المؤسسة العامة للتدريب التقني والمهني
Technical and Vocational Training Corporation

KINGDOM OF SAUDI ARABIA
Technical and Vocational Training Corporation
Director General for Curricula

المملكة العربية السعودية
المؤسسة العامة للتدريب التقني والمهني
الإدارة العامة للمناهج

نسخة أولية

الخطط التدريبية للكليات التقنية

Training Plans for Colleges of Technology

CURRICULUM FOR

Department
Mechanical Engineering

Major
Automotive mechanics

A Bachelor's Degree

Semesters
1439H - 2017

Index

Program Description

Program Description

Technical and Vocational Training Corporation (TVTC) is one of Saudi Arabia leading technology education for Automotive Engineering. TVTC's strong links with industry and run by Saudi government recognized academics, our Automotive Engineering program will give you the specialized expertise you need to become a professional engineer in the automotive industry, or equally provide you with the right skill set to take up a career in automotive technology flied.

Program overview

Our Automotive technology Engineering degree is a unique program that focuses on new and promising sustainable automotive technologies. which will give you a valuable opportunity to apply your knowledge to real-life problems and gain hands-on experience in automotive technology .

Program structure

The structure of our program follows clear educational aims that are modified to automotive program. The Automotive technology Engineering program emphasizes managerial skills while assuring students receive a firm understanding of automotive operations, learn to solve technical problems through analysis—and gain knowledge in computer applications and information management skills. This program completed within five semesters after high diploma in automotive technology department. The coursework for the five semesters is as follows:

Sixth Semester

Mathematics (1), Physics, English language (1), Control system fundamentals, Thermodynamics and Statics.

Seventh Semester

Mathematics (2), English language (2), Quality tools and applications, Computer aided Simulation and modeling, internal combustion engines and Mechanics of Materials.

Eighth Semester

Statistics and Probability, Applied fluid mechanics, Advanced engine management and emission control, Mechanical noise and vibration, and Applied Computer aided Vehicle design (Solidworks).

Ninth Semester

Engineering economy, Engineering project management, Elective course (1), Advanced chassis and body control, Vehicle part design and Fluid power.

Tenth Semester

Vehicles dynamics, Elective course (2), Senior project, Automotive workshop management, Alternative fuel technologies; hybrid and electrical vehicles.

The Theoretical and Practical Tests and Graduation Projects Determine Learning Outcomes and Trainee Levels for each program.

The training courses contain a theoretical part and a practical part. The practical part is tested as a practical test and the theoretical part is a theoretical test with different evaluation methods

The Bachelor Degree Graduate gets the seventh level in the Saudi Arabian Qualifications Framework (SAQF).

Admission Requirements: The applicant must have a diploma in Automotive Mechanics.

Brief Description

Course Name	Mathematics (1)	Course Code	MATH 301	Credit Hours	3
Description	An automotive technology mathematics course designed to briefly revise and then extend A-Level mathematics material and introduce more mathematical techniques to support automotive technology major.				

Course Name	Physics	Course Code	PHYS 301	Credit Hours	3
Description	The main objective of this course is to provide a conceptually-based exposure to the fundamental principles and processes of the physical world. Topics include basic concepts of motion, forces, energy, heat, and fluid which support automotive technology major.				

Course Name	English language (1)	Course Code	ENGL 301	Credit Hours	3
Description	English 1is for intermediate level students of English. It is employed to improve reading, writing, listening and grammar, which develops skills including Language analysis, thought-provoking discussions and writing.				

Course Name	Thermodynamics	Course Code	MMEV 341	Credit Hours	3
Description	The main objective of this course is to understand the basic concepts of thermodynamics by providing the student with the fundamentals of thermodynamics through the study of the relationship between heat, work and properties of working fluids. This relationship is demonstrated by applying the first and second laws of thermodynamics to automotive problems.				

Course Name	Statics	Course Code	MMEV 443	Credit Hours	3
Description	The course covers the following topics: statics of particles: forces in plane, forces in space, equilibrium, moment of a force, moment of a couple, equivalent systems of forces on rigid bodies, equilibrium in two dimensions, equilibrium in three dimensions, distributed forces: centroids and center of gravity, analysis of structures: trusses, frames and machines, internal forces in beams and cables, friction, moments of inertia of areas, moments of inertia of masses, method of virtual work.				

Course Name	Control system fundamentals	Course Code	MMEV 352	Credit Hours	3
Description	The main objective of this course is to allow the students to understand the fundamentals of control system to introduce the techniques that are used in the analysis and design of control systems which is to be used to examine the behavior of a variety of control systems commonly used in automotive engineering applications.				

Course Name	Mathematics (2)	Course Code	MATH 302	Credit Hours	3
Description	An automotive technology mathematics course designed to briefly revise and then extend A-Level mathematics material and introduce more mathematical techniques to support automotive technology major.				

Course Name	English language (2)	Course Code	ENGL 302	Credit Hours	3
Description	English 2is for high intermediate level students of English, It is employed to improve reading, writing, listening and grammar, which develops skills including Language analysis, thought-provoking discussions and writing.				

Course Name	Quality tools and Applications	Course Code	GNRL 404	Credit Hours	3
Description	This course provides the students with an idea of how important is good customer services. Developing a Winning Customer Service Strategy. Acquiring Customers and Keeping Them. The Meaning of Quality and Quality Improvement. Brief History of Quality Control and Improvement. Statistical Methods for Quality Control and Improvement.				

Course Name	Internal combustion engine	Course Code	MMEV 322	Credit Hours	3
Description	The main objective of this course is discuss the parameters that define IC engine performance through identifying the distinct operating characteristics of different classifications of IC engines. Understand and predict the thermodynamic and mechanical constrains governing design. Explain the environmental issues concerning future IC engine technology and market trends.				

Course Name	Computer Aided Simulation and Modeling	Course Code	MMEV 313	Credit Hours	2
Description	The main objective of this course is to provide a comprehensive introduction to the MATLAB technical computing environment for automotive engineers. The Subjects of data analysis, visualization, modeling, and programming are explored throughout the course, with an emphasis on practical application to automotive engineering.				

Course Name	Mechanics of Materials	Course Code	MMEV 342	Credit Hours	3
Description	The objective of the course is to study the relationship between the structure and properties of a material, and their applications through the analysis of forces on physical systems in static equilibrium and interpretation of the forces supporting objects.				

Course Name	Statistics and Probability	Course Code	STAT 303	Credit Hours	3
Description	This course is designed for students majoring in engineering of technology. Topics include: probability, random variables, discrete and continuous probability distributions, statistical process control and parameters estimation.				

Course Name	Applied fluid mechanics	Course Code	MMEV 314	Credit Hours	3
Description	This course introduces the students to the fundamental aspects of fluid motions, including important fluid properties, regimes of flow, pressure variations in fluids at rest and in motion, fluid kinematics, and methods of flow description and analysis. It deals with advantages of using dimensional analysis and similitude for organizing test data and for planning experiments. The course also covers, applications such as pipe flow, flow measurement and the fluid mechanics fundamentals associated with turbomachines.				

Course Name	Advanced engine management and emission control	Course Code	MMEV 322	Credit Hours	4
Description	This course provides students with knowledge on the engine performance, emissions and the engine electronic control in order to manage all engine systems, focusing on ignition and fuel delivery. Which implements The ECU (Electronic control unit) to monitor the engine speed, load and temperature while at the same time providing the ignition spark at the right time for the prevailing conditions and metering the fuel to the engine in the exact quantity required.				

Course Name	Automotive noise and vibration	Course Code	MMEV412	Credit Hours	3
Description	The main objective of this course is to understand the noise and vibration of motor vehicles and the application of noise and vibration control principles to the design of quality automotive vehicles. Student will develop an understanding of automotive structure and the physical mechanisms involved.				

Course Name	Applied Computer Aided Vehicle Design (Solidworks)	Course Code	MMEV 413	Credit Hours	2
Description	This course provides automotive students the ability to plan out their project by employing the solidworks commercial software for creating solid models, dimensioned mechanical drawings, assembly, and repeat prototype (3D printing) in addition there is engineering simulation employed for finite element analysis and mechanical analysis to create products better, faster, and more cost-effectively.				

Course Name	Engineering economy	Course Code	GNRL 405	Credit Hours	2
Description	This course covers the basics of economic analysis from an engineering perspective. The concepts and techniques required to facilitate the evaluation and comparison of investment opportunities on an economic basis are presented, along with the corresponding Excel spreadsheet functions. Topics include: foundations of engineering economy, nominal and effective interest rates, engineering economy factors, present worth analysis, annual worth analysis, rate of return analysis, benefit/cost analysis and public sector economics, breakeven and payback analysis and depreciation methods.				

Course Name	Engineering project management	Course Code	GNRL 437	Credit Hours	3
Description	Engineering project management is the application of management principles to deliver a project to a specified timescale, budget and quality. This course will consider the principles of the management of engineering projects with respect to the life-cycle of the project, the parties, planning, estimating, contractor selection and contract management.				

Course Name	Advanced Chassis and Body Control	Course Code	MMEV 462	Credit Hours	4
Description	This course provides students the basic design principles, safety regulations and industry standards applying Computer modeling, commonly used to design of shafts and couplings, brakes, clutches, belt drives, transmissions, steering and suspension as automotive parts.				

Course Name	Vehicle Part Design	Course Code	MMEV 434	Credit Hours	2
Description	This course provides students the basic design principles, safety regulations and industry standards applying Computer modeling, commonly used to design of shafts and couplings, brakes, clutches, belt drives, transmissions, steering and suspension as automotive parts.				

Course Name	Fluid Power	Course Code	MMEV 443	Credit Hours	3
Description	This course provides the student with the basic knowledge concerned with the function, processes, and applications of the hydraulic and pneumatic components. This is achieved by analyzing the performance of hydraulic and pneumatic components. Also included in this course is performing the design and constructing the principle circuit in the lab.				

Course Name	Vehicles Dynamics	Course Code	MMEV 442	Credit Hours	3
Description	The main objectives of this course are describe and analyses the operation of a vehicle suspension and predict vehicle ride behavior and steady state handling performance. In this course the physical principles of road vehicle aerodynamic design are explained.				

Course Name	Graduation Project	Course Code	MMEV 491	Credit Hours	4
Description	The students are required to use the skills acquired in their different studied subjects on a multidisciplinary team to design a system, component, or process to meet desired needs within realistic constraints. A standard engineering design process is followed including the selection of a client defined problem, literature review, problem formulation (objectives, constraints, and evaluation criteria), generation of design alternatives and work plan.				

Course Name	Automotive Workshop Management	Course Code	MMEV 483	Credit Hours	2
Description	This course is designed to provide students with management skills such as planning, organizational structure, workshop layout design, scheduling and controlling which will be needed in Automotive Workshops. Calculating cost and expenditures of the workshops and the process of supplying spare parts to these workshops and maintenance scheduling of various vehicle's groups will be discussed.				

Course Name	Alternative Fuel Technologies ,Hybrid and Electrical Vehicles	Course Code	MMEV 431	Credit Hours	3
Description	This course is designed to provide students with knowledge of the theory and principles description of hybrid vehicles and electric vehicles, which are presently as a revolution in Automotive technology sectors In addition to that, the course, introduces current trends in alternative fueled vehicles. The course includes an overview of current alternative fueled vehicles in production. The theory of operation of different types of hybrid vehicles will be covered, battery types, Fuel Cell Vehicles, Hydrogen-ICE vehicles, Alternative Fuels and Flex Fuel vehicles.				

Course Name	Renewable energies	Course Code	MMEV461	Credit Hours	2
Description	The main objectives of this course describes the classification and description of different types of renewable energy systems, including solar energy, hydropower, fuel cells, and biomass. In order to support modern automotive technology major.				

Course Name	Heating, ventilation and air conditioning	Course Code	MMEV 472	Credit Hours	2
Description	This course provides the student with knowledge on vapor compression cycles, Refrigerants and their characteristics, Basic vapor compression equipment, Introduction to absorption refrigeration, Psychometrics and psychometric processes, Human comfort, Heat gain-through walls and fenestrations, Cooling load calculations, Duct design and air distribution system.				

Course Name	Advanced topics in automotive technology	Course Code	MMEV 482	Credit Hours	2
Description	This course deals with analysis of the technological trends in the automotive industry and how technology changes may affect the future technician job duties, manager's decisions, and society as a whole. How business and society will adapt to emerging technology. To promote understanding of the course content, course projects, study of engineering functions, and collection of technical data may be integrated when appropriate.				

Course Name	Turbocharging and engine boosting	Course Code	MMEV 473	Credit Hours	2
Description	This course provides the student with a comprehensive presentation of the principles of turbochargers, engine-turbocharger matching, and the performance of turbocharged engine systems. It gives an in-depth insight into turbocharger design, methods for ensuring correct matching of compressor and turbine with the ICE, advanced turbocharger system concepts like variable geometry turbocharger and compounding are covered. This course deals also with other engine boosting techniques as superchargers.				

Study Plan

Sixth Semester								
No.	Course Code	Course Name	Pre.Req	No. of Units				
				CRH	L	P	T	CTH
1	MATH 301	Mathematics (1)		3	2	2	0	4
2	PHYS 301	Physics		3	2	2	0	4
3	ENGL 301	English Language (1)		3	3	0	1	4
4	MMEV 341	Thermodynamics		3	2	2	0	4
5	MMEV441	Statics		3	3	0	1	4
6	MMEV 352	Control system fundamentals		3	2	2	0	4
Total				18	14	8	2	24

CRH:Credit Hours**L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Seventh Semester								
No.	Course Code	Course Name	Pre.Req	No. of Units				
				CRH	L	P	T	CTH
1	MATH 302	Mathematics (2)	MATH301	3	2	2	0	4
2	ENGL302	English Language (2)	ENGL301	3	3	0	1	4
3	GNRL 404	Quality tools and Applications		3	3	0	0	3
4	MMEV 322	Internal combustion engines	MMEV 341	3	2	2	0	4
5	MMEV 313	Computer Aided Simulation and Modeling		2	0	4	0	4
6	MMEV 342	Mechanics of Materials		3	2	2	1	5
Total				17	12	10	2	24

CRH:Credit Hours**L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Eighth Semester								
No.	Course Code	Course Name	Pre. Req	No. of Units				
				CRH	L	P	T	CTH
1	STAT 303	Statistics and Probability		3	3	0	1	4
2	MMEV 314	Applied fluid mechanics		3	2	2	1	5
3	MMEV 332	Advanced engine management and emission control	MMEV 352	4	2	4	0	6
4	MMEV 412	Automotive noise and vibration	MMEV 342	3	2	2	0	4

5	MMEV 413	Applied Computer aided Vehicle design (Solidworks)		2	0	4	0	4
Total				**15**	**9**	**12**	**2**	**23**

CRH:Credit Hours**L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Ninth Semester								
No.	Course Code	Course Name	Pre. Req	No. of Units				
				CRH	L	P	T	CTH
1	GNRL405	Engineering Economy		2	2	0	0	2
2	GNRL 402	Engineering project management		3	3	0	0	3
3	MMEV ***	Elective course (1)		2	2	0	0	2
4	MMEV 462	Advanced chassis and body control systems		4	2	4	0	6
5	MMEV 434	Vehicle part design	MMEV 342	2	2	0	3	5
6	MMEV 443	Fluid power	MMEV 314	3	2	2	0	4
Total				16	13	6	3	22

CRH:Credit Hours**L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Tenth Semester								
No.	Course Code	Course Name	Pre. Req	No. of Units				
				CRH	L	P	T	CTH
1	MMEV 491	Graduation Project		4	2	4	0	6
2	MMEV ***	Elective course (2)		2	2	0	0	2
3	MMEV 442	Vehicles dynamics		3	2	2	2	6
4	MMEV 483	Automotive workshop management		2	2	0	0	2
5	MMEV 431	Alterative fuel technologies ,Hybrid and electrical vehicles		3	2	2	0	4
Total				14	10	8	2	20

CRH:Credit Hours **L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Total Number of Semesters Credit Units	CRH	L	P	T	CTH
	80	58	44	11	113
Total of training Hours 16 * 114	1808				

Elective Courses

Elective Course 1								
No.	Course Code	Course Name	Pre. req	No. of Units				
				CRH	L	P	T	CTH
1	MMEV 461	Renewable energies		2	2	0	0	2
2	MMEV 472	Heating, ventilation and air conditioning		2	2	0	0	2

CRH:Credit Hours**L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Elective Course 2								
No.	Course Code	Course Name	Pre. req	No. of Units				
				CRH	L	P	T	CTH
1	MMEV 482	Advanced topics in automotive technology		2	2	0	0	2
2	MMEV 473	Turbocharging and engine boosting		2	2	0	0	2

CRH:Credit Hours**L**:Lecture **P**:Practical **T**:Tutorial **CTH**:Contact Hours

Courses Description

Department	General Study	Major	Automotive engineering technology
Course Name	Physics	Course Code	PHYS 301
Prerequisites		Credit Hours CRH	3 CTH 4
			L 2 P 2 T 0

CRH: **Credit Hours** L: **Lecture** P: **Practical** T: **Tutorial** CTH: **Contact Hours**

Course Description:
The main objective of this course is to provide a conceptually-based exposure to the fundamental principles and processes of the physical world. Topics include basic concepts of motion, forces, energy, heat, and fluid which support automotive technology major.

Topics:

- Motion in one dimension.
- Motion in one dimension
- The laws of motion

Experiments: If applicable it will support the theoretical topics.
References: College physics by Serway and Faughn.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Introduction: trigonometry and vectors standard of length, mass and time. The building blocks of matter. Dimensional analysis. Uncertainty in measurement and significant figures. Unit conversion for physical quantities. estimates and order-of-magnitude calculations coordinate systems. Trigonometry review.	**4**
2	Motion in one dimension: displacement, velocity, and acceleration. Motion diagrams. One-dimensional motion with constant acceleration. Freely falling objects.	**5**
3	Vectors and two-dimensional motion: displacement, velocity, and acceleration in two dimensions. Two dimensional motion relative velocity. Newton's laws of motion.	**6**
4	The laws of motion: the normal and kinetic friction forces. Static friction forces. Tension forces. Applications of Newton's laws. Two body problems.	**6**
5	Work and energy: work. Kinetic energy and work-energy theorem. Gravitational potential energy. Gravity and nonconservative forces. Spring potential energy. Systems and energy conservation. Power. Work done by a varying force.	**6**
6	Momentum and collisions: momentum and impulse. Conservation of momentum. Collisions in one dimension. Glancing collisions. Rocket propulsion.	**6**
7	Circular motion and the law of gravity: Angular Velocity and Angular Acceleration. Rotational Motion Under Constant Angular Acceleration. Tangential Velocity, Tangential Acceleration and Centripetal Acceleration. Newton's Second Law for Uniform Circular Motion. Newtonian Graviton.	**6**
Textbook	College physics by Serway and Faughn.	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Solve a problem and exercise for each topic.	**12**
2	Basic experimental work support the theoretical topics.	**14**
Textbook	Lab Experiments user manual	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Thermodynamics	Course Code	MMEV 341
Prerequisites		Credit Hours CRH	3 CTH 4
		L 2 P 2 T 0	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
The main objective of this course is to understand the basic concepts of thermodynamics by providing the student with the fundamentals of thermodynamics through the study of the relationship between heat, work and properties of working fluids. This relationship is demonstrated by applying the first and second laws of thermodynamics to automotive problems.

Topics:

- learn about thermodynamic systems and boundaries
- study the basic laws of thermodynamics including:

1-conservation of mass
2- conservation of energy or first law
3- second law

- understand various forms of energy including heat transfer and work
- identify various type of properties (e.g., extensive and intensive properties)
- use tables, equations, and charts, in evaluation of thermodynamic properties
- apply conservation of mass, first law, and second law in thermodynamic analysis of systems
- Understanding the basic mechanisms of heat transfer, which are conduction, convection, and radiation

Experiments: If applicable it will support the theoretical topics

References: Thermodynamics: An Engineering Approach. Yunus Cengel / Michael Boles
ISBN10/13 : 0077986695 / 0-07-798669-5

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Thermodynamic systems, Property, state, process, and equilibrium, system of units	2
2	Energy and the first law of thermodynamics, Energy of a system	2
3	Energy transfer by work of heat, Energy balance for systems and cycles	4
4	Properties of pure, simple compressible substance, Tables of thermodynamic properties	2
5	Generalized compressibility chart and ideal gas Model	2
6	Conservation of mass and energy for a control Volume	2
7	Irreversible and reversible processes	2
8	Ideal performance for power, refrigeration, & heat pump cycles	4
9	Second law of thermodynamics and definition of entropy change	2
10	Control volume analyses for steady state and transient processes	2

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
11	Isentropic efficiencies of turbines, nozzles, compressors, and pumps	**2**
12	Heat Transfer rate By conduction: Fourier's law of heat conduction.	**2**
13	Heat Transfer by Convection : Newton's law of cooling	**2**
14	The Stefan–Boltzmann law of radiation.	**2**
Textbook	Thermodynamics: An Engineering Approach. Yunus Cengel / Michael Boles ISBN10/13 : 0077986695 / 0-07-798669-5	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Demonstration of the basic principles of free and forced convection, Demonstration of heat transfer at fins.	**4**
2	Determination of the coefficients of heat transfer,	**4**
3	Determination of thermal conductivity	**4**
4	Temperature and flow rate measurement, Familiarization with the various methods, their areas of application and special features	**4**
5	Calibrating electronic temperature sensors,	**2**
6	Temperature distribution in the heat exchanger	**2**
7	Calibrating electronic temperature sensors,	**2**
8	Familiarization with different pressure measurement methods, Function of a Bourdon tube manometer	**4**
9	Pressure measurements with U-tube and Bourdon tube manometers, Calibration of mechanical manometers	**4**
10	Determining air humidity with a psychomotor	**2**
Textbook	Lab Experiments user manual	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Statics	Course Code	MMEV 443
Prerequisites		Credit Hours CRH	3 CTH 4
			L 3 P 0 T 1

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
The course covers the following topics; statics of particles: forces in plane, forces in space, equilibrium, moment of a force, moment of a couple, equivalent