

MICROCONTROLLER ARCHITECTURE

Subject: Micro-controller Architecture, Year: 3 Semester: 2 Credit: 2
Lecturer: Mr. TEP Sovichea, Master Degree from N7-INP, FRance
Tel.: 061 645 160 E-mail: sovichea.tep@itc.edu.kh

1. Course Description

Microcontroller (MCU) is the heart of every embedded electronic system from as simple as a digital watch to mission-critical spacecraft. Therefore, it is absolutely necessary that students grasp the understanding of MCU architecture, and how to program/debug in Assembly as well as in C language. What makes the MCU even more special, is that there are many integrated peripherals such as, Timers, UART, ADC and DAC, which can accelerate the development time and cut down the cost significantly. In this course, students will learn how to program and setup an 8-bit MCU EFM8LB12F64E from Silicon Labs, that include all the features we have discussed above. In addition, students will also get the hands-on experience with programming and external components interfacing, that gives them the knowledge they need for designing higher level of embedded system.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the architecture of one of the most popular microcontrollers (MCU) families. The students will be able to use other MCU families and be flexible with various embedded system design.	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Use an integrated development environment (IDE) to program and debug an MCU, which allows the students to work with large and complex code.	PLO1, PLO2, PLO3, PLO4, PLO5
CLO3	Program an MCU using Assembly and C languages, which is the preferred language by many embedded system engineers.	PLO1, PLO2, PLO3, PLO4, PLO5
CLO4	Understand and use peripherals integrated into an MCU	PLO1, PLO2, PLO3, PLO4, PLO5
CLO5	Interface an MCU to simple external components and use interrupt to get an insight of how MCU is used in the real world.	PLO1, PLO2, PLO3, PLO4, PLO5
CLO6	Use timers in various modes, which is mostly set up for motor control	PLO1, PLO2, PLO3, PLO4, PLO5
CLO7	Communicate using a serial interface, so that the MCU can transfer data between PCs for advanced monitoring and control	PLO1, PLO2, PLO3, PLO4, PLO5
CLO8	Understand and use analog to digital converters (ADC), digital to analog converters (DAC) and comparators, which are essential for mixed-signal engineers	PLO1, PLO2, PLO3, PLO4, PLO5
CLO9	Students will be able to use this knowledge and experience to design all kinds of embedded system, that can be used in a vast electronic sector, such as consumer	PLO1, PLO2, PLO3, PLO4, PLO5

	electronics, automobile industry, automation, aeronautics, robotics, just to name a few.	

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1 → CLO9
2	Assignment (quality reports)	25	CLO1 → CLO9
3	Quality oral presentation	25	CLO1 → CLO9
4	Mid-Term exam	20	CLO1 → CLO9
5	Final Exam	20	CLO1 → CLO9

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment
1	CLO1	After this lecture, students should be able: - Understand the architecture of 8051 microcontrollers - Why 8-bit microcontroller is still being used - The differences between Harvard and Neumann architecture - Basic 8051 memory organization - Common Special Function Registers that are available to all 8050 microcontrollers	Lecture 1: Course overview and 8051 architecture	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 1	- Lecture notes - Computer, LCD, ink markers
2	CLO1, CLO4	After the lecture, students should be able: - Recognize CIP-51 microcontroller core from Silicon Labs - Understand the Memory organization and additional SFR available in EFM8LB12F64E - Get the insight of other peripherals such as digital IO port, crossbar, Timers, ADC, DAC, analog comparators, and voltage references	Lecture 2: System overview of EFM8LB12F64E	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 2 - Prelab: Working with the tools	- Lecture notes - Computer, LCD, ink markers

3	CLO2	After this lecture, students should be able to: - Understand the microcontroller development flow and environment - Understand SLSTK2030A block diagram - Get familiar with Simplicity Studio IDE - Know how to build the DEMO project - Most important of all, understand the debug environment and how to work with the debugger	Lecture 3: Simplicity Studio platform overview	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance	- Lecture notes - Computer, LCD, ink markers
4	CLO3, CLO5	After this lecture, students should be able to: - Understand the different types of addressing modes, such as immediate constant addressing, direct and indirect addressing, register addressing, etc. - Understand 8051 instructions such as, arithmetic operation, logic operation, Boolean operations, data transfer and branching. - Students will be able write a simple assembly program to control the state of an LED.	Lecture 4: 8051 instructions set	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 3	- Lecture notes - Computer, LCD, ink markers

5	CLO3, CLO5	After this lecture, students should be able to: - Understand the different types of system clock and how to it is configured - Understand the operation of watchdog timer - Understand the GPIOs and how it is configured - Understand Crossbar and pin assignment priority	Lecture 5: System Clock, Crossbar and GPIO	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 4 - Lab 1: Blinky (no timers) using ASM	- Lecture notes - Computer, LCD, ink markers
6	CLO2, CLO3,	After this lecture, students should be able: - Understand code generation flow - Understand segment control statement - Understand address control statement - Understand symbol definition - Understand the differences between memory reservation (DS) and memory initialization (DB, DW, DD) - Understand the basic assembly programming template	Lecture 6: Assembler directives	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 5 - Lab 2: 16x16 multiply	- Lecture notes - Computer, LCD, ink markers
7	CLO3	After this lecture, students should be able to: - Understand C programming structure - Understand internal data memory declaration - Know the differences between bit-valued and bit-addressable data - Understand external data memory declaration	Lecture 7: Programming using C language	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 6 - Lab 3: Blinky (no timers) using C	- Lecture notes - Computer, LCD, ink markers

		- Get familiar with C and register level operators such as, relational, logical, bit-wise and compound operators					
8	CLO1	After this lecture, students should be able to: - Understand what an interrupt and ISR is - Understand interrupt execution flow - Understand interrupt organization in EFM8LB12F64E - Understand the interrupt priorities - Understand the differences between software/timer interrupt and hardware interrupt	Lecture 8: Interrupts	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 7	- Lecture notes - Computer, LCD, ink markers
9	Mid-Term						
10	CLO3, CLO5, CLO6	After this lecture, students should be able to: - Understand the functional overview of a Timer - Understand Timer programming sequence - Know the different types of Timer in EFM8LB12F64E - Configure Timer overflow period - Write an Interrupt Service Routine (ISR) to blink an LED or compute a task	Lecture 9: Timer operations and programming	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 8 - Lab 4: Blinky (timer with ISR) - Lab 5: Switch debouncing	- Lecture notes - Computer, LCD, ink markers
11	CLO3, CLO5, CLO6	After this lecture, students should be able to: - Understand the functional overview of a Programmable Counter Array (PCA)	Lecture 10: PCA operation and programming	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Lab 6: Input capture - Lab 7: PWM	- Lecture notes - Computer, LCD, ink markers

		- Understand the various features of a PCA, such as edge capture, PWM, arbitrary waveform generation - Configure a PCA as edge capture for a square wave frequency measurement - Configure a PCA as PWM output for LED/DC motor intensity control					
12	CLO3, CLO5, CLO7	After this lecture, students should be able to: - Understand the differences between synchronous and asynchronous serial communications - Understand UART block diagram and clock requirements in EFM8LB12F64E - Configure UART SFRs - Understand the operation modes and baud rate calculation - Initialize UART0 using Timer 1 - Configure UART transmit and receive interrupt - Send simple commands through UART to the PC and plot the data in a virtual oscilloscope	Lecture 11: Serial communication	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 9 - Lab 8: Serial communication and LCD	- Lecture notes - Computer, LCD, ink markers
13	CLO3, CLO5, CLO8	After this lecture, students should be able to: - Understand what an DAC is - Understand the different types of DAC such as voltage DAC (VDAC) and current DAC (or IDAC)	Lecture 13: DAC and comparator	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Lab 9: Analog comparator - Lab 10: DAC	- Lecture notes - Computer, LCD, ink markers

		- Configure DAC's output scheduling and scaling - Understand the functional block diagram of analog comparators - Configure analog watchdog windows					
14	CLO3, CLO5, CLO8, CLO9	After this lecture, students should be able to: - Understand what an ADC is - Understand the input range of ADC - Understand the different types of ADC, such as single slope, dual slope, SAR and Sigma-Delta - Configure SAR end-of-conversion interrupt, conversion frequency and sample time - Program ADC using polling and interrupt method - Read multiple ADC channels using AMUX as well as the die temperature - Select different reference voltage for ADC	Lecture 14: ADC	- Give lecture - Whiteboard demonstration - Answer questions	- Taking notes - Working on tutorial questions - Asking questions - Group work	- Attendance - Tutorial questions 10 - Lab 11: ADC	- Lecture notes - Computer, LCD, ink markers
17	Final						

6. References

[1] Chew, M. T., & Gupta, G. S. (n.d.). *Embedded Programming with Field-Programmable Mixed-Signal µControllers.*

[2] Gingl, Z., & Mingesz, R. Z. (2014). Laboratory practicals with the C8051Fxxx microcontroller family.

[3] EFM8LB1 Reference Manual (Revision 0.5). (December, 2018). Silicon Labs.

[4] EFM8LB1 Datasheet (Revision 1.3). (December, 2018). Silicon Labs.

[5] UG126: EFM8LB1-SLSTK2030A User's Guide (Revision 0.6). (February, 2019). Silicon Labs Lab Manuals

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: EE

DETAILED COURSE SYLLABUS

POWER ELECTRONICS

Subject: Power Electronics, Year: 4 Semester: 1 Credit: 3
Lecturer: Dr. AM Sok Chea,
Tel.: 096 34 55 449 E-mail: Sokchea_am@itc.edu.kh

1. Course Description

This subject is to provide the fundamental concept of power electronics system which can converter from AC/DC voltage to another AC/DC voltage level. The detailed description about power electronics devices is also provided for forming the power converter. One main part of the lecture is mainly focus on how to design power converter for a suitable application.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to understand the power electronics components, topology and applications	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to model the converter by simulation work	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to build the power electronics circuit	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO4	Able to perform research in Power Electronics	PLO6, PLO7
CLO5	Able to increase soft-skill: report + presentation	PLO8, PLO9, PLO11

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4, CLO5
2	Assignment (quality reports)	25	CLO2, CLO3, CLO4
3	Quality oral presentation	25	CLO5
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	2h/2h	CLO1	- Ability to select power electronics system for suitable application. - Ability to distinguish different power electronics devices, especially power semiconductors.	Lecture 1: Power Electronics Technology	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
2-3	4h/4h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to compute the half-wave rectifier with Diode. - Ability to analyze the half-wave rectifier operation and devices selection. - Ability to simulate the half-wave rectifier with case study.	Lecture 2: Circuit with switches and diodes	- Tutorial/lecture - Demonstrate simulation tool (MATLAB/Simulink) - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a half-wave model and verify result with simulation work - Report submission - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
4-5	4h/4h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to compute the half-wave-controlled rectifier with Thyristor. - Ability to analyze the half-wave-controlled rectifier operation and devices selection. - Ability to simulate the half-wave-controlled rectifier with case study.	Lecture 3: Thyristor and single-phase half-wave-controlled rectifier	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a half-wave model and verify result with simulation work - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
6-7	4h/4h	CLO1 CLO2 CLO3 CLO4	- Ability to compute the full-wave rectifier with Diodes bridge.	Lecture 4: 3-phase diode rectifier	- Tutorial/lecture - Provide 12-15 problems (case study)	- Taking note - Make a half-wave model and verify	- Attendance - Quality of report	- PPT Present - Lecture Note

		CLO5	- Ability to analyze the full-wave rectifier operation and devices selection. - Ability to compute and analyze the operation of 3-phase rectifier. - Ability to simulate the full-wave rectifier and 3-phase rectifier with case study.		and define student name for simulation and presentation work.	result with simulation work - Report submission (all students) - Oral presentation (only assigned students)	- Quality of presentation	- Problems and assigned name of student for presentation
8	2h	Midterm						
9-10	4h/4h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to compute the 3-phased controlled rectifier with Thyristor. - Ability to analyze the 3-phase controlled rectifier operation and devices selection. - Ability to simulate the 3-phase controlled rectifier with case study.	Lecture 5: 3-phase Thyristor controlled rectifier	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a half-wave model and verify result with simulation work - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
11-12	2h/4h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to compute the buck, boost, buck-boost converter. - Ability to analyze the buck, boost, buck-boost converter's operation and devices selection. - Ability to simulate the DC-DC converter with case study.	Lecture 6: DC-DC non-isolated converter	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a half-wave model and verify result with simulation work - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation

13-14	2h/4h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to compute the Flyback, Forward, Push-pull converter. - Ability to analyze the Flyback, Forward, push-pull converter's operation and devices selection. - Ability to simulate the DC-DC converter with case study.	Lecture 7: DC-Power Supply	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a half-wave model and verify result with simulation work - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
15-16	2h/4h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to compute the 2-level inverter converter. - Ability to analyze the 2-level inverter's operation and devices selection. - Ability to simulate the DC-AC inverter with case study.	Lecture 8: Inverter	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a half-wave model and verify result with simulation work - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
17	2h	Final Exam						

6. References

[1] S. N. Manias, “Power Electronics and Motor Drive Systems,” Elsevier Inc., 2017

[2] D. W. Hart, “Power Electronics,” McGraw-Hill, 2011

[3] R. W. Erickson, D. Maksimovic, “Fundamentals of Power Electronics,” 2nd Edition, Kluwer Academic Publishers, 2004

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRICAL AND ENERGY- EE

DETAILED COURSE SYLLABUS

ENERGY CONVERSION

Subject: Energy Conversion, Year: 4 Semester: 1 Credit: 3
Lecturer: Dr. BUN Long, PhD. from INPG, France
Tel.: 095 222 776 E-mail: bunlong@itc.edu.kh

1. Course Description

This subject is to provide students the basic knowledge on the conversion of energy from one form to another by mean of latest technology. The study mainly focuses on the renewable energy such as solar energy, wind energy, biomass energy, etc.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the energy conversion in general, mainly on renewable energy conversion	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to model the energy conversion by simulation work	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Build a power system with renewable energy integration	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO4	Capable to do research in renewable energy field and its application	PLO6, PLO7

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4
2	Assignment (quality reports)	25	CLO2, CLO3, CLO4
3	Quality oral presentation	25	CLO3, PLO4
4	Mid-Term exam	20	CLO1, CLO2, CLO3
5	Final Exam	20	CLO1, CLO2, CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-2	4h/4h	CLO1	- Ability to understand the current usage energy forms in the world. - Ability to understand the energy forms and its conversion. - Ability to know the different types of renewable energy.	Lecture 1: Introduction to energy conversion	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
3-7	10h/10h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the construction of solar panel. - Ability to model the solar panel in solar system. - Ability to analyze the operation of solar system and its applications - Ability to simulate the solar system with case study.	Lecture 2: Solar Energy	- Tutorial/lecture - Demonstrate simulation tool (MATLAB/Simulink) - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a model of solar system and verify result with simulation work - Report submission - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
8-10	6h/6h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the wind energy and its application. - Ability to understand the different type of wind turbines. - Ability to compute the wind power and	Lecture 3: Wind Energy	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a model of wind power system and verify result with simulation work - Report submission (all students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation

			draw power from wind. - Ability to optimization the wind turbine system. - Ability to simulate the wind power system with case studies.			- Oral presentation (only assigned students)		
11	2h	Midterm						
12-16	10h/10h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the hydro-power system and its applications. - Ability to analyze the hydro-power system such as hydro-power devices, location of hydro-power system, … - Ability to select the wind turbine correctly. - Ability to select the generator. - Ability to simulate hydro-power with case study.	Lecture 4: Hydro-Power System	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a model of hydro-power and verify result with simulation work - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
17	2h	Final Exam						

6. References

[1] Gilbert M. Masters, Renewable and efficient Electric Power Systems, John Wiley & Sons, Inc., Hoboken, New Jersey., 2004

[2] IEA, International Energy Agency Report, 2016

[3] Leon F. & David I., Renewable Energy in Power System, A John Wiley & Sons,2008

[4] BP Statistical Review of World Energy 2017

[5] A.K. Raja, Amit Prakash Srivastava, Manish Dwivedi, Power Plant Engineering, New Age International (P) Ltd, Publishers, 2006

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRICAL AND ENERGY- EE

DETAILED COURSE SYLLABUS

ELECTRICAL SYSTEM DESIGN

Subject: Electrical System Design, Year: 4 Semester: 1 Credit: 3
Lecturer: Mr. CHHENG Monyvathna, Master Degree from UP, Philippine
Tel.: 016 744 571 E-mail: vathna.chheng@itc.edu.kh

1. Course Description

This subject is to provide students on know how to design and to calculate the electrical system for installation in residential building, industry, etc.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the electrical system in building and industry	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Design electrical system for building and industry by using software AutoCAD	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Calculate the power consumption in building and in industry	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO4	Install electrical system in building	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4
2	Assignment (quality reports)	25	CLO2, CLO3, CLO4
3	Quality oral presentation	25	CLO3, PLO4
4	Mid-Term exam	20	CLO1, CLO2, CLO3
5	Final Exam	20	CLO1, CLO2, CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-3	6h/6h	CLO1	- Ability to understand the system components and electrical devices. - Ability to understand the design electrical system. - Ability to know the steps of electrical system design.	Lecture 1: Low-voltage system and design	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
4-6	6h/6h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the internal and external lighting system. - Ability to calculate the lighting devices. - Ability to select the lighting devices.	Lecture 2: Study on Lighting System	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Report submission - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
7-9	6h/6h	CLO1 CLO2 CLO3 CLO4	- Ability to calculate the load. - Ability to select MCB, MCCB, RCCB,… - Ability to select transformer and generator.	Lecture 3: Load calculation	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
10	2h	Midterm						
11-16	12h/12h	CLO1 CLO2 CLO3 CLO4	- Ability to design electrical system. - Ability to calculate permissible current	Lecture 4: Cable sizing and protection devices	- Tutorial/lecture	- Taking note - Report submission (all students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name

			and short-circuit current. - Ability to select the cable type and its diameter. - Ability to select lightning system and earthing system.			- Oral presentation (only assigned students)		of student for presentation
17	2h	Final Exam						

6. References

[1] SCHNEIDER ELECTRIC: ELECTRICAL INSTALLATION GUIDE. 2016.

[2] WALTER T. GRONDZIK, ALISON G. KWOK, BENJAMIN STEIN, JOHN S. REYNOLDS MECHANICAL AND ELECTRICAL EQUIPMENT FOR BUILDING, ELEVENTH EDITION. 2010.

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRICAL AND ENERGY - EE

DETAILED COURSE SYLLABUS

POWER ELECTRONICS FOR ENERGY CONVERSION

Subject: Power Electronics for Energy Conversion, Year: 4 Semester: 2 Credit: 2
Lecturer: Dr. AM Sok Chea, PhD. from UGA, France
Tel.: 096 34 55 449 E-mail: Sokchea_am@itc.edu.kh

1. Course Description

This subject is to provide the students the concepts of high-power converter for grid connection such as NPC, FC, CHB, and MMC converter. The study mainly focuses on renewable energy grid integration.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the power electronics for high power application.	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Create simulation model the converter by simulation work	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to perform research in Power Electronics for high power application.	PLO6, PLO7

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	25	CLO1, CLO2, CLO3
3	Quality oral presentation	25	CLO2, CLO3
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-3	3h/6h	CLO1 CLO2 CLO3	- Ability to analyze the operation of 2-level inverter. - Ability to simulate 2-L inverter by using Matlab/Simulink.	Lecture 1: Classical Inverter	- Tutorial/lecture - Asking key question - Demonstrate simulation tool (MATLAB/Simulink) - Provide 12-15 problems (case study) and define student name for simulation and presentation work	- Group discussion - Asking key question - Report submission - Oral presentation (only assigned students)	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
4-7	4h/8h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to analyze the operation of NPC inverter. - Ability to simulate NPC converter by using Matlab/Simulink.	Lecture 2: Neutral Pointed Clamp NPC converter	- Tutorial/lecture - Demonstrate simulation tool (MATLAB/Simulink) - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Report submission - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
8-11	4h/8h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to analyze the operation of FC inverter. - Ability to simulate FC converter by using Matlab/Simulink.	Lecture 2: Flying Capacitor FC converter	- Tutorial/lecture - Demonstrate simulation tool (MATLAB/Simulink) - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Report submission - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
12	2h	Midterm						

13-16	4h/8h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to analyze the operation of MMC inverter. - Ability to simulate MMC converter by using Matlab/Simulink.	Lecture 2: Modular Multilevel converter MMC	- Tutorial/lecture - Demonstrate simulation tool (MATLAB/Simulink) - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Report submission - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
17	2h	Final Exam						

6. References

[1] S. N. Manias, “Power Electronics and Motor Drive Systems,” Elsevier Inc., 2017

[2] D. W. Hart, “Power Electronics,” McGraw-Hill, 2011

[3] R. W. Erickson, D. Maksimovic, “Fundamentals of Power Electronics,” 2nd Edition, Kluwer Academic Publishers, 2004

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRICAL AND ENERGY - EE

DETAILED COURSE SYLLABUS

ENGINEERING ECONOMIC

Subject: Engineering Economic, Year: 4 Semester: 1 Credit: 2
Lecturer: Dr. CHRIN Phok, PhD. from INP-Toulouse, France
Tel.: 096 97 90 999 E-mail: pchrin@itc.edu.kh

1. Course Description

One of the core activities in energy economics and planning is to conduct financial evaluations and economic analyses for energy sector investment projects and reviewing and evaluating such work done by others.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the cost concept and financial calculations	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Analyze the economics in engineering project	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to manage engineering project	PLO6, PLO7

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	25	CLO1, CLO2, CLO3
3	Mid-Term exam	30	CLO1, CLO2
4	Final Exam	35	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-3	3h/6h	CLO1 CLO2 CLO3	- Ability to understand the context of engineering project. - Ability to develop the engineering project.	Lecture 1: Introduction to engineering economics	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
4-6	3h/6h	CLO1 CLO2 CLO3	- Ability to understand the cost concept of engineering project. - Ability to calculate the financial of engineering project.	Lecture 2: Cost Concepts and Financial Calculations	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present - Lecture Note
7-9	3h/6h	CLO1 CLO2 CLO3	- Ability to understand the risk analysis of project.	Lecture 3: Data Relevant for Project Analysis	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present - Lecture Note
10	2h	Midterm						
11-13	3h/6h	CLO1 CLO2 CLO3	- Ability to analyze the economic cost and benefit.	Lecture 4: Economic Analysis of Engineering Projects	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present
14-16	3h/6h	CLO1 CLO2 CLO3	- Ability to develop project planning and execution. - Ability to monitor and evaluate the project. - Ability to develop project proposal and closing project.	Lecture 5: Project Management	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present
17	2h	Final Exam						

6. References

[1] Chan S. Park “Contemporary Engineering Economics” Fourth Edition PEARSON Prentice Hall 2007

[2] Michael B. Bender “A Manager’s Guide To Project Management” PEARSON Education, Inc. 2010

[3] Harold Kerzer, Ph.D “Project Management, A System Approach to Planning, Scheduling and Control” 10th Edition John Wiley & Sons, Inc. 2009

[4] Trevor L Young “The Handbook of Project Management Practical Guide to Effective Policies, Techniques and Processes” Revised 2nd Edition KOGAN Page Limited London and Philandelphia 2007.

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

Motor Drives

Subject: Feedback control systems Year: 4 Semester: 2 Credit: 3

Lecturer: Dr. Kim Bunthern
Tel.: 077 512 157 E-mail:kimbunthern@itc.edu.kh

1. Course Description

This subject provides the basic knowledge and advance skill in motor drive applications/ motor control. It is an interdisciplinary subject of Electrical Machine, mechanical system, Power Electronic and control system.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to understand the basic knowledge of electrical machine and its application	PLO1, PLO2, PLO3
CLO2	Able to analyze the operation of DC and AC motor	PLO5, PLO6, PLO7, PLO8
CLO3	Able to design the motor drives system for both AC and DC motor	PLO5, PLO6, PLO7, PLO8

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Discussion
- Presentation

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Case study/Quiz	20	CLO1, CLO2, CLO3
3	Assignment	20	CLO1, CLO2, CLO3
4	Mid-Term exam	20	CLO1, CLO2, CLO3
5	Final Exam	30	CLO1, CLO2, CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed LLOs

Weeks		CLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material	Lecture
1	4h/4h		- Ability to understand the notion of electromechanical phenomenon. - Ability to understand the different type of electric motors.	Lecture 1: Introduction to Electric motor and it applications	- Lecture - Tutorial	- Listen/Note - Asking question	- Attendance	- Lecture Note /PPT - LCD
2-4	6h/12h		- Ability to create and analyze the model of a DC motor. - Ability to implement a control system for regulating the speed and position of a brushed DC motor.	Lecture 2: Principle control of dc motors	- Tutorial - Lecture - Simulation - Experimentation	- Participate in modeling dc motor - Do the case studies	- Attendance - Simulation result - Short report of experiments	- Lecture Note/PPT - dc motor - Matlab/PSIM
5-6	4h/8h		- Ability to create and analyze the model of the stepper motor. - Ability to implement a control system for speed control/ position.	Lecture 3: Stepper motor	- Lecture - Tutorial - Simulation	- Participate stepper dc motor - Do the case studies	- Attendance - Simulation result	- Lecture Note/PPT - dc motor - Matlab/PSIM
7-8	4h/8h		- Ability to understand the transformation model abc-dq0 and dq0-abc - Ability to create and analyze the model of an AC induction motor.	Lecture 4: Model of induction machine	- Lecture - Tutorial - Model of induction motor - Build model of AC induction motor in Matlab/PSIM	- Student built the - Do the case studies	- Attendance - Simulation result - Short report of experiments	- Lecture Note/PPT - dc motor - Matlab/PSIM
9	2h	**Midterm**						

9-11	6h/12h		- Ability to implement simple closed loop control systems - Ability to design the controller for induction motor speed control	Lecture 5: Simple control of AC motors	- Lecture - Tutorial - experiment - Assignment	- Participate in experiment set up - Do the case studies	- Attendance - Short report of simple closed loop control	- Lecture Note/PPT - ac motor - power converter - Matlab/PSIM - dspace
12-13	6h/10h		- Ability to understand the notion of field-oriented control (FOC) - Ability to create and analyze the model of AC induction motor in rotating reference frame (dq-frame). - Ability to implement control systems for regulating the speed of the AC induction motor using FOC and direct torque control (DTC).	Lecture 6: Vector control of AC induction motor (IM)	- Lecture - Tutorial - Experiment on FOC, DTC - Assignment	- Participate in experiment set up - Do the case studies on FOC and DTC	- Attendance Short report of simple closed loop control	- Lecture Note/PPT - ac motor - Power converter - Matlab/PSIM - dspace
14-15	3h/6h		- Ability to implement speed control of synchronous motor using FOC and direct torque control (DTC).	Lecture 7: Vector control of AC synchronous motor (PMSM)	- Lecture - Tutorial - Experiment vector control for ac synchronous motor - Case studies of ac motor speed control	- Participate in experiment set up - Student involve Case studies of ac motor speed control	- Attendance - Short report	- Lecture Note/PPT - ac motor - power converter - Matlab/PSIM - dspace
16		Final Exam						

6. References

[1]. DR. P. C. SEN, ‘Principles of Electric Machines and Power Electronics’, Fellow IEEE, Third edition,

[2]. Bin Wu, ‘High-power Converters And AC Drives’, IEEE PRESS, 2006.

INTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION

Course Syllabus

Research Methodology

Subject: Research Methodology Year: 3 Semester: 1 Credit: 2.5

Lecturer: Dr. AM Sok Chea, PhD. from UGA-Grenoble, France
Tel.: 096 34 55 449 / E-mail: sokchea_am@itc.edu.kh

1. Description of Course

This subject is proposed to provide student the basic knowledge on research methodology tools and technique for their future research works.

2. Course Learning Outcomes (CLOs)

Description of CLOs		Matching PLOs of Program
CLO1	Basic knowledge on searching articles, documents for support research topic.	PLO5, PLO6, PLO7
CLO2	Able to analyze the articles/journals and verify by simulation.	PLO10
CLO3	Able to produce quality technical report	PLO7, PLO9
CLO4	Able to apply research methodology for their future research work.	PLO7, PLO9

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Evaluation Methodology

No	Evaluation Types	Score	Matching CLOs
1	Attendants	10	CLO1, CLO2, CLO3, CLO4
2	Assignments and report	20	CLO3
3	1st Oral Presentation	20	CLO1, CLO2, CLO3, CLO4
4	Report in Journal format with max. 6 pages	20	CLO3
5	2nd Oral presentation	30	CLO1, CLO2, CLO3, CLO4

Passing Score:

- Final Moyenne > 50: score of subjects under 30 must re-do exam
- Final Moyenne < 50: score of subjects under 50 must re-do exam

5. Detailed of content

Weeks		CLOs	LLOs	Content	Teaching met.	Learning met.	Assessment	Equipment
1	2h	CLO1	- Ability to understand what is research. - Ability to define research scope.	Lecture 1: Introduction to Research	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
2-3	4h	CLO1 CLO2 CLO3 CLO4	- Ability to use web to download valuable articles/journals - Ability to classify types of articles.	Lecture 2: Research Methodology-Tool	- Tutorial/lecture - Demonstrate on how to classify quality article. - Request student to select/propose research topic	- Actively participate in class activities - Select/propose research topic and start to collect data (published articles)	- Attendance	- PPT Present - Lecture Note
4-5	4h	CLO1 CLO2 CLO3 CLO4	- Ability to read article correctly. - Ability to analyze the provided articles.	Lecture 3 : Analyse the articles	- Tutorial/lecture - Demonstrate on how to read article effectively way. - Request student to analyze each section in their selected article.	- Actively participate in class activities - Presentation their result of analyze article	- Attendance - Presentation - Report	- PPT Present - Lecture Note
6-7	4h	CLO1 CLO2 CLO3 CLO4	- Ability to summary main outcome of article - Ability to define scope of research	Lecture 4: Abstract the articles	- Tutorial/lecture - Demonstrate on how to summary the work. - Request student to summary finding in their selected article.	- Actively participate in class activities - Presentation their abstract.	- Attendance - Presentation - Report	- PPT Present - Lecture Note
8-10	6h	CLO1 CLO2 CLO3 CLO4	- Ability to verify the finding result in article by simulation work.	Lecture 5: Technique of Research Methodology	- Tutorial/lecture - Demonstrate on how to verify the	- Actively participate in class activities	- Attendance - Presentation - Report	- PPT Present - Lecture Note

					finding results in article.	- Presentation their abstract.		
11-12	2h/4h	CLO1 CLO2 CLO3 CLO4	- Ability to develop quality technical report.	Lecture 6 : Technical report part 1	- Tutorial/lecture - Demonstrate on how to summary the work.	- Actively participate in class activities - Presentation	- Attendance - Presentation - Report	- PPT Present - Lecture Note
13-16	2h/4h	CLO1 CLO2 CLO3	- Ability to produce results in journal format with max. pages	Lecture 7: Technical report in Journal format: part 2	- Tutorial/lecture - Demonstrate on how to write technical result in journal format	- Actively participate in class activities - Presentation	- Attendance - Presentation - Report	- PPT Present - Lecture Note

6. References

[1] Prabhat Pandey, Meenu Mishra Pandey “RESEARCH METHODOLOGY: TOOLS AND TECHNIQUES” Bridge Center, 2015

[2] Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers’Distributors

[3] Kothari, C.R.,1985, Research Methodology- Methods and Techniques, New Delhi, Wiley Eastern Limited.

[4] Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners,(2nd.ed.),Singapore, Pearson Education

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

STUDENT PROJECT PART 1

Subject: Student Project Part 1, Year: 4 Semester: 2 Credit: 1
Lecturer: Dr. AM Sok Chea, PhD. from UGA, France
Tel.: 096 34 55 449 E-mail: Sokchea_am@itc.edu.kh

1. Course Description

This subject is to provide the students the first experience in real research project or projects from partner industries.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to do real research projects or industries' projects	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to do simulation for related project	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to increase soft-skill: report + presentation	PLO8, PLO9, PLO11

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	40	CLO1, CLO2, CLO3
3	Quality oral presentation	50	CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	2h	CLO1	- Ability to define small groups for specific research projects. - Ability to match students with partner industries.	Lec. 1: Small of group of students	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
2-3	4h/4h	CLO1 CLO2 CLO3	- Ability to define technical topic for students to perform research. - Ability to collect documents for defined research topic.	Lec. 2: Small group technical research topics	- Tutorial/lecture - Demonstrate on analysis of article	- Taking note - Download documents and start analysis the articles	- Attendance	- PPT Present - Lecture Note
4-5	4h	CLO1 CLO2 CLO3	- Ability to analyze the sub-section results of read article.	Lec. 3: Analyze the sub-sections	- Tutorial/lecture	- Taking note - Develop simulation	- Attendance	- PPT Present - Lecture Note
6-7	4h	CLO1 CLO2 CLO3	- Ability to do research for answering to the need of society	Lec. 4: Start create similar project + work for industries project	- Tutorial/lecture - Present the industries to students	- Taking note - Make simulation	- Attendance	- PPT Present - Lecture Note
9-10	4h	CLO1 CLO2 CLO3	- Ability to do research for answering to the need of society	Lec. 4: Start create similar project + work for industries project (Cont. 1)	- Tutorial/lecture - Present the industries to students	- Taking note - Make simulation file	- Attendance	- PPT Present - Lecture Note
11-12	4h	CLO1 CLO2 CLO3	- Ability to do research for answering to the need of society	Lec. 4: Start create similar project + work for industries project (Cont. 2)	- Tutorial/lecture - Present the industries to students	- Taking note - Make simulation file	- Attendance	- PPT Present - Lecture Note
13-16	8h	CLO1 CLO2 CLO3	- Ability to do research for answering to the need of society	Lec. 4: Start create similar project + work for industries project (Cont. 3)	- Tutorial/lecture - Present the industries to students	- Taking note - Make simulation file	- Attendance	- PPT Present - Lecture Note -

6. References

[1] ITC, IG Tech Grou “MoU of Coorporation” 2022

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRICAL AND ENERGY - EE

DETAILED COURSE SYLLABUS

POWER SYSTEM ANALYSIS AND OPTIMIZATION

Subject: Power system analysis and optimization, Year: 4 Semester: 2 Credit: 3
Lecturer: Dr. VAI Vannak, Phd. from UGA, France
Tel.: 012 617 364 E-mail: vannak.vai@itc.edu.kh

1. Course Description

This course is intended to give an overview of the characteristics of distribution systems, power quality requirements, and protection measures. The planning and design considerations are also introduced. After study of this subject, the students will have knowledges and experiences of Power Distribution System: Power supply requirements, customer classification, over-current protection devices and its coordination, power quality requirements and its control, reliability of distribution systems, planning and design consideration of distribution system, grounding and safety of distribution systems.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the line admittance/impedance model of power distribution network.	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Compute oof power flow by using different methods: Gauss Seildel, Newton Raphson, Fast decouple, …	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Create power distribution model by using software Matlab/Simulink, Power World	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO4	Able to perform research in Power System Analysis and Optimization	PLO6, PLO7
CLO5	Able to increase soft-skill: report + presentation	PLO8, PLO9, PLO11

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4, CLO5
2	Assignment (quality reports)	25	CLO2, CLO3, CLO4
3	Quality oral presentation	25	CLO5
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-2	4h/4h	CLO1	- Ability to understand the overview of power distribution system and its components.	Lecture 1: Introduction to Power System	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
3-5	6h/6h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to compute the model of electrical system, generator, transformer, electrical loads, and unit.	Lecture 2: Modeling of Electrical Device	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
6-8	6h/6h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to the overhead line, underground line, model of admittance/impedance. - Ability to compute Y matric and Z matric. - Ability to model Tap changing. - Ability to simulate the Y/Z matric with case study.	Lecture 3: Power System	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
9	2h	Midterm						
9-13	10h/10h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to compute the power flow equation. - Ability to solve the power flow problems by using Gauss-Seidel, Newton Raphson, Fast-Deco9uple, … - Ability to simulate the power flow with case study.	Lecture 4: Power Flow Solution	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation

14-16	6h/6h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to compute the economics study of power flow problem. - Ability to simulate the Power World Software for solving Power System problem.	Lecture 5: Economic Dispatch	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
17	2h	Final Exam						

6. References

[1] H. Saadat: Power System Analysis, McGraw-Hill, 2004.

[2] J.J. Grainger, and W.D. Stevenson: Power System Analysis, McGraw-Hill, Inc, Singapore, 1994.

[3] A. R. Bergen and V. Vittal: Power System Analysis, Prentice-Hall, 2000.

[4] A.J. Wood and B.F. Wollenberg: Power Generation, Operation and Control, John Wiley & Sons, New York, USA, 1996

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRICAL AND ENERGY

DETAILED COURSE SYLLABUS

POWER SYSTEM ARCHITECTURE AND PROTECTION

Subject: Power system architecture and protection, Year: 4 Semester: 2 Credit: 3
Lecturer: Dr. VAI Vannak, Phd. from UGA, France
Tel.: 012 617 364 E-mail: vannak.vai@itc.edu.kh

1. Course Description

This course is intended to give an overview of the characteristics of distribution systems, power quality requirements, and protection measures. The planning and design considerations are also introduced. After study of this subject, the students will have knowledges and experiences of Power Distribution System: Power supply requirements, customer classification, over-current protection devices and its coordination, power quality requirements and its control, reliability of distribution systems, planning and design consideration of distribution system, grounding and safety of distribution systems.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the power system architecture and protection such as load characteristics, distribution system, power quality, …	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Compute the model of power system architecture	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to perform research in Power System field	PLO6, PLO7
CLO4	Able to increase soft-skill: report + presentation	PLO8, PLO9, PLO11

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4
2	Assignment (quality reports)	25	CLO2, CLO3
3	Quality oral presentation	25	CLO4
4	Mid-Term exam	20	CLO1, CLO2
5	Final Exam	20	CLO1, CLO2

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-2	4h/4h	CLO1	- Ability to understand the important of distribution system. - Ability to identify the differences of power supply between Urban and Rural Area	Lecture 1: Introduction	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
3-4	4h/4h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to perform load survey and load fluctuation - Ability to identify the sensitive load and computer load.	Lecture 2: Load Characteristics and Consumer Classification	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
5-7	6h/6h	CLO1 CLO2 CLO3 CLO4 CLO5	- Ability to understand the distribution systems: distribution primary feeders, bus-bar arrangement, unit substation.	Lecture 3: Distribution Systems and Its Features	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
8	2h	Midterm						
9-10	4h/4h	CLO1 CLO2 CLO3 CLO4	- Ability to compute the power quality, harmonics, voltage sage, interruption, transients, and power supply for sensitive loads.	Lecture 4: Power Quality Fundamentals	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present - Lecture Note
11-12	4h/4h	CLO1 CLO2 CLO3 CLO4	- Ability to compute the voltage drop and line losses.	Lecture 5: Voltage Drop and Line losses	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present - Lecture Note

			- Ability to find optimal capacitor and its placement.					
11-12	4h/4h	CLO1 CLO2 CLO3 CLO4	- Ability to compute the fault current classification, over-current protection devices.	Lecture 6: Over-Current Protection Devices and its Coordination	- Tutorial/lecture	- Taking note -	- Attendance	- PPT Present - Lecture Note
13-14	4h/4h	CLO1 CLO2 CLO3 CLO4	- Ability to compute the factors effecting on reliability.	Lecture 7: Reliability of Distribution System	- Tutorial/lecture	- Taking note -	- Attendance	- PPT Present - Lecture Note
15-16	4h/4h	CLO1 CLO2 CLO3 CLO4	- Ability to compute the classification of custom devices and its application.	Lecture 8: Custom Power Device	- Tutorial/lecture	- Taking note -	- Attendance	- PPT Present - Lecture Note
17	2h	Final Exam						

6. References

[1] William H. Kersting: Distribution System Modeling and Analysis,CRC Press LLC,2002

[2] Anthony J. Pansini, : Electrical Distribution Engineering, CRC Press LLC,2006

[3] ABDELHAY A. SALLAM: Electrical Distribution System, A JOHN WILEY & SONS, INC.,2011

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRICAL AND ENERGY- EE

DETAILED COURSE SYLLABUS

TECHNOLOGY SUSTAINABLE ENERGY

Subject: Technology Sustainable Energy, Year: 5 Semester: 1 Credit: 2
Lecturer: Dr. BUN Long, PhD. from INPG, France
Tel.: 095 222 776 E-mail: bunlong@itc.edu.kh

1. Course Description

This subject is to provide students the basic knowledge on how to consume the energy with less impact to environment.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the technology of sustainable energy	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Understand the impact to environment from energy generation.	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO4	Capable to do research in technology for sustainable energy	PLO6, PLO7

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4
2	Assignment (quality reports)	25	CLO2, CLO3, CLO4
3	Quality oral presentation	25	CLO3, PLO4
4	Mid-Term exam	20	CLO1, CLO2, CLO3
5	Final Exam	20	CLO1, CLO2, CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-2	4h/4h	CLO1	- Ability to understand the statistic of energy consumption. - Ability to understand the technique to consume electricity in the efficiency way.	Lecture 1: Introduction to energy	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
3	2h/2h	CLO1 CLO2 CLO3 CLO4	- Ability to analyze the energy and CO2.	Lecture 2: Energy Analysis and CO2 Emission	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present - Lecture Note
4	2h/2h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the fossil fuel in power plant.	Lecture 3: Fossil Fuel	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present - Lecture Note
5-8	8h/8h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the energy technology. - Ability to compute the transmission and distribution system.	Lecture 4: Power plant	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present - Lecture Note
9	2h	Midterm						
10-16	10h/10h	CLO1 CLO2 CLO3 CLO4	- Ability to determine the energy economic. - Ability to manage the energy consumption. - Ability to propose technology for sustainable energy	Lecture 5: Economic	- Tutorial/lecture	- Taking note	- Attendance	- PPT Present - Lecture Note
17	2h	Final Exam						

6. References

[1] Energy and the Environment, James A. Fay, Dan S.Golomb
[2] Energy systems Engineering Evaluation and Implementation, Francis M. Vanek, Louis D. Albright
[3] Global Energy Assessment Toward a sustainable Future, Thomas B.johansson, Nebbojsa Nakicenovic

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRICAL AND ENERGY- EE

DETAILED COURSE SYLLABUS

ENERGY EFFICIENCY AND CONSERVATION

Subject: Energy Efficiency and Conservation, Year: 5 Semester: 1 Credit: 3
Lecturer: Mr. ETH Oudaya, Master Degree from CU, Thailand
Tel.: 015 310 851 E-mail: oudaya.eth@itc.edu.kh

1. Course Description

This subject is to provide students the concept of usage energy in the optimization way which focus on selection criteria of equipment and high safety standard (must follow the technical standard).

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the energy efficiency of electrical equipment	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to analyze the energy efficiency based on heat calculation on electrical system in industry	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Capable to perform energy audit	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO4	Capable to do research in energy efficiency field and its application	PLO6, PLO7

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4
2	Assignment (quality reports)	25	CLO2, CLO3, CLO4
3	Quality oral presentation	25	CLO3, PLO4
4	Mid-Term exam	20	CLO1, CLO2, CLO3
5	Final Exam	20	CLO1, CLO2, CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-3	6h/6h	CLO1	- Ability to understand the statistic of electrical usage. - Ability to identify the consume electricity in the efficiency way. - Ability to compute the energy bill.	Lecture 1: Electrical Consumption.	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
4-9	12h/12h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the lighting system, motors, pump, air con., … - Ability to compute the efficiency from those electrical devices. - Ability to simulate the energy efficiency with case study.	Lecture 2: Energy Efficiency of electrical devices	- Tutorial/lecture - Demonstrate simulation tool (MATLAB/Simulink) - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Calculate the energy efficiency of electrical devices and verify result with simulation work - Report submission - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
10-13	8h/8h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the boiler - Ability to compute the recycle energy from waste. - Ability to optimization the boiler system in power plant. - Ability to select the cogeneration.	Lecture 3: Study of Energy Efficiency	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Calculate the energy efficiency of electrical devices and verify result with simulation work. - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation

			- Ability to simulate the energy efficiency of boiler system.					
14	2h	Midterm						
15-16	4h/4h	CLO1 CLO2 CLO3 CLO4	- Ability to understand on how to perform the energy audit. - Ability to use the energy audit tools. - Ability to analyze the audit result.	Lecture 4: Energy Audit	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a model of hydro-power and verify result with simulation work - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
17	2h	Final Exam						

6. References

[1] Energy Efficiency Guide for Industry in Asia, www.energyefficiencyasia.org, UNDP

[2] Bureau of Energy Efficiency, Ministry of Power, Government of India. Energy Efficiency in Electrical Utilities. 2004.

[3] International Energy Agency. World Energy Outlook 2004.

[4] Barney L. Capehart, Guide to Energy Management, Seventh Edition, 2011

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRICAL AND ENERGY- EE

DETAILED COURSE SYLLABUS

POWER SYSTEM ANALYSIS AND OPTIMIZATION

Subject: Power System Analysis and Optimization, Year: 4 Semester: 2 Credit: 3
Lecturer: Dr. VAI Vannak, PhD. from UGA, France
Tel.: 012 617 364 E-mail: vannak.vai@itc.edu.kh

1. Course Description

This course is intended to give an overview of the characteristics of distribution systems, power quality requirements, and protection measures. The planning and design considerations are also introduced. After the course study of Power System Analysis and Optimization, the students will have the knowledge and experiences of Power supply requirements, customer classification, over-current protection devices and its coordination, power quality requirements and its control, reliability of distribution systems, planning and design consideration of distribution system, grounding and safety of distribution systems.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Understand the energy efficiency of electrical equipment	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to analyze the energy efficiency based on heat calculation on electrical system in industry	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Capable to perform energy audit	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO4	Capable to do research in energy efficiency field and its application	PLO6, PLO7

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3, CLO4
2	Assignment (quality reports)	25	CLO2, CLO3, CLO4
3	Quality oral presentation	25	CLO3, PLO4
4	Mid-Term exam	20	CLO1, CLO2, CLO3
5	Final Exam	20	CLO1, CLO2, CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-3	6h/6h	CLO1	- Ability to understand the statistic of electrical usage. - Ability to identify the consume electricity in the efficiency way. - Ability to compute the energy bill.	Lecture 1: Electrical Consumption.	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
4-9	12h/12h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the lighting system, motors, pump, air con., … - Ability to compute the efficiency from those electrical devices. - Ability to simulate the energy efficiency with case study.	Lecture 2: Energy Efficiency of electrical devices	- Tutorial/lecture - Demonstrate simulation tool (MATLAB/Simulink) - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Calculate the energy efficiency of electrical devices and verify result with simulation work - Report submission - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
10-13	8h/8h	CLO1 CLO2 CLO3 CLO4	- Ability to understand the boiler - Ability to compute the recycle energy from waste. - Ability to optimization the boiler system in power plant. - Ability to select the cogeneration.	Lecture 3: Study of Energy Efficiency	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Calculate the energy efficiency of electrical devices and verify result with simulation work. - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation

			- Ability to simulate the energy efficiency of boiler system.					
14	2h	Midterm						
15-16	4h/4h	CLO1 CLO2 CLO3 CLO4	- Ability to understand on how to perform the energy audit. - Ability to use the energy audit tools. - Ability to analyze the audit result.	Lecture 4: Energy Audit	- Tutorial/lecture - Provide 12-15 problems (case study) and define student name for simulation and presentation work.	- Taking note - Make a model of hydro-power and verify result with simulation work - Report submission (all students) - Oral presentation (only assigned students)	- Attendance - Quality of report - Quality of presentation	- PPT Present - Lecture Note - Problems and assigned name of student for presentation
17	2h	Final Exam						

6. References

[1] Energy Efficiency Guide for Industry in Asia, www.energyefficiencyasia.org, UNDP

[2] Bureau of Energy Efficiency, Ministry of Power, Government of India. Energy Efficiency in Electrical Utilities. 2004.

[3] International Energy Agency. World Energy Outlook 2004.

[4] Barney L. Capehart, Guide to Energy Management, Seventh Edition, 2011

INTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY DEPARTMENT

OPTION: ELECTRONICS AND AUTOMATION/ ELECTRICAL ENERGY

Course Syllabus

PROJECT MANAGEMENT

Detailed Course Syllabus

Subject: Project Management Subject code: ……

Year: 5… Semester: …1 Credit: 2.5

Responsible Lecturer: Dr. AM Sok Chea, PhD. from UGA-Grenoble, France

Tel.: …096 34 55 449 / E-mail: sokchea_am@itc.edu.kh

1. Description of Course

This subject is proposed to provide student the basic knowledge on Project Management and tool for project implementation.

2. Course Learning Outcomes (CLOs)

Description of CLOs		Matching PLOs of Program
CLO1	Basic knowledge on Project Planning (Workplan, Budget Plan, Action Plan)	PLO1, PLO2, PLO3
CLO2	Able to monitor and evaluation project progress (Project implementation, PDM tool, evaluation	PLO1 PLO2 PLO3 PLO4
CLO3	Able to produce evaluation report and problem-solving technique for project's progress	PLO4, PLO11

3. Teaching Methodology

- Tutorial, and active learning system: more activities from students with clear guideline from lecturer
- Assignments in group
- Oral presentation of assignment

4. Evaluation Methodology

No	Evaluation Types	Score	Matching CLOs
1	Attendants	10	
2	Assignments and report	20	CLO1, CLO2, CLO3, CLO4
3	1st Oral Presentation	20	CLO1, CLO2, CLO3, CLO4
4	Monitoring and Evaluation Report	20	CLO1, CLO2, CLO3, CLO4
5	2nd Oral presentation	30	CLO1, CLO2, CLO3, CLO4

Passing Score:

- Final Moyenne > 50: score of subjects under 30 must re-do exam
- Final Moyenne < 50: score of subjects under 50 must re-do exam

5. Detailed of content

Weeks		CLOs	LLOs	Content	Teaching met.	Learning met.	Assessment	Equipment
1	2h/2h		- Ability to understand what is Project. - Ability to define definition of project management.	Lecture 1: Introduction to Project Management	- Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
2-3	4h/4h		- Ability to develop PDM for project planning - Ability to plan activities to achieve project outputs/outcomes.	Lecture 2: Project Design Matrix (PDM)	- Tutorial	- Note - Searching - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
4-5	4h/5h		- Ability to develop PDM for project planning - Ability to plan activities to achieve project outputs/outcomes.	Lecture 3, Project Design Matrix (PDM) – Cont.	- Lecture - Tutorial	- Note - Q/A	- Quiz 2 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
6-7	4h/5h		- Ability to develop workplan from PDM - Ability to develop Action plan and budget plan.	Lecture 4: Project planning: Workplan, Action plan, Budget plan	- Lecture - Tutorial	- Note - Q/A	- Homework 1 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
8	2h	**Midterm**						
9-10	2h/4h		- Ability to develop project planning with Microsoft Project.	Lecture 5, Project Planning with Software	- Lecture - Tutorial	- Discussion - Q/A	- Homework 2 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
11-12	2h/4h		- Ability to monitor and evaluate project progress and problem-solving skill	Lecture6, Project Implementation	- Lecture - Tutorial	- Discussion - Q/A	- Quiz 3 - Attendance	- PPT Present - Lecture Note
13-16	2h/4h		- Ability to produce quality report and oral presentation.	Lecture7, Report and oral presentaiotn	- Lecture - Tutorial	- Presentation	- Attendance	- PPT Present - Lecture Note
17		**Final Exam**						

5. References

[1] JOSEPH HEAGNEY “Fundamentals of Project Management” 4th Edition Amacon, 2011

[2] Xia Qin, “Project Management and Project Action Plan” Asean QA, 2009

INTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY DEPARTMENT

OPTION: ELECTRONICS AND AUTOMATION/ ELECTRICAL ENERGY

DETAILED COURSE SYLLABUS

TECHNOPRENEURSHIP

Subject: Technopreneurship Subject code: ……

Year: 5… Semester: …1 Credit: 1

Responsible Lecturer: Dr. AM Sok Chea, PhD. from UGA-Grenoble, France

Tel.: …096 34 55 449 / E-mail: sokchea_am@itc.edu.kh

1. Description of Course

This subject is proposed to provide student the basic knowledge and experiences from success khmer entrepreneur in the field of engineering.

2. Course Learning Outcomes (CLOs)

Description of CLOs		Matching PLOs of Program
CLO1	Basic knowledge on Technology and Entrepreneurship	PLO6, PLO7, PLO8
CLO2	Able to monitor and evaluation project progress (Project implementation, PDM tool, evaluation	PLO6, PLO7, PLO8
CLO3	Able to produce evaluation report and problem-solving technique for project's progress	PLO6, PLO7, PLO8

3. Teaching Methodology

- Tutorial, and active learning system: more activities from students with clear guideline from lecturer
- Assignments in group
- Oral presentation of assignment

4. Evaluation Methodology

No	Evaluation Types	Score	Matching CLOs
1	Attendants	10	
2	Assignments and report	20	CLO1, CLO2, CLO3
3	1st Oral Presentation	20	CLO1, CLO2, CLO3
4	Monitoring and Evaluation Report	20	CLO1, CLO2, CLO3
5	2nd Oral presentation	30	CLO1, CLO2, CLO3

Passing Score:

- Final Moyenne > 50: score of subjects under 30 must re-do exam
- Final Moyenne < 50: score of subjects under 50 must re-do exam

5. Detailed of content

Weeks		CLOs	LLOs	Content	Teaching met.	Learning met.	Assessment	Equipment
1	2h/2h		- Ability to understand what is Project. - Ability to define definition of project management.	Lecture 1: Introduction to Project Management	- Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
2-3	4h/4h		- Ability to develop PDM for project planning - Ability to plan activities to achieve project outputs/outcomes.	Lecture 2: Project Design Matrix (PDM)	- Tutorial	- Note - Searching - Q/A	- Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
4-5	4h/5h		- Ability to develop PDM for project planning - Ability to plan activities to achieve project outputs/outcomes.	Lecture 3, Project Design Matrix (PDM) – Cont.	- Lecture - Tutorial	- Note - Q/A	- Quiz 2 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
6-7	4h/5h		- Ability to develop workplan from PDM - Ability to develop Action plan and budget plan.	Lecture 4: Project planning: Workplan, Action plan, Budget plan	- Lecture - Tutorial	- Note - Q/A	- Homework 1 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
8	2h	**Midterm**						
9-10	2h/4h		- Ability to develop project planning with Microsoft Project.	Lecture 5, Project Planning with Software	- Lecture - Tutorial	- Discussion - Q/A	- Homework 2 - Attendance	- PPT Present - Lecture Note - Computer, LCD, ink markers
11-12	2h/4h		- Ability to monitor and evaluate project progress and problem-solving skill	Lecture6, Project Implementation	- Lecture - Tutorial	- Discussion - Q/A	- Quiz 3 - Attendance	- PPT Present - Lecture Note
13-16	2h/4h		- Ability to produce quality report and oral presentation.	Lecture7, Report and oral presentaiotn	- Lecture - Tutorial	- Presentation	- Attendance	- PPT Present - Lecture Note
17		**Final Exam**						

5. References

[1] JOSEPH HEAGNEY “Fundamentals of Project Management” 4th Edition Amacon, 2011

[2] Xia Qin, “Project Management and Project Action Plan” Asean QA, 2009

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

WORK-LIFE AND SOCIAL PSYCHOLOGY

Subject: Work-life and psychology, Year: 5 Semester: 1 Credit: 1
Lecturer: Dr. BUN Long, PhD. Degree from UGA, France
Tel.: 095 222 776 E-mail: bunlong@itc.edu.kh

1. Course Description

This subject is to provide the students the different between the work-life and student-life. This subject is to teach students to prepare for real-job after graduation.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to understand the work pressure	PLO6, PLO7, PLO8
CLO2	Able to tolerance with work	PLO6, PLO7, PLO8
CLO3	Able to prepare for real-job	PLO6, PLO7, PLO8

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	45	CLO1, CLO2, CLO3
3	Quality oral presentation	45	CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1-3	6h		- Ability to understand the student life and ready for work-life	Lecture 1: Re-call of student life	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note
4-6	6h		- Ability to know how to face big pressure from work load	Lecture 2: Confort zoon come to end	- Lecture - Tutorial	- Note - Q/A	Attendance	- PPT Present - Lecture Note
7-8	4h		- Ability to well planning activities for completing the teamwork project	Lecture 3: Planning for achieving	- Lecture - Tutorial - Assignment 1	- Note - Q/A	- Attendance - Quiz 2	- PPT Present - Lecture Note
9-11	4h		- Ability to complete on time with sharing load in team	Lecture 4: Work-pressure	- Lecture - Tutorial - Assignment 2	- Note - Q/A	- Attendance	- PPT Present - Lecture Note
12-16	10h		- Ability to understand the difficulty at work.	Lecture 5: Sharing experience on real-work	- Lecture - Tutorial	- Note - Q/A	- Attendance	- PPT Present - Lecture Note
17								

6. References

[1] Oyedele O. Ola, Willoughby O. John, Olaniyi A. Simeon and Oyero A. Mutiu, "Impact of Work Life Balance on the Social Life of Workers Living in Lagos Metropolitan Borders"

[2] K.D.H Sarawaty, "Psychological Well-Being: The Impact of Work-Life Balance and Work Pressure" Published by Atlantis Press SARL, 2020

INSTITUTE OF TECHNOLOGY OF CAMBODIA

FACULTY: ELECTRICITY

DEPARTMENT: ELECTRICAL AND ENERGY

ENGINEERING DEGREE: ELECTRONICS AND AUTOMATION - EA

DETAILED COURSE SYLLABUS

STUDENT PROJECT PART 2

Subject: Student Project Part 2, Year: 5 Semester: 1 Credit: 1

Lecturer: Dr. AM Sok Chea, PhD. from UGA, France
Tel.: 096 34 55 449 E-mail: Sokchea_am@itc.edu.kh

1. Course Description

This subject is to provide the students the continuation on real research project or projects from partner industries linked from Student Project Part 1.

2. Course Learning Outcomes - CLOs

Description of course learning outcomes - CLOs		Matching PLOs
CLO1	Able to do real research projects or industries' projects	PLO1, PLO2, PLO3, PLO4, PLO5
CLO2	Able to do simulation for related project	PLO1, PLO2, PLO3, PLO4, PLO5, PLO10
CLO3	Able to increase soft-skill: report + presentation	PLO8, PLO9, PLO11

3. Teaching Methodology

In this lecture, we use active learning methodology where student is engaged in more activities than just listening.

- Participate actively in lectures
- Do modeling and make a simulation for each assignment
- Quality presentation
- Quality of report writing

4. Assessment Methodology

No.	Evaluation	% of score	Matching CLOs
1	Attendant	10	CLO1, CLO2, CLO3
2	Assignment (quality reports)	40	CLO1, CLO2, CLO3
3	Quality oral presentation	50	CLO3

Passing score:

- If overall average is over 50, subjects with score lower than 30 have to re-sit
- If overall average is under 50, subjects with score lower than 50 have to re-sit.

5. Detailed Contents

Weeks	N. of hours	CLOs	LLOs	Lecture	Teaching Methodology	Learning Methodology	Assessment	Material
1	2h	CLO1	- Ability to define small groups for specific research projects. - Ability to match students with partner industries.	Lec. 1: Continue working on project from Student Project Part 1	- Tutorial/lecture - Asking key question	- Group discussion - Asking key question	- Attendance	- PPT Present - Lecture Note
2-3	4h/4h	CLO1 CLO2 CLO3	- Ability to present research results. - Ability to prototype the findings	Lec. 2: Continue working on project from Student Project Part 1 (Cont. 1)	- Tutorial/lecture - Demonstrate on how to prototype	- Taking note	- Attendance - Presentation	- PPT Present - Lecture Note
4-5	4h	CLO1 CLO2 CLO3	- Ability to present research results. - Ability to prototype the findings	Lec. 3: Continue working on project from Student Project Part 1 (Cont. 1)	- Tutorial/lecture Demonstrate on how to prototype	- Taking note -	- Attendance - Presentation	- PPT Present - Lecture Note -
6-7	4h	CLO1 CLO2 CLO3	- Ability to present research results. - Ability to prototype the findings	Lec. 4: Continue working on project from Student Project Part 1 (Cont. 1)	- Tutorial/lecture - Demonstrate on how to prototype	- Taking note	- Attendance - Presentation	- PPT Present - Lecture Note
9-10	4h	CLO1 CLO2 CLO3	- Ability to present research results. - Ability to prototype the findings	Lec. 5: Continue working on project from Student Project Part 1 (Cont. 1)	- Tutorial/lecture - Demonstrate on how to prototype	- Taking note -	- Attendance - Presentation	- PPT Present - Lecture Note -
11-12	4h	CLO1 CLO2 CLO3	- Ability to present research results. - Ability to prototype the findings	Lec. 6: Continue working on project from Student Project Part 1 (Cont. 1)	- Tutorial/lecture - Demonstrate on how to prototype	- Taking note -	- Attendance - Presentation	- PPT Present - Lecture Note
13-16	8h	CLO1 CLO2 CLO3	- Ability to present research results. - Ability to prototype the findings	Lec. 7: Continue working on project from Student Project Part 1 (Cont. 1)	- Tutorial/lecture - Demonstrate on how to prototype	- Taking note -	- Attendance - Presentation	- PPT Present - Lecture Note -

6. References

[1] ITC, IG Tech Grou “MoU of Coorporation” 2022