Republic of the Philippines
SULTAN KUDARAT STATE UNIVERSITY
Isulan Campus, Isulan Sultan Kudarat
College of Industrial Technology

ET 222A- INDUSTRIAL MOTOR CONTROLLERS

UNIVERSITY VISION

A leading University in advancing scholarly innovation, multi-cultural convergence, and responsive public service in a borderless Region.

UNIVERSITY MISSION

The University shall primarily provide advanced instruction and professional training in science and technology, agriculture, fisheries, education and other related fields of study. It shall also undertake research and extension services, and provide progressive leadership in its areas of specialization.

UNIVERSITY STRATEGIC GOALS

a. Deliver quality service to stakeholders to address current and future needs in instruction, research, extension, and production
b. Observe strict implementation of the laws as well as the policies and regulations of the University
c. Acquire with urgency state-of-the-art resources for its service areas
d. Bolster the relationship of the University with its local and international customers and partners
e. Leverage the qualifications and competences in personnel action and staffing
f. Evaluate the efficiency and responsiveness of the University systems and processes

INSTITUTIONAL OUTCOMES (IO)

a. Enhance competency development, commitment, professionalism, unity and true spirit of service for public accountability, transparency and delivery of quality services
b. Provide relevant programs and professional trainings that will respond to the development needs of the region
c. Strengthen local and international collaborations and partnerships for borderless programs
d. Develop a research culture among faculty and students
e. Develop and promote environmentally-sound and market-driven knowledge and technologies at par with international standards
f. Promote research-based information and technologies for sustainable development
g. Enhance resource generation and mobilization to sustain financial viability of the university

PROGRAM OUTCOMES (PO) COMMON TO ALL PROGRAMS AND ITS RELATIONSHIPS TO INSTITUTIONAL OUTCOMES

A graduate of the BIndTech program can:	INSTITUTIONAL OUTCOMES (IO)						
	a	b	c	d	e	f	g
a. Analyze broadly defined industrial technology processes by using analytical tools that enhance creativity, innovativeness, and intellectual curiosity to improve methods, processes, and systems that meet the industry standards;	✓	✓				✓	
b. Design and implement broadly defined industrial systems, components, products, or processes to meet specific industry needs with proficiency and flexibility in the area of specialization in accordance with global standards;	✓	✓		✓		✓	

c. Apply appropriate techniques, resources, and state-of-the-art industrial technology tools to meet current industry needs and use these modern tools and processes to improve and increase entrepreneurial activities upholding the safety and health standards of business and industry;	✓		✓	✓	✓		
d. Communicate with diverse groups of clienteles the appropriate cultural language with clarity and persuasion, in both oral and written forms, including understanding and giving of clear instructions, high comprehension level, effectiveness in delivering presentations and writing documents, and articulating technological innovation outputs;	✓	✓	✓	✓	✓		
e. Develop leadership and management skills in a team-based environment by making informed decisions, keeping the team motivated, acting and delegating responsibility, and inspiring positive changes in the organization by exercising responsibility with integrity and accountability in the practice of one's profession;	✓	✓	✓	✓	✓		
f. Practice the moral responsibilities of an industrial technologist to manage and balance wider public interest and uphold the norms and safety standards of the industrial technology profession;				✓	✓	✓	✓
g. Demonstrate enthusiasm and passion for continuous personal and professional development in broadly defined industrial technology and effecting positive changes in the entrepreneurial and industrial endeavor; and	✓	✓	✓	✓	✓	✓	✓
h. Recognize the need for, and an ability to engage in lifelong learning.	✓	✓	✓	✓	✓	✓	✓

1 **COURSE CODE** ET 311A
2 **COURSE TITLE** TRANSMISSION AND DISTRIBUTION SYSTEM
3 **PREREQUISITE** ET 211 LOGIC CIRCUITS, ET222 INDUSTRIAL MOTOR CONTROLLER
4 **CREDITS** 3 units

5 **COURSE DESCRIPTION**
This course provides a comprehensive overview of motor control systems utilized in industrial applications. Students will explore the principles of both single-phase and three-phase motors, learning about various motor starters such as Direct On-Line (DOL), star-delta, and soft starters. The course emphasizes advanced control techniques, including variable frequency drives (VFDs) control, alongside practical skills in circuit design and implementation..

6 **COURSE LEARNING OUTCOMES (CLO) AND ITS RELATIONSHIPS TO PROGRAM OUTCOMES**

Course Learning Outcomes (CLO)	Program Outcomes							
At the end of the course, a student can:	a	b	c	d	e	f	g	
a. Identify and describe the major components and systems of an automobile.	✓	✓	✓	✓	✓	✓	✓	
b. Demonstrate basic diagnostic and maintenance procedures on various automotive systems.	✓	✓	✓	✓	✓	✓	✓	
c. Apply safety practices in the automotive workshop environment.	✓	✓	✓	✓	✓	✓	✓	
d. Use diagnostic tools and equipment effectively for troubleshooting automotive issues.	✓	✓	✓	✓	✓	✓	✓	
e. Communicate technical information related to automotive technology clearly.	✓	✓	✓	✓	✓	✓	✓	

7 COURSE CONTENTS

WEEK	CONTENT	INTENDED LEARNING OUTCOMES((ILOs)	TEACHING AND LEARNING ACTIVITIES (TLA)	OUTCOMES-BASED ASSESSMENT (OBA)	COURSE LEARNING OUTCOMES (CLOs)
1	**Course Orientation** *SKSU VMGO, Classroom Policies, Course Overview, Course Requirements, Grading System*	At the end of the week, the student can: a. Discuss the University's VMGO, classroom policies, course overview, requirements and grading system	Discuss the VMGO of the University, the classroom policies, scope of the course, course requirements and grading system	a. Participation in discussions	abcdefg
2	**Introduction to Motor Controllers** a. Types of Motors b. Basics of Motor Control c. Motor Control Terminology **d.** Safety Considerations	At the end of the week, the student can: a. Identify and differentiate various types of industrial motors (AC, DC, synchronous, asynchronous) and their respective applications in real-world scenarios. b. Explain the fundamental principles of motor control systems, including the impact of voltage, current, and frequency on motor performance. c. Understand and correctly use key terminology related to motor controllers, including starter types, control methods, and operational parameters. d. Recognize and apply essential safety measures and best practices when working with motor control systems to prevent accidents and ensure compliance with industry standards.	a. Video/power point presentation b. Individual participation in discussions c. Quiz	a) Quiz b) participation c) Video presentation	abcdefg

3	**Principles of Single and Three-Phase Motors** a. Comparison of Single and Three-Phase Motors	At the end of the week, the student can: b. Explain the operational principles, advantages, and limitations of single-phase motors, including starting methods and applications c. Describe the operational principles of three-phase motors, emphasizing their efficiency, starting methods, and applications in industrial settings. d. Analyze the differences between single-phase and three-phase motors, including performance characteristics and suitability for various applications.	a) Video/power point presentation b) Individual participation in discussions c) Quiz	a) Quiz results b) participation c) Video presentation	abcdefg
4	**Motor Starters** a) Direct On-Line (DOL) Starter b) Reduce Voltage Motor Starter	At the end of the week, the student can: a. Explain the operational principles of DOL starters, including their advantages and disadvantages in motor starting applications. b. Explain the operational principles of reduce voltage motor starter starters, including their advantages and disadvantages in motor starting applications.	a) Video/power point presentation b) Individual participation in discussions c) Quiz	a) Quiz b) participation c) Video presentation	abcdefg
5	**Control Methods and Wiring Schematics of Motor Starters** a. Start-Stop b. Forward-Reverse Control	At the end of the week, the student can: a. Implement and troubleshoot start-stop and forward-reverse control methods, understanding their applications in conveyor systems and other industrial processes.	a) Video/power point presentation b) Individual participation in discussions c) Quiz	a) Quiz b) participation c) Video presentation	abcdefg

	c. Sequential Control d. Part Winding Starter e. Star-Delta Starter f. Soft Starters g. Relay Control Circuits h. Control Circuit Troubleshooting	b. Design and analyze sequential control systems for multiple motors, ensuring proper coordination and timing in automated processes. c. Describe the operation and advantages of part winding starters in large motors, including their impact on torque and efficiency during startup. d. Analyze the configuration and operation of star-delta starters, discussing their benefits in reducing starting current for large motors. e. Understand soft starter technology, including its advantages in reducing mechanical stress on motors during startup and improving operational efficiency. f. Design and analyze relay control circuits, understanding their role in motor operation and safety features, including overload protection. g. Diagnose and troubleshoot common issues in control circuits, applying systematic troubleshooting methodologies to identify and resolve faults efficiently.			
		MIDTERM EXAM			

6	**Sensors and Feedback Systems** a. Types of Sensors b. Feedback Mechanisms c. Sensor Switches for Motor Starters	At the end of the week, the student can: a. Identify and evaluate various sensors (proximity, limit, temperature) used in motor control applications, understanding their roles in automation. b. Explain the importance of feedback in control systems, including how it enhances performance and stability in motor operations. c. Describe the operation of motor starters using different sensor switches, evaluating their advantages in automation and control. d. Troubleshoot common sensor issues in motor control applications, developing skills to effectively diagnose and resolve sensor-related problems.	a) Video/power point presentation b) Individual participation in discussions c) Quiz	a. participation b. Video presentation	abcdefg
7	**Motor Protection and Maintenance** a. Overcurrent Protection b. Thermal Protection c. Regular Maintenance Practices d. Troubleshooting Techniques	At the end of the week, the student can: a. Explain the significance of overcurrent protection in motor circuits, detailing how to select and implement appropriate protective devices. b. Describe thermal protection methods for motors, including the principles of operation and selection criteria for thermal overload relays. c. Implement regular maintenance practices for industrial motors, understanding the impact of maintenance on performance and longevity.	a) Video/power point presentation b) Individual participation in discussions c) Quiz	a. Quiz b. Activity Output/ Video Presentation	abcdefg

		d. Apply effective troubleshooting techniques for motor and controller issues, developing a systematic approach to identifying and resolving faults.			
8	**Programming Motor Controllers** **a.** Ladder Logic Programming	At the end of the week, the student can: a. Understand the role of Programmable Logic Controllers (PLCs) in motor control applications, including their architecture and functionality. b. Write, interpret, and analyze basic ladder logic programs for motor control, demonstrating proficiency in programming techniques.	**a.** Class Discussion/ Video Presentation b. Role-Playing Activity c. Quiz d. Group Project	a. **Quiz** **b. Role Playing Evaluation**	abcdefg
9	**FINAL EXAMINATION**				

Total No. of Hours : 54

8 COURSE REQUIREMENTS AND COURSE POLICIES

COURSE REQUIREMENTS

Each student is required to:

1. submit accomplished assignments, and activities;
2. make a PowerPoint presentation, and a written summary of the assigned report;
3. participate actively in all discussion;
4. discuss an assigned topic to report and participate in class discussions; and
5. pass the major exams (midterm and final)

COURSE POLICIES

Attendance: A student will be marked late if he/she enters the class 5 minutes after start of class period. Any student who comes to class 15 minutes after the scheduled time shall be marked absent.

Missed work or exam: Any student who missed to submit a work assignment or to take a test should consult the concerned instructor for immediate compliance

Cheating and Plagiarism: Any student who committed any form of academic dishonesty (e.g., copy-paste plagiarism) shall be given disciplinary action provided in the SKSU Student's Handbook

Use of Technology: Cell phones should be turned off while the session is in progress. Using laptops, notebook PCs, smart phones, and tablets shall be allowed only when needed. A scientific calculator (e.g. Casio fx-991ES) shall be utilized in solving if applicable.

9 GRADING SYSTEM AND RUBRICS FOR GRADING

GRADING SYSTEM

Midterm Grade

Midterm Examination	45%
Attendance/ Class Participation	10%
Quizzes	10%
Project	20%
Report	15%
TOTAL	100%

Final Term Grade

Final Term Examination	45%
Attendance/Class Participation	10%
Quizzes	10%
Project	20%
Report	15%
TOTAL	100%

FINAL GRADE

Midterm Grade	50%
Final Term Grade	50%
TOTAL	**100%**

Materials used: Laptop, Powerpoint presentations and video clips
Books, Magazines, Online slides, Teacher-made slides

References:

- ***Industrial Motor Control***. *Stephen L. Herman (2013)*
- ***Electric Motor Control***. *Stephen F. McBride (2016)*
- ***Electric Motors and Drives: Fundamentals, Types and Applications***. *Austin Hughes and Bill Drury (2013)*
- ***Fundamentals of Electric Drives***. *Gopal K. Dubey (2014)*
- ***Motor Control: A Comprehensive Guide***. *David W. Hurst (2015)*
- ***Control of Electric Machine Drive Systems***. *Seung-Ki Sul (2011)*
- ***Electrical Motor Controls for Integrated Systems***. *Gary J. Kissel (2017)*
- ***Programmable Logic Controllers: Principles and Applications***. *John W. Webb and Ronald A. Reis (2016)*
- ***Electric Machinery Fundamentals***. *Stephen J. Chapman (2011)*
- ***Introduction to Electric Circuits***. *Author: Richard H. Dorf and James A. Svoboda (2015)*

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