

## COURSE PLAN

### FIRST: AUTOMOTIVE ENGINEERING

#### College

College : Faculty of Engineering Technology

Department : Mechanical Engineering Department

#### Course

Course Title : Hybrid Vehicles Technology Workshops

Course Code : 020201264

Credit Hours : 2 (0 Theoretical, 2 Practical)

Prerequisite : 020201235

#### Instructor

Name : Dr. Suleiman Qasim Abu-Ein

Office No. :

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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. Workshop Manuals.
2. Electric and Hybrid Vehicles: Technologies, Modeling and Control

### SECOND: PROFESSIONAL INFORMATION

#### COURSE DESCRIPTION

This course specifies a basic principles of workshop safety and instructions in inspection, diagnosis, disassembly and assembly of hybrid vehicles components such as, power sources, powertrain, high voltage batteries, electric power steering, engine cooling system, inverter system and brake system etc.

#### COURSE OBJECTIVES

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

- Explain and follow the high voltage safety and precautions.
- Develop working competence of Hybrid Vehicles Special Tools.
- Explain the major components of Hybrid Vehicles: control system, High Voltage Batteries, Motor Generators and Inverter Assembly.
- Develop working competence of Diagnostics of Hybrid Vehicles.

#### COURSE LEARNING OUTCOMES

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

- CLO1. Apply the basics of safe working and hazard management and use the right tools  
 CLO2. Diagnose and check hybrid vehicles' power sources  
 CLO3. Diagnose and check Power Split Device-PSD  
 CLO4. Diagnose and check high voltage battery  
 CLO5. Diagnose and check inverter assembly  
 CLO6. Diagnose and check steering systems  
 CLO7. Diagnose and check cooling system  
 CLO8 Diagnose and check braking system

**COURSE SYLLABUS**

Week	Unit	Content	Related LO and Reference (Chapter)	Proposed assignments
1	Safe working, Tools and Hazard Management	<ul style="list-style-type: none"> <li>• Personal safety.</li> <li>• Safety Isolated Tools.</li> <li>• High-Voltage safety precautions.</li> <li>• Low and High Voltage safety.</li> <li>• Personal protective equipment.</li> <li>• High-energy Cables and components.</li> </ul>	CLO1	
2	Diagnose and Check Hybrid Vehicles' Power Sources -1	<ul style="list-style-type: none"> <li>• Internal Combustion Engine:                             <ol style="list-style-type: none"> <li>a) Piston.</li> <li>b) Cylinders.</li> <li>c) Connecting Rod.</li> <li>d) Crankshaft.</li> <li>e) Oil Pump.</li> </ol> </li> <li>• Cylinder Head.</li> <li>• Variable Valve Timing.</li> </ul>	CLO2	
3	Diagnose and Check Hybrid Vehicles' Power Sources -1	<ul style="list-style-type: none"> <li>• Motor Generators (MG):                             <ol style="list-style-type: none"> <li>a) MG Sensors.</li> <li>b) Position Sensor (Resolver).</li> <li>c) MG cooling system.</li> </ol> </li> <li>• MG Coils resistance.</li> </ul>	CLO2	Practice report
4	Diagnose and Check Power Split Device-PSD -1	<ul style="list-style-type: none"> <li>• Shift Control System.                             <ol style="list-style-type: none"> <li>a) Shift Position Sensor.</li> <li>b) Shift Position Lock system.</li> </ol> </li> <li>• Transaxle Oil Level Check.</li> <li>• Powertrain Check.</li> </ul>	CLO3	
5	Diagnose and Check Power Split Device-PSD -2	<ul style="list-style-type: none"> <li>• Transmission Control Module:                             <ol style="list-style-type: none"> <li>a) Transmission Temperature Sensors.</li> </ol> </li> <li>• Electronic Transmission system Faults:                             <ol style="list-style-type: none"> <li>a) Failure in required time shifting.</li> <li>b) Parking Lock Control Relay.</li> <li>c) Parking Lock Mechanism.</li> <li>d) Parking Lock Warning Lamp.</li> <li>e) Shift Lever Sensors.</li> </ol> </li> </ul>	CLO3	Practice report
6	Diagnose and Check High Voltage Battery -1	<ul style="list-style-type: none"> <li>• Safety Precautions and personal safety protection devices.</li> <li>• Capacity test using Scan Tool.</li> <li>• Acceleration Mode test.</li> </ul>	CLO4	

Week	Unit	Content	Related LO and Reference (Chapter)	Proposed assignments
		<ul style="list-style-type: none"> <li>Fuel Economy Mode test.</li> <li>Battery Control Unit Check Points.</li> <li>System Voltage diagnosis.</li> </ul>		
7	Diagnose and Check High Voltage Battery -2	<ul style="list-style-type: none"> <li>Check and replace Battery Packs.</li> <li>Battery Pack Cooling Fane.</li> <li>Battery Pack Cooling Fane circuit.</li> <li>Hugh Voltage Fuse.</li> <li>High Voltage Battery Temperature sensor.</li> <li>Battery Pack Air Temperature Sensor.</li> <li>Auxiliary Battery Temperature Sensor.</li> </ul>	CLO4	
8	<b>Mid Exam</b>			
9	Diagnose and Check High Voltage Battery -3	<ul style="list-style-type: none"> <li>Check for Short.</li> <li>Battery Pack Current Sensor.</li> <li>Low Voltage System in High Voltage Battery:               <ol style="list-style-type: none"> <li>Code P0A1F.</li> <li>Reading Battery Pack Voltage.</li> </ol> </li> <li>Battery Pack Voltage Drop.</li> <li>Battery Block Voltage Check.</li> <li>Check Communication Loss between control modules.</li> <li>System Main Relay Fault check.</li> </ul>	CLO4	Practice report
10	Diagnose and Check Inverter Assembly - 1	<ul style="list-style-type: none"> <li>Inverter Common Faults.</li> <li>Boost Converter Temperature Sensing Circuit.</li> <li>Boost Converter Voltage Signal.</li> <li>Bost Converter Fail (FCV) signal circuit.</li> <li>Converter Gate Shutdown Signal (CSDN).</li> <li>Boost Converter Monitoring signal.</li> </ul>	CLO5	
11	Diagnose and Check Inverter Assembly - 2	<ul style="list-style-type: none"> <li>Inverter Sensors:               <ol style="list-style-type: none"> <li>Inverter Temperature Sensor for MG.</li> <li>Current Sensor for MG.</li> <li>Inverter Voltage Sensor.</li> </ol> </li> <li>Inverter Signals:               <ol style="list-style-type: none"> <li>Motor Gate Shutdown Signal (MSDN).</li> <li>Pulse Width Modulation Signal.</li> <li>Inverter Fail Signal for Generator.</li> </ol> </li> <li>Generator Gate Shutdown Signal (GSDN).</li> </ul>	CLO5	Practice report

Week	Unit	Content	Related LO and Reference (Chapter)	Proposed assignments
12	Diagnose and Check Steering System	<ul style="list-style-type: none"> <li>• System Test.</li> <li>• Rack and Pinion.</li> <li>• Torque Sensor.</li> <li>• DC Motor.</li> <li>• Wheel Alignment:               <ol style="list-style-type: none"> <li>a) Camber.</li> <li>b) Castor.</li> <li>c) Toe in</li> <li>d) Toe out</li> <li>e) King Pin Angle.</li> </ol> </li> <li>• Steering Angle Sensor.</li> <li>• Steering System Faults and Causes.</li> <li>• Tire Pressure Warning System.</li> </ul>	CLO6	Practice report
13	Diagnose and Check Cooling System	<ul style="list-style-type: none"> <li>• Systematic Test.</li> <li>• Engine Coolant.</li> <li>• Antifreeze.</li> <li>• Engine Coolant Temperature Sensor.</li> <li>• Coolant Storage Tank.</li> <li>• Engine Coolant Pump:               <ol style="list-style-type: none"> <li>a) Connectors.</li> <li>b) Power Source.</li> <li>c) Voltage.</li> <li>d) Relay.</li> </ol> </li> <li>• Inverter Cooling System.               <ol style="list-style-type: none"> <li>a) Coolant.</li> <li>b) Hoses.</li> <li>c) Pump.</li> <li>d) Connectors.</li> </ol> </li> </ul>	CLO7	Practice report
14	Diagnose and Check Braking System -1	<ul style="list-style-type: none"> <li>• Safety Precautions.</li> <li>• Systematic Visual Inspection.</li> <li>• Brake Fluid.</li> <li>• Brake Fluid Level Switch.</li> <li>• High Pressure Switch.</li> <li>• Low Pressure Switch.</li> <li>• Brake Relay.</li> </ul>	CLO8	
15	Diagnose and Check Braking System -2	<ul style="list-style-type: none"> <li>• Safety Precautions.</li> <li>• Air Bleeding.</li> <li>• Cruise Control.</li> <li>• Wheel Speed Sensors.</li> <li>• Electrical Connections.</li> <li>• Bleeding ABS.</li> <li>• ABS Warning Lamps.</li> <li>• ABS Scan Tool Test.</li> </ul>	CLO8	Practice report
16	<b>Final Exam</b>			

## COURSE LEARNING RESOURCES

The effectiveness of teaching in this course depends on making students familiar with the basic manual skills, such as: inspection, diagnosis, disassembly and assembly of Hybrid Vehicles components (Power Sources, powertrain (Motor Generators, Planetary Gear unit), High Voltage Batteries, Electric Power Steering, engine cooling system, inverter assembly, brake system, ICE), and using the Scan Tools.

### Teaching methods:

- Exercising and practicing: by training students to follow the basics of safe working and hazard management, and use the right tools do all the practical works and to identify the type of exercise.
- 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.youtube.com](http://www.youtube.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	
Researches and Reports	20
Participation	
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**

{ The instructor can add any comments and directives such as the attendance policy and topics related to ethics }

**COURSE COORDINATOR**

**Course Coordinator:** Eng. Mohammad Noor Ibrahim Al Shraifeen **Department Head:**  
**Signature:** **Signature:**  
**Date:** **Date:**