



67. Elective 2

Course Specification of Modern Automotive Technology

I. Course Identification and General Information:						
1.	Course Title:	Modern Automotive technology (Elective).				
2.	Course Code & Number:	ME329.				
3.	Credit Hours:	C.H				TOTAL CR. HRS
		Th.	Seminar/Tu	Pr	Tr.	
		2	-	-	-	
4.	Study level/ semester at which this course is offered:	Fourth Year - Second Semester (Elective).				
5.	Pre –requisite (if any):	Internal Combustion Engines (ME355) and Automotive Engineering, (ME326).				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered:	Mechanical Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	Location of teaching the course:	Mechanical Engineering Department.				
10.	Prepared By:	Asst. Prof. Dr. Abdullah Dhaiban.				
11.	Date of Approval:					

II. Course Description:
This course aims to prepare the students to critically evaluate the challenges and identify the role of electronics and software systems in modern automobiles. Students are taught the limitation of conventional systems, the needs for electronic controls to improve the performance, safety and meet regulatory requirements. In addition, they are motivated to explore potential new functions and applications in automotive.

III. Alignments of the Course Intended learning outcomes (CILOs)	Referenced PILOs	
a1	Describe construction, functions and applications of various sensors and actuators used in modern vehicle.	A2

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a2	Explain the features and functions of electronic systems in modern automobile.	A1
b1	Explore addition of new features in the existing electronic automotive subsystems for enhanced functionality.	B2
c1	Interpret the development trends of automotive technology.	C1
d1	Engage in independent lifelong learning.	D3

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1- Describe construction, functions and applications of various sensors and actuators used in modern vehicle.	Active Lectures, Seminars, Projects	Written Exam, Homework Presentations.
a2- Explain the features and functions of electronic systems in modern automobile.	Active Lectures, Seminars, Projects	Written Exam, Homework Presentations.

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Explore addition of new features in the existing electronic automotive subsystems for enhanced functionality.	Active Lectures, Seminars, Projects	Written Exam, Homework Presentations

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1- Interpret the development trends of automotive technology.	Active Lectures, Seminars, Projects	Written Exam, Homework Presentations

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(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1- Engage in independent lifelong learning.	Seminars, Projects	Presentations, Reports

IV. Course Content:					
A – Theoretical Aspect:					
Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1.	Automotive Sensors & Actuators	a1, a2, b1	Inductive, Hall Effect, Thermistor, Piezo Electric, Piezo Resistive, Based Sensors. Throttle Position, Mass Air Flow, Crank Shaft Position, Cam Position, Engine Speed Sensor, Exhaust Oxygen Level (Two Step, Linear Lambda and Wideband), Knock, Manifold Temperature and Pressure Sensors. Solenoid, Relay (Four And Five Pin), Stepper Motor.	4	8
2.	Spark Ignition Engine Management	a1, a2, b1, c1, d1	Layout and Working of SI Engine Management Systems. Group And Sequential Injection Techniques. Advantages of Electronic Ignition Systems. Types of Solid State Ignition Systems And Their Principle of Operation, Contactless (Breakerless) Electronic Ignition System, Electronic Spark Timing Control.	2	4
3.	Compression Ignition	a1, a2, b1, c1, d1	Fuel Injection System Parameters Affecting Combustion, Noise and Emissions in CI Engines.	1	2

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	Engine Management		Electronically Controlled Unit Injection System. Common Rail Fuel Injection System. Working of Components Like Fuel Injector, Fuel Pump, Rail Pressure Limiter, Flow Limiter, EGR Valve		
4.	Mid-Term Exam	a1, a2, b1, c1, d1	The First Three Chapters	1	2
5.	Compression Ignition Engine Management	a1, a2, b1, c1, d1	Fuel Injection System Parameters Affecting Combustion, Noise and Emissions in CI Engines. Electronically Controlled Unit Injection System. Common Rail Fuel Injection System. Working of Components Like Fuel Injector, Fuel Pump, Rail Pressure Limiter, Flow Limiter, EGR Valve	1	2
6.	Advanced Automotive Lighting	a1, a2, b1, c1, d1	Computer Controlled Headlight Systems, Automatic on/off with Time Delay, Automatic Headlight Dimming, Headlight Leveling, Adaptive Headlights, Daytime Running Lamps, Adaptive Brake Lights, Instrument Panel Dimming, Fiber Optics, Lamp Outage Indicators, High Intensity Discharge Headlamps, Projector Headlamps, LED Lamps, Cornering Lights.	1	2
7.	Driver Assistance System	a1, a2, b1, c1, d1	Digital Instrument Cluster, Travel Information System, Head up Display, Night Vision System, Global Positioning Navigation System, Lane Change Warning	1	2

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			System, Warning Programs, Traffic Management System, Hand's Free Communication and Operation		
8.	Automatic Transmission and Driveline:	a1, a2, b1, c1, d1	Drive by Wire System, Electronic Shift Transmission, Direct Shift Gearbox, S-Tronic Gearbox, Paddle Shift Control, Constantly Variable Transmission, Cruise Control, Limited Slip Differential, Differential Lock, Hill Ascent Function.	1	2
9.	Modern Suspension and Steering	a1, a2, b1, c1, d1	Active Suspension System, Magnetic Fluid Suspension, Height Adjustable Suspension System, Load Sensing Suspension, Hydrogen Suspension, Variable Gear Ratio Steering, Speed Sensitive Steering, Collapsible Steering Column.	1	2
10.	Vehicles with Alternative Power Sources	a1, a2, b1, c1, d1	Introduction, Electric Vehicles, Hybrid Vehicles, 42-Volt Systems, Fuel Cells.	1	2
11.	Advance Safety and Passive Restraint System	a1, a2, b1, c1, d1	Introduction, Primary Restraint System, Secondary Restraint System, Passive Seat Belt Systems, Air Bag Systems, Air Bag Deployment, Passenger-Side Air Bags, Hybrid Air Bag, Multistage Air Bag Deployment, Side Impact Air Bags, Seat Belt Pre-Tensioners, Inflatable Knee Blockers, Occupant Classification Systems, Anti-Whiplash Headrest Restraint System, NCAP Crash Test Ratings.	1	2
12.	Final Exam	a1, a2, b1, c1, d1	All the Chapters	1	2

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Number of Weeks /and Units Per Semester	16	32
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V. Teaching strategies of the course:
<ul style="list-style-type: none"> • Active lectures • Audiovisuals • Independent Learning and Work • Computer and Web-Based Learning • Seminars

VI. Assignments:				
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Assignment 1	a1, a2, b1, c1, d1	1 st	1
2.	Assignment 2	a1, a2, b1, c1, d1	2 nd	1
3.	Assignment 3	a1, a2, b1, c1, d1	3 rd	1
4.	Assignment 4	a1, a2, b1, c1, d1	4 th	1
5.	Assignment 5	a1, a2, b1, c1, d1	5 th	1
6.	Assignment 6	a1, a2, b1, c1, d1	6 th	1
7.	Assignment 7	a1, a2, b1, c1, d1	7 th	1
8.	Assignment 8	a1, a2, b1, c1, d1	8 th	1
9.	Assignment 9	a1, a2, b1, c1, d1	9 th	1
10.	Assignment 10	a1, a2, b1, c1, d1	10 th	1
Total				10

VII. Schedule of Assessment Tasks for Students During the Semester:					
No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Assignment	1-14	10	10%	a1, a2, b1, c1, d1
2	Project Presentation.	14	10	10%	b1, c1, d1
3	Attendance and Participations.	Weekly	5	5%	a1, a2, b1, c1, d1

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4	Mid-Term Exam.	8	15	15%	a1, a2, b1, c1
5	Final Exam.	16	60	60%	a1, a2, b1, c1
Total		100	100		

VIII. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. James E. Duffy, 2017 Modern Automotive technology, 9th edition, GoodHeart-Willcox.
2. William B Ribbens, 2017, Understanding Automotive Electronics, 6th edition.

2- Essential References.

- 1- Robert Bosch, 2004. Diesel Engine Management, 3rd Edition, SAE Publications,
- 2- Robert Bosch, 2004, Gasoline Engine Management, 2nd Edition SAE Publications.

3- Electronic Materials and Web Sites etc.

1. https://tr-cam.com/channels/UMi87x5R_zkN4u0To0jqHw.html
2. <https://www.autotraining.edu/blog/what-is-automotive-technology/>
3. <https://www.globenewswire.com/news-release/2020/02/22/1988892/0/en/Global-Automotive-Sensors-Industry.html>
4. https://www.reportlinker.com/p05721139/Global-Automotive-Sensors-Industry.html?utm_source=GNW
5. <https://www.electronicsspecifier.com/products/power/challenges-for-next-gen-automotive-power-systems>
6. <https://training.ti.com/designing-low-emi-dcdc-converters-automotive-systems-part-1>
7. <https://www.radiantvisionsystems.com/learn/webinars/improving-automotive-inspection-light-color-measurement-systems>

IX. Course Policies:

1	<p>Class Attendance:</p> <p>The students should have more than 75 % of attendance according to rules and regulations of the Faculty.</p>
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2	Tardy: The students should respect the timing of attending the lectures. They should attend within 10 minutes from starting of the lecture.
3	Exam Attendance/Punctuality: The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for mid-term exam and final exam.
4	Assignments & Projects: The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
5	Cheating: If any cheating occurred during the examination, the student is not allowed to continue and he has to face the examination committee for enquiries .
6	Plagiarism: The student will be terminated from the Faculty, if one student attend the exam on another behalf according to the policy, rules and regulations of the university.
7	Other policies: <ul style="list-style-type: none"> • All the teaching materials should be kept out the examination hall. • The mobile phone is not allowed. • There should be a respect between the student and his teacher.

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67.Template for Course Plan of Modern Automotive Technology

I. Information about Faculty Member Responsible for the Course:						
Name of Faculty Member	Asst. Prof. Dr. Abdullah Dhaiban	Office Hours				
Location & Telephone No.	Faculty of Engineering	SAT	SUN	MON	TUE	WED
E-mail	a.dhaiban@eng-su.edu.ye a_daiban@yahoo.com					

II. Course Identification and General Information:						
1.	Course Title:	Modern Automotive Technology.				
2.	Course Number & Code:	ME329.				
3.	Credit Hours:	C.H				TOTAL CR. HRS
		Th.	Seminar/Tu.	Pr.	Tr.	
		2	-	-	-	
4.	Study level/year at which this course is offered:	Fourth Year - Second Semester (Elective).				
5.	Pre –requisite (if any):	Internal Combustion Engines (ME355) and Automotive Engineering, (ME326).				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered	Mechanical Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	System of Study:	Semesters.				
10.	Mode of delivery:	Lectures and Projects.				
11.	Location of teaching the course:	Mechanical Engineering Department.				

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III. Course Description:
<p>This course aims to prepare the students to critically evaluate the challenges and identify the role of electronics and software systems in modern automobiles. Students are taught the limitation of conventional systems, the needs for electronic controls to improve the performance, safety and meet regulatory requirements. In addition, they are motivated to explore potential new functions and applications in automotive.</p>

IV. Intended learning outcomes (ILOs) of the course:
<ul style="list-style-type: none"> • Brief summary of the knowledge or skill the course is intended to develop: <ol style="list-style-type: none"> 1. Describe construction, functions and applications of various sensors and actuators used in modern vehicle. 2. Explain the features and functions of electronic systems in modern automobile. 3. Explore addition of new features in the existing electronic automotive subsystems for enhanced functionality. 4. Interpret the development trends of automotive technology. 5. Engage in independent lifelong learning.

V. Course Content:					
A – Theoretical Aspect:					
Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1.	Automotive Sensors & Actuators	a1, a2, b1	Inductive, Hall Effect, Thermistor, Piezo Electric, Piezo Resistive, Based Sensors. Throttle Position, Mass Air Flow, Crank Shaft Position, Cam Position, Engine Speed Sensor, Exhaust Oxygen Level (Two Step, Linear Lambda and Wideband), Knock, Manifold Temperature and Pressure Sensors. Solenoid, Relay	1 st , 2 nd , 3 rd , 4 th	8

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			(Four And Five Pin), Stepper Motor.		
2.	Spark Ignition Engine Management	a1, a2, b1, c1, d1	Layout and Working of SI Engine Management Systems. Group And Sequential Injection Techniques. Advantages of Electronic Ignition Systems. Types of Solid State Ignition Systems And Their Principle of Operation, Contactless (Breakerless) Electronic Ignition System, Electronic Spark Timing Control.	5 th , 6 th	4
3.	Compression Ignition Engine Management	a1, a2, b1, c1, d1	Fuel Injection System Parameters Affecting Combustion, Noise and Emissions in CI Engines. Electronically Controlled Unit Injection System. Common Rail Fuel Injection System. Working of Components Like Fuel Injector, Fuel Pump, Rail Pressure Limiter, Flow Limiter, EGR Valve	7 th	2
4.	Mid-Term Exam	a1, a2, b1, c1, d1	The First Three Chapters	8 th	2
5.	Compression Ignition Engine Management	a1, a2, b1, c1, d1	Fuel Injection System Parameters Affecting Combustion, Noise and Emissions in CI Engines. Electronically Controlled Unit Injection System. Common Rail Fuel Injection System. Working of Components Like Fuel Injector, Fuel Pump, Rail	9 th	2

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			Pressure Limiter, Flow Limiter, EGR Valve		
6.	Advanced Automotive Lighting	a1, a2, b1, c1, d1	Computer Controlled Headlight Systems, Automatic on/off with Time Delay, Automatic Headlight Dimming, Headlight Leveling, Adaptive Headlights, Daytime Running Lamps, Adaptive Brake Lights, Instrument Panel Dimming, Fiber Optics, Lamp Outage Indicators, High Intensity Discharge Headlamps, Projector Headlamps, LED Lamps, Cornering Lights.	10 th	2
7.	Driver Assistance System	a1, a2, b1, c1, d1	Digital Instrument Cluster, Travel Information System, Head up Display, Night Vision System, Global Positioning Navigation System, Lane Change Warning System, Warning Programs, Traffic Management System, Hand's Free Communication and Operation	11 th	2
8.	Automatic Transmission and Driveline:	a1, a2, b1, c1, d1	Drive by Wire System, Electronic Shift Transmission, Direct Shift Gearbox, S-Tronic Gearbox, Paddle Shift Control, Constantly Variable Transmission, Cruise Control, Limited Slip Differential, Differential Lock, Hill Ascent Function.	12 th	2
9.	Modern Suspension and Steering	a1, a2, b1, c1, d1	Active Suspension System, Magnetic Fluid Suspension, Height Adjustable Suspension System, Load Sensing Suspension, Hydrogen	13 th	2

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			Suspension, Variable Gear Ratio Steering, Speed Sensitive Steering, Collapsible Steering Column.		
10.	Vehicles with Alternative Power Sources	a1, a2, b1, c1, d1	Introduction, Electric Vehicles, Hybrid Vehicles, 42-Volt Systems, Fuel Cells.	14 th	2
11.	Advance Safety and Passive Restraint System	a1, a2, b1, c1, d1	Introduction, Primary Restraint System, Secondary Restraint System, Passive Seat Belt Systems, Air Bag Systems, Air Bag Deployment, Passenger-Side Air Bags, Hybrid Air Bag, Multistage Air Bag Deployment, Side Impact Air Bags, Seat Belt Pre-Tensioners, Inflatable Knee Blockers, Occupant Classification Systems, Anti-Whiplash Headrest Restraint System, NCAP Crash Test Ratings.	15 th	2
12.	Final Exam	a1, a2, b1, c1, d1	All the Chapters	16 th	2
Number of Weeks /and Units Per Semester				16	32

VI. Teaching strategies of the course:

- Active lectures
- Audiovisuals
- Independent Learning and Work
- Computer and Web-Based Learning
- Seminars

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VII. Assignments:				
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Homework 1	a1, a2, b1, c1, d1	1 st	1
2.	Homework 2	a1, a2, b1, c1, d1	2 nd	1
3.	Homework 3	a1, a2, b1, c1, d1	3 rd	1
4.	Homework 4	a1, a2, b1, c1, d1	4 th	1
5.	Homework 5	a1, a2, b1, c1, d1	5 th	1
6.	Homework 6	a1, a2, b1, c1, d1	6 th	1
7.	Homework 7	a1, a2, b1, c1, d1	7 th	1
8.	Homework 8	a1, a2, b1, c1, d1	8 th	1
9.	Homework 9	a1, a2, b1, c1, d1	9 th	1
10.	Homework 10	a1, a2, b1, c1, d1	10 th	1
Total				10

VIII. Schedule of Assessment Tasks for Students During the Semester:				
Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Assignment for every chapters	1-14	10	10%
2	Project Presentation	14	10	10%
3	Attendance and Participations	Weekly	5	5%
4	Mid-Term Exam	8	15	15%
5	Final Exam	16	60	60%
Total			100	100%

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IX. Learning Resources:	
<p>• Written in the following order: (Author – Year of publication – Title – Edition – Place of publication – Publisher).</p>	
1- Required Textbook(s) (maximum two).	
<p>1- James E. Duffy, 2017 Modern Automotive technology, 9th Edition, GoodHeart-Willcox. 2- William B Ribbens, 2017, Understanding Automotive Electronics, 6th Edition.</p>	
2- Essential References.	
<p>1- Robert Bosch, 2004. Diesel Engine Management, 3rd Edition, SAE Publications. 2- Robert Bosch, 2004, Gasoline Engine Management, 2nd Edition SAE Publications.</p>	
3- Electronic Materials and Web Sites etc.	
<p>1. https://tr-cam.com/channels/UMi87x5R_zkN4u0To0jqHw.html 2. https://www.autotraining.edu/blog/what-is-automotive-technology/ 3. https://www.globenewswire.com/news-release/2020/02/22/1988892/0/en/Global-Automotive-Sensors-Industry.html 4. https://www.reportlinker.com/p05721139/Global-Automotive-Sensors-Industry.html?utm_source=GNW 5. https://www.electronicsspecifier.com/products/power/challenges-for-next-gen-automotive-power-systems 6. https://training.ti.com/designing-low-emi-dcdc-converters-automotive-systems-part-1 7. https://www.radiantvisionsystems.com/learn/webinars/improving-automotive-inspection-light-color-measurement-systems</p>	

I. Course Policies:	
1	<p>Class Attendance: - The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and be considerd as an exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic.</p>
2	<p>Tardy:</p>

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	- For lateness in attending the class, the student will be initially notified . If he repeats late in attending class he will be considered absent .
3	Exam Attendance/Punctuality: - The student should attend the exam on time. He is permitted to attend the exam half one hour from exam beginning, after that he/she will not be permitted to take exam and he/she is considered absent in the exam.
4	Assignments & Projects: - In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after giving the assignment
5	Cheating: - For cheating in exam, the student is considered as failure . In case the cheating is repeated three times during study the student will be disengaged from the Faculty
6	Plagiarism: Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Affair Council of the university.
7	Other policies: - The mobile phone is not allowable to be used during class lecture. It must be switched off , otherwise the student will be ordered to leave the lecture room. - The mobile phone is not allowed to be taken during the examination time . - Lecture notes and assignments may be given directly to students using soft or hard copy.

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Academic
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 Assoc. Prof. Dr.
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