



AT 312– Hybrid and Electric Vehicle

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 BlndTech 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;	✓	✓		✓		✓	

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 clientele 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 AT 312

2 COURSE TITLE Hybrid and Electric Vehicle

3 PREREQUISITE AT 221

4 CREDITS 3 units

5 COURSE DESCRIPTION

This course provides a broad technical knowledge and practical expertise of hybrid and electric vehicle (HEV) technologies, analysis, design, component selection, and sizing at both the system and vehicle levels.

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. Understand SKSU-VGMO, Classroom Policies, Course Overview, Course Requirements and Grading System;	✓	✓	✓	✓	✓	✓	✓
b. Understand Electrical Principles: Explain the fundamental concepts of current, voltage, and resistance, and apply Ohm's Law to various circuit scenarios.	✓	✓	✓	✓	✓	✓	✓
c. Identify Materials: Distinguish between conductors and insulators, and evaluate their applications in automotive electronics.	✓	✓	✓	✓	✓	✓	✓
d. Analyze Circuit Components: Calculate total resistance and analyze the behavior of resistors, capacitors, and inductors in both series and parallel circuits.	✓	✓	✓	✓	✓	✓	✓
e. Utilize Measurement Tools: Perform accurate measurements of electrical parameters using multi-meters and interpret the results for troubleshooting.	✓	✓	✓	✓	✓	✓	✓

Soldering Techniques: Demonstrate proper soldering techniques and evaluate the quality of solder joints in electronic components.	✓	✓	✓	✓	✓	✓	✓
g. Understand PCB Design: Explain the structure and function of printed circuit boards (PCBs) and design simple layouts for basic circuits.	✓	✓	✓	✓	✓	✓	✓
h. Electronic Systems Knowledge: Describe the principles and operation of automotive electronic components, including ignition systems and sensors.	✓	✓	✓	✓	✓	✓	✓

7 COURSE CONTENTS

WEEK	CONTENT	INTENDED LEARNING OUTCOMES (ILOs)	TEACHING AND LEARNING ACTIVITIES (TLA)	OUTCOMES-BASED ASSESSMENT (OBA)	COURSE LEARNING OUTCOME S (CLOs)
1	Course Orientation <i>SKSU VMGO, Classroom Policies, Course Overview, Course Requirements, Grading System</i>	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	a. Introduction to hybrid electric vehicle	At the end of the week, the student can: a. Explain the basic advantages of having electric drive vehicles available to the public. b. Describe the basic components of all-electric drive vehicles. c. Describe what a battery electric vehicle is. d. Describe what a hybrid electric vehicle is. e. Describe what a fuel cell electric vehicle is. f. Discuss the evolution of electric drive vehicles.	a. Video/power point presentation b. Individual participation in discussions	a. Quiz b. participation	abcdefg
3	b. Hybrid safety and service procedures	At the end of the week, the student can: a. Safely de-power a hybrid electric vehicle. b. Safely perform high-voltage	a. Video/power point presentation b. Individual participation in discussions.	a. Quiz b. participation	abcdefg

		<p>disconnects. •</p> <p>c. Understand the unique service issues related to HEV high-voltage systems.</p> <p>d. Correctly use appropriate personal protective equipment (PPE).</p> <p>e. Perform routine vehicle service procedure on a hybrid electric vehicle.</p> <p>f. Explain hazards while driving, moving, and hoisting a hybrid electric vehicle.</p>			
4	Plug-in hybrid Electric vehicles	<p>At the end of the week, the student can:</p> <ul style="list-style-type: none"> a) Explain how inductors store energy in magnetic fields. b) Analyze the role of inductors in filtering and tuning circuits. c) Conduct experiments to demonstrate inductance effects. d) Describe the operation of transformers in voltage conversion. e) Calculate primary and secondary voltages. f) Analyze transformer efficiency and losses. 	<p>a. Video/power point presentation</p> <p>b. Individual participation in discussions</p>	<p>a. Quiz</p> <p>b. participation</p>	abcdefg
5	MIDTERM EXAM				
6	Batteries, ultracapacitors, fuel	<p>At the end of the week, the student can:</p> <ul style="list-style-type: none"> a. Explain the purpose of a battery. b. Describe how a battery works. c. Describe the basic construction of an electrochemical cell. 	<p>a. Video/power point presentation</p> <p>b. Individual participation in discussions</p>	<p>a. Quiz</p> <p>b. participation</p>	abcdefg

		<p>d. Explain how electrochemical cells can be connected to increase voltage and current.</p> <p>e. List and describe the various types of batteries, according to their chemistries, that may be used in automobiles.</p> <p>f. Describe the construction and operation of a lead-acid battery.</p> <p>g. Explain how a capacitor stores electrical energy.</p> <p>h. Describe the construction and operation of an ultra-capacitor</p> <p>i. Complete a soldering project to assemble electronic components.</p>			
7	Electric Machines and Drives in HEV's	<p>At the end of the week, the student can:</p> <p>a. Describe the basic operation of all electric motors.</p> <p>b. Understand the importance of magnetic principles in the operation of a motor and generator.</p> <p>c. Summarize the principles of magnetism described by Faraday's and Lenz's laws.</p> <p>d. Identify the major parts of a DC motor.</p> <p>e. Compare the operation of a brushless DC motor to a brushed DC motor.</p> <p>f. Understand the characteristics of three-phase AC voltage and describe the operation of a three-phase AC motor.</p> <p>g. Explain the differences between a motor and a generator (AC and DC).</p> <p>h. Explain the purposes of a controller in a motor/generator circuit</p>	<p>a. Video/power point presentation</p> <p>b. Individual participation in discussions</p>	<p>a. Quiz</p> <p>b. participation</p>	abcdefg

	Fuel Cell and advance Technologies	At the end of the week, the student can: a. Explain how a fuel cell generates electricity. b. Describe the advantages and disadvantages of electric vehicles. c. Discuss the advantages and disadvantages of fuel cells. d. Discuss alternative energy sources.	a. Video/power point presentation b. Individual participation in discussions	a. Quiz b. participation	
9			FINAL EXAMINATION		

Total No. of Hours : 54

8 COURSE REQUIREMENTS AND COURSE POLICIES

Each student is required to:

COURSE REQUIREMENTS	1. submit accomplished assignments, and activities;
	2. participate actively in all discussion;
	3. submit all the projects and activities; and
	4. 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.
	Attire, and Haircut: Students are required to follow the agreement discuss during class orientation.

9 GRADING SYSTEM AND RUBRICS FOR GRADING

GRADING SYSTEM	Midterm Grade			Final Term Grade			FINAL
	Midterm Examination	Attendance/ Class Participation	Quizzes	GRADE	Final Term Examination	Attendance/Class Participation	
	50%	10%	10%		45%	10%	Midterm Grade 50% Final Term Grade 50%

Project	20%	Quizzes	10%	TOTAL	100%
Report	10%	Project	20%		
TOTAL	100%	Report	15%		

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

References:

Repair of Vehicle Bodies, Fifth edition 2005, © A. Robinson 1973, 1989, 1993, © A. Robinson and W. A. Livesey 2000,
Butterworth-Heinemann An imprint of Elsevier Linacre House, Jordan Hill, Oxford OX2 8DP, UK 84 Theobald's Road, London WC1X 8RR, UK

Modern Diesel Technology: Light Duty Diesels Sean Bennett
2012 Delmar, Cengage Learning Delmar,
5 Maxwell Drive Clifton Park, NY 12065-2919 USA

Fundamentals of Mobile Heavy Equipment Owen C. Duffy, Scott A. Heard, Gus Wright
Copyright © 2019 by Jones & Bartlett Learning, LLC, an Ascend Learning Company Jones & Bartlett Learning 5 Wall Street Burlington, MA 01803 978-443-5.

Fundamentals of Motor Vehicle Technology Sixth Edition, Nelson Thornes, Delta Place 27 Bath Road CHELTENHAM GL53 7TH United Kingdom

Automotive Electrical and Electronic Systems Classroom Manual, Fifth Edition John F. Kershaw, Ed.D.
Revision Author James D. Halderman Series Advisor
Copyright © 2007 by Pearson Education, Inc., Upper Saddle River, New Jersey 07458.

AUTOMOTIVE TECHNOLOGY A SYSTEMS APPROACH, 5th Edition, Jack Erjavec
© 2010 Delmar, Cengage Learning 5 Maxwell Drive Clifton Park, NY 12065-2919 USA

AUTOMOTIVE FUEL AND EMISSIONS CONTROL SYSTEMS, THIRD EDITION, James D. Halderman, Jim Linder
Copyright © 2012, 2009, 2006 Pearson Education, Inc., publishing as Pearson Education, 1 Lake Street, Upper Saddle River, New Jersey 07458.

Technician™: Automotive Electricity and Electronics, 5th Edition Barry Hollembeak, © 2011 Delmar, Cengage Learning, Maxwell Drive Clifton Park, NY 12065-2919 USA

AUTOMOTIVE FUEL AND EMISSIONS CONTROL SYSTEMS, THIRD EDITION James D. Halderman Jim Linder, Copyright © 2012, 2009, 2006 Pearson Education, Inc., publishing as Pearson Education, 1 Lake Street, Upper Saddle River, New Jersey 07458.

Hybrid, Electric & Fuel-Cell Vehicles, Second Edition Jack Erjavec, c 2013, 2007, Delmar, Cengage Learning, Maxwell Drive Clifton Park, NY 12065-2919 USA

AUTOMOTIVE TECHNOLOGY Principles, Diagnosis, and Service FOURTH EDITION James D. Halderman, Copyright © 2012, 2009, 2003, 1999 Pearson Education, Inc., publishing as Pearson Education, 1 Lake Street, Upper Saddle River, New Jersey 07458 .

Ohm's Law. (n.d.). In Electronics Tutorials. Retrieved from <https://www.electronicstutorials.com>

Conductors and insulators. (n.d.). In Electrical4U. Retrieved from <https://www.electrical4u.com>

Resistors. (n.d.). In Electronics Hub. Retrieved from <https://www.electronicshub.org>

Capacitors. (n.d.). In Electronics Tutorials. Retrieved from <https://www.electronicstutorials.com>

Inductors. (n.d.). In Electronics Hub. Retrieved from <https://www.electronicshub.org>

Transformers. (n.d.). In Electronics Tutorials. Retrieved from <https://www.electronicstutorials.com>

Digital multimeters. (n.d.). In Fluke. Retrieved from <https://www.fluke.com>

Prepared:

RANDY T. BERINA
SHELMER D. CARIGABA
KRISTIAN JAY O. CABANAL
Faculty

Reviewed:

GLENN S. TALUA, MERE IRENE BINAG, MAT
Program Chairman, BSIT/BTVTE

2025 -08- 11

Noted:

CHARLIE J. MAGHANOY, Ed.D.
Dean, College of Industrial Technology