

COURSE PLAN

FIRST: AUTOMOTIVE ENGINEERING

College

College : Faculty of Engineering Technology

Department : Mechanical Engineering Department

Course

Course Title : Electric and Hybrid Vehicles Technology

Course Code : 020201235

Credit Hours : 3 (3 Theoretical, 0 Practical)

Prerequisite : 020201261

Instructor

Name : Dr. Suleiman Qasim Abu-Ein

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Office Hours :

Class Times

Building	Day	Start Time	End Time	Room No.
00	00	00	00	00

Text Book

Title : • Electric and Hybrid Vehicles, 2nd Edition, Tom Denton
 • Electric and Hybrid Vehicles, Power Sources, Models, Sustainability, Infrastructure and the Market, Editor: Gianfranco Pistoia

References

1. Electric and Hybrid Vehicles: Technologies, Modeling and Control

SECOND: PROFESSIONAL INFORMATION

COURSE DESCRIPTION

This course specifies a knowledge of hybrid and electric vehicles principles of operation. It includes major components such as a transaxle (MGs, Planetary Gear Unit), hybrid control modes, high voltage batteries, electronic power steering, cooling system, safety procedures, inverter assembly and brake system etc.

COURSE OBJECTIVES

The objective of this course is to enable the student to do the following:

- Explain the principles of high voltage safety and precautions.
- Explain the principles of Hybrid and Electric Vehicles Special Tools.
- Explain the principles of Hybrid and Electric Vehicles.
- Explain the basic knowledge of major components of HV and EV, control systems, high voltage batteries, Traction Motors and Inverter Assembly
- Explain the principles Diagnostics of HV and EV.

COURSE LEARNING OUTCOMES

By the end of the course, the students will be able to:

- CLO1. Explain the basics of **electric** and **hybrid vehicles** systems
- CLO2. Explain the basics of **safe working, tools and hazard** management
- CLO3. Explain **hybrid vehicles' power sources**
- CLO4. Explain the Power Split Device-PSD
- CLO5. Explain the **high voltage battery**
- CLO6. Explain the **inverter assembly**
- CLO7. Explain the **steering and cooling systems**
- CLO8. Explain the **braking system**
- CLO9. Explain the **electric vehicles systems**
- CLO10. Explain the **traction motors and inverter assembly**
- CLO11. Explain the EV **high voltage batteries**
- CLO12. Explain the **transmission system**
- CLO13. Explain the basics of Vehicle Control Module (VCM)
- CLO14. Explain the basics of Power Delivery Module (PDM)

COURSE SYLLABUS

Week	Topic	Topic Details	Reference (Chapter)	Proposed Assignments
1	Introduction	<ul style="list-style-type: none"> • History of Hybrid Vehicles (HV). • History of Electric Vehicles (EV). • Why Electric Drive? • Hybrid Vehicles Categories. • Hybrid Vehicles Systems and Components. 	CLO1	
2	Safe working, Tools and Hazard Management	<ul style="list-style-type: none"> • Introduction. • Safety. • General Safety Guidance: <ol style="list-style-type: none"> a) Before Maintenance. b) After Maintenance. c) High-Voltage safety precautions. d) Low and High Voltage. e) Personal protective equipment. f) High-energy Cables and components. 	CLO2	
3	Hybrid Vehicles' Power Coerces	<ul style="list-style-type: none"> • Internal Combustion Engine – ICE. • Electrical Motor/Generators. • Electrical Motor/Generators sensors. 	CLO3	
4	Power Split Device-PSD	<ul style="list-style-type: none"> • Introduction. • Powertrain. • Transmission of movement between power sources and the wheels. • Hybrid Vehicles driving modes. 	CLO4	
5	High Voltage Battery	<ul style="list-style-type: none"> • High voltage Battery specifications. • Types of High Voltage Batteries. • High Voltage Battery modules. • High Voltage Battery Cooling System. • High Voltage Battery ECU. • System Main Relays. 	CLO5	

