SYLLABUS

1. **Course name: ELECTRICAL DRIVES IN PRACTICE**
2. **Course code:** ELEC322645
3. **Credits: 2** (0/2/4)

    Duration: 15 weeks (90hrs main course and 180hrs self-study)
4. **Instructors:**

    1- M.Eng. Luu Van Quang

    2- PhD. Tran Quang Tho

    3- M.Eng. Nguyen Vinh Quan

    4- PhD. Nguyen Phan Thanh
5. **Course conditions**

    Prerequisites: Electric machines

    Corequisites: Automatic Electric Drive

6. **Course description**

    This course provides the learner with knowledge of drawing and surveying torque speed characteristics of DC motor and AC induction motor, speed adjustment of DC motor and AC motor.

7. **Course Goals**

Goals	*Goal description* *(This course provides students:)*	ELOs
G1	Ability to apply the rules of the left hand, the laws of electromagnetic induction, conservation of energy, etc. Knowledge in circuit network engineering, electrical machines, electric-electronic measurement and instrumentation; automatic electric drive Having advanced knowledge, management of the field of automatic electric drive in the production of reality, industrial systems ...	1.1, 1.2 2.1
G2	Have professional ethics, environmental consciousness, and professional. Experimental and knowledge discovery issues in automatic electric drive. Thinking ability and systematic thinking to the problems in automatic electric drive.	2.5, 3.2 4.1, 4.2
G3	Teamwork skill, communication, text presentation, graphics and presentation. Ability to read technical materials on automatic electric drive practice in English.	3.1, 3.3
G4	Recognizing the influence and social needs of the electric drive.	2.4, 4.1

		Read, check the connection diagram laboratory kit.	4.6
		Control circuit design, dynamic circuit	
		Set up the operating procedure for the model.	
		Operate models in electric motors such as DC motors, AC motors.	
		Survey torque speed characteristics and evaluate the results achieved when adjusting engine speed with different parameters, and speed indicators.	

8. Course Learning Outcomes (CLOs)

CLOs		Description *(After completing this course, students can have:)*	Outcome
G1	G1.1	Presented the contruction, working principle, torque speed characteristics of DC motors, AC motors. Presented parameters impact on the speed torque characteristics of a motor, the starting current method	1.1, 1.2, 2.1
	G1.2	Survey and draw the speed torque characteristics when adjusting the speed with different parameters.	1.1, 1.2, 2.1
	G1.3	Good management and operation of the experimental model. Formed the ability to manage production systems.	1.1, 1.2, 2.1
G2	G2.1	Seriously in the process of testing, preserving practice equipment. Ensure that the process is carried out correctly. Arrange equipment neatly, sanitation in the laboratory. Forming self-consciousness, safety in production, industrial style.	2.5, 3.2
	G2.2	Ability to manually search for documents, self-study and present the contents of electrical drives practice. Model analysis, wiring diagram.	4.1, 4.2
	G2.3	Explain the function of the block diagrams in the model. Understand operating procedures, operation using equipment.	4.1, 4.2
	G2.4	Steps proceed experiment on the time required. Evaluate the results after the experiment.	4.1, 4.2
G3	G3.1	Ability to organize, assign tasks, coordinate work among team members to solve problems related to electrical drives practice.	3.1, 3.3
	G3.2	Present ideas, conclusions after group work in front of the class. Present reports after the experiment scientifically.	3.1, 3.3
	G3.3	Understand the English terms used in electrical drives practice.	3.1, 3.3
G4	G4.1	Present the role of electrical drives practice for the development, environment and work of society by: starting methods, speed control of DC motors, AC motors.	4.1, 2.4
	G4.2	Read the test kit connection diagram. Check for errors after connection.	4.1
	G4.3	Present operation procedure of the experimental model. Operate properly models in electric drive such as DC motor	4.1, 4.6

		model, AC motor model.		
	G4.4	Survey the speed torque characteristics, draw the speed torque characteristics and evaluate the results achieved when adjust speed with different parameters and speed indicators.	4.1, 4.6	

9. Study materials

- Textbooks:

[1] Lecture on Electrical drives practice.

- References:

[2] Italtec document.

[3] Omron document.

[4] Siemens document.

[5] Bui Quoc Khanh, Truyen dong dien, Technical and Scientific Publisher, 2005.

10. Student Assessments

- Grading points: 10

- Planning for students assessment is followed:

Assessment Types	Assessment Content	Time	Assessment techniques	CLOs	Rates (%)
Report					50
Exercise #1	Proficient use of equipment in the control circuit. Design control circuit and dynamic circuit. Describe the working principle of the control circuit and dynamic circuit. Install and operate control circuit and dynamic circuit according to technology requirements.	Week 2	Report		5
Exercise #2	Manual programming on the ZEN keyboard. Write the program by programming with ZEN SOFT software and load into the ZEN CPU. Circuit operation is connected to ZEN according to technology requirements.	Week 3	Report		5
Exercise #3	Write program by programming with CX-Programmer software and load into CPU of PLC. Circuit operation connected to	Week 5	Report		5

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	PLC on technology requirements.				
Exercise #4	Monitor and control using OMRON **NB HMI**. Use NP-Designer software to design interfaces and controls.	Week 7	Report		5
Exercise #5	Present the wiring diagram, function of the control terminals on the inverter, screen control function, parameters of 3G3JX inverter. Communication between PLC and inverter. Application of 3G3JX inverter to control the motor.	Week 8	Report		5
Exercise #6	Present contruction, working principle and operate DC motor. Draw principle diagram, and and make the wiring for the model, write operating procedures. Survey and evaluate results the speed torque characteristics when adjusting the speed with different parameters.	Week 9	Report		5
Exercise #7	Present contruction, working principle and operate BL motor. Draw principle diagram, and and make the wiring for the model, write operating procedures. Survey and evaluate results the speed torque characteristics when adjusting the speed with different parameters.	Week 10	Report		5
Exercise #8	Present contruction, working principle, main types of stepper motors, angle - torque characteristics of stepper motors. Write operating procedures of stepper motor model. Survey and evaluate performance results of the stepper motor model.	Week 11	Report		5
Exercise #9	Present contruction, working principle of three phase induction motor. Determine the speed torque characteristic equation, the influence of the parameters,	Week 12	Report		5

	reducing starting current. Draw the speed torque characteristic equation. Survey and evaluate performance results of controlling the speed of three phase induction motor by V/f method.				
Exercise #10	Setting parameters for Siemens inverter model and model operation. Survey results with different operating modes of load Comment on the speed adjustment method.	Week 14	Report		5
Final exam					50
Final exam	- The content covers all the important outcomes of the course. - The form of essay or multiple choice.	Week 15	Essay - Report		

11. Course details:

Week	Contents	CLOs
1-2	**Chapter I. Control circuit with contact point**	
	A. Contents and teaching methods in the classroom (2)	
	Contents:	
	+Target lesson	
	+ Lesson content	
	+ Search devices in control circuit: Push button, contactor, 3-phase induction motor with one speed level, 3-phase induction motor with two speed level, intermediate relay, timer, thermal relay, ...	
	+ Design control circuit and dynamic circuit:	
	• Motors start up directly	
	• Reverse the rotation of motor	
	• The Star-Delta (Y-Δ) 3-phase Motor Starting Method	
	• Three Phase Motor Star/Delta (Y-Δ) reverse / forward	
	• Start up two speed level AC motor	
	• Start up two speed level AC motor reverse / forward	
	+ Present the working principle of control circuit and dynamic circuit.	
	+ Set up and operate dynamic and control circuits according to technology requirements.	

	+ Write report	
	Teaching methods:	
	+ Oral Speaking	
	+ Group discussion	
	+ Sample manipulation	
	B. Study at home (4)	
	+ Read electric drive documentation	
	+ Make a report	
	+ Collect more realistic images of devices used in the control circuit	
3	**Chapter II. ZEN Programmable Logic Module**	
	A. Contents and teaching methods in the classroom (2)	
	Contents:	
	+Target lesson	
	+ Lesson content	
	+Manual programming on the ZEN keyboard	
	+ Programming with ZEN SOFT software	
	• Creating the Program	
	• Using Timers and Counters	
	• Write program using ZEN SOFT software: Starting an electric motor with on / Off button	
	• Write program using ZEN SOFT software: The Star-Delta (Y-Δ) 3-phase motor starting method	
	• Write program using ZEN SOFT software: Three Phase Motor Star/Delta (Y-Δ) reverse / forward	
	+Write program and load into ZEN CPU	
	+Connect ZEN to hardware.	
	+Write the operating procedure.	
	+ Operate circuit connected to ZEN according to technology requirements.	
	+ Write report	
	Teaching methods:	
	+ Oral Speaking	
	+ Group discussion	
	+ Sample manipulation	
	B. Study at home (4)	
	+ Read ZEN and ZEN SOFT software documentation	
	+ Make a report	

	+ Exercises in Chapter 2	
4-5	**Chapter III. PLC CP1L**	
	A. Contents and teaching methods in the classroom (4)	
	Contents:	
	+Target lesson	
	+ Lesson content	
	+ Programming with CX-Programmer software	
	+ Write program and load into PLC	
	+Connect PLC CP1L to hardware.	
	+Write the operating procedure.	
	+ Operate circuit connected to PLC according to technology requirements.	
	+ Write report	
	Teaching methods:	
	+ Oral Speaking	
	+ Group discussion	
	+ Sample manipulation	
	B. Study at home (8)	
	+ Read PLC CP1L and CX-Programmer software documentation	
	+ Make a report	
	+ Exercises in Chapter 3	
6-7	**Chapter IV: NB HMI**	
	A. Contents and teaching methods in the classroom (4)	
	Contents:	
	+Target lesson	
	+ Lesson content	
	+Introduce OMRON HMI Kit	
	+NP-Designer software	
	+ HMI application exercises and NP-Designer software	
	+ Write report	
	Teaching methods:	
	+ Oral Speaking	
	+ Group discussion	
	+ Sample manipulation	
	B. Study at home (8)	
	+ Read more documents about NB and NP-Designer software.	
	+ Make a report	
8	**Chapter V: Inverter 3G3JX**	

	A. Contents and teaching methods in the classroom (2) **Contents:** +Target lesson + Lesson content +Introduce Inverter 3G3JX • Inverter wiring diagram • Function of the control terminal of the inverter • Screen control function • Parameters of inverter +Communication between PLC and inverter + Inverter adjustment exercise + Write report **Teaching methods:** + Oral Speaking + Group discussion + Sample manipulation	
	B. Study at home (4) + Read more documents about Inverter 3G3JX OMRON. + Make a report.	
9	**Chapter VI: Model of DC speed control**	
	A. Contents and teaching methods in the classroom (4) **Contents:** +Target lesson. + Lesson content. +Introduce Inverter 3G3JX. +Learn about the DC speed control model. + Draw a schematic diagram of the DC speed control model. + Draw the wiring diagram. + Write operating procedures. + Operate model and survey the speed torque characteristic. + Write report. **Teaching methods:** + Oral Speaking + Group discussion + Sample manipulation	
	B. Study at home (8) + Read more documents about DC speed control.	

	+ Make a report.	
	+Collect 5 images of actual DC motors	
	+ Collect 5 applications adjust the speed of the DC motor	
10	**Chapter VII: Brushless motor model**	
	A. Contents and teaching methods in the classroom (4)	
	Contents:	
	+Target lesson.	
	+ Lesson content.	
	+ Learn the BL motor model	
	+ Draw the principle diagram, wiring diagram	
	+ Write operating procedures	
	+ Operate the BL motor model	
	+ Write report	
	Teaching methods:	
	+ Oral Speaking	
	+ Group discussion	
	+ Sample manipulation	
	B. Study at home (8)	
	+ Read more documents about BL motor.	
	+ Make a report.	
	+ Collect 5 images of BL motor applications.	
11	**Chapter VIII: Stepper motor model**	
	A. Contents and teaching methods in the classroom (2)	
	Contents:	
	+Target lesson.	
	+ Lesson content.	
	+ Learn the Stepper motor model	
	+ Draw the principle diagram, wiring diagram	
	+ Write operating procedures	
	+ Operate the Stepper motor model	
	+ Write report	
	Teaching methods:	
	+ Oral Speaking	
	+ Group discussion	
	+ Sample manipulation	
	B. Study At Home (4)	
	+ Read more documents about stepper motor.	

	+ Make a report	
	+Collect 5 images of stepper motors	
12	**CHAPTER IX. Survey and operate the V / f control of three-phase induction motor model**	
	A. Contents and teaching methods in the classroom (4)	
	Contents:	
	+Target lesson.	
	+ Lesson content.	
	+Survey three-phase induction motor model.	
	+ Research into contruction and working principle of an induction motor	
	+ Draw the wiring diagram	
	+Write operating procedures	
	+ Operate three-phase induction motor model	
	+ Write report	
	Teaching methods:	
	+ Oral Speaking	
	+ Group discussion	
	+ Sample manipulation	
	B. Study At Home (8)	
	+ Read more documents about three-phase induction motor model.	
	+ Make a report	
	+Collect 5 images of three-phase induction motor model.	
13-14	**CHAPTER X. Survey and operate speed control of three-phase induction motor model with MICROMASTER 440**	
	A. Contents and teaching methods in the classroom (2)	
	Contents:	
	+Target lesson.	
	+ Lesson content.	
	+Survey three-phase induction motor model with MICROMASTER 440	
	+ Determine the speed adjustment method	
	+Draw the block diagram of speed control	
	+ Define the installation parameters	
	+ Model operation	
	+ Write report	
	Teaching methods:	
	+ Oral Speaking	
	+ Group discussion	
	+ Sample manipulation	

	B. Study At Home (4)	
	+ Read more documents about three-phase induction motor model and Micromaster 440	
	+ Make a report	
	+ Collect speed adjusting applications	
15	**Final exam**	
	- The content covers all the important outcomes of the course.	
	- The form of essay or multiple choice.	

12. Learning ethics:

- The homework, tests and exam must be done by the students themselves. If detect copying, use document is not allowed, the students involved must be evaluated 0 (zero) at process exam and final exam.

13. First approved date:

14. Approval level:

Dean	Department	Instructor
Assoc. Prof. PhD. Nguyen Minh Tam	**Assoc. Prof. PhD. Truong Viet Anh**	**M.Eng. Luu Van Quang**

15. Syllabus updated process

1st time: Updated content dated	Instructors
2st time: Updated content dated	Head of department