Week	Topic	Topic Details	Reference (Chapter)	Proposed Assignments
6	Inverter Assembly	<ul style="list-style-type: none"> • Inverter operation. • Inverter functions. • DC/DC Converter. • Boost Converter. • Inverter's Sensors. 	CLO6	
7	Steering and Cooling Systems	<ul style="list-style-type: none"> • Hydraulic steering system. • Power Assist Steering System (Electric Motor): <ol style="list-style-type: none"> a) Torque sensor. b) DC Motor. c) Electronic Control Unit – ECU. • Internal Combustion Engine Cooling System. • Inverter assembly cooling system. 	CLO7	
8	Mid Exam			
9	Braking System	<ul style="list-style-type: none"> • Introduction. • Hybrid Vehicles Brake System. • Regenerative Braking. • Electronic Brake Force Distribution - EBD. • Brake Assist System. • Traction Control System. • Anti-Lock Brake System-ABS. 	CLO8	
10	Electric Vehicles	<ul style="list-style-type: none"> • Introduction to EVs. • EV components and Block Diagram. • Power Transmission Mechanism. • Different between Hybrid and Electric Vehicles. 	CLO9	
11	Traction Motors and Inverter Assembly	<ul style="list-style-type: none"> • Traction Motors Types. • Principles of Operation. • Inverter assembly. • DC/DC converter. 	CLO10	
12	High Voltage Battery	<ul style="list-style-type: none"> • HV Battery components. • HV Battery Performance. • Lithium-Ion Battery Controller (LBC). • Factors of Capacity Reduction. • Charging and Regeneration System. 	CLO11	
13	Transmission System	<ul style="list-style-type: none"> • Electronic Control Unit Management System. • Electric Vehicles Driving Modes. • Power Transmission. 	CLO12	
14	Vehicle Control Module (VCM)	<ul style="list-style-type: none"> • VCM Functions - system power control. • VCM Functions - System Main Relay Control. • VCM Functions- EV system output control. • VCM Functions – Cooperative Control with electronically-controlled brake 	CLO13	

Week	Topic	Topic Details	Reference (Chapter)	Proposed Assignments
		system (e-ATC). • VCM Functions- HV Battery charge control. • VCM Functions- DC/DC converter control. • VCM Functions- Cooling system control. • VCM Functions- Fail-Safe.		
15	Power Delivery Module (PDM)	• DC/DC converter. • On board charger. • Junction. • Electric Control Brake system	CLO14	
16	Final Exam			

COURSE LEARNING RESOURCES

The effectiveness of teaching in this course depends on making students familiar with the basic of Electric and Hybrid Vehicles systems such as: principles of operation, major components such as: transaxle (MGs, Planetary Gear Unit), Control System, Hybrid Control Modes, High Voltage (HV) Batteries, Electronic Power Steering, Cooling System, Safety Procedures, Inverter assembly, brake system, IC Engine, System Sensors.

E.V. Propulsion System (DC motors, Induction Motors, and others), Architecture of Hybrid Electric Train, Energy Storage, Batteries. Check and diagnosis of Electric and Hybrid Vehicles.

Teaching methods:

- Lectures and HomeWorks: using PowerPoint for, example, by the teacher to provide the students with the all information that they need, and to give them a home work as a research method or/and report.
- Online research skills, watching related videos such as you tube, on topics related to course objectives and recent developments in the field of specific work.

Learning skills and adaptability: Developed by transferring students and reconfiguring work teams to enable them to adapt to other individuals from time to time.

ONLINE RESOURCES

www.autoshop101.com

ASSESSMANT TOOLS

(Write assessment tools that will be used to test students ability to understand the course material and gain the skills and competencies stated in learning outcomes)

ASSESSMENT TOOLS	%
Quizzes	10
Researches and Reports	
Participation	10
Oral Exams	
Activities/attendance	
Presentation	
Mid Exam	30
Final Exam	50
TOTAL MARKS	100

THIRD: COURSE RULES

ATTENDANCE RULES

Attendance and participation are extremely important, and the usual University rules will apply. Attendance will be recorded for each class. Absence of 10% will result in a first written warning. Absence of 15% of the course will result in a second warning. Absence of 20% or more will result in forfeiting the course and the student will not be permitted to attend the final examination. Should a student encounter any special circumstances (i.e. medical or personal), he/she is encouraged to discuss this with the instructor and written proof will be required to delete any absences from his/her attendance records.

GRADING SYSTEM

Example:

0 – 49 Fail
50 – 100 Pass

REMARKS

- Some selective topics related to modern hydride and EV vehicles will be discussed and presented during the course
- Share practical experiences that could be faced in the future work environment

COURSE COORDINATOR

Course Coordinator: Dr. Suleiman Qasim Abu-Ein

Signature:

Date:

Department Head:

Signature:

Date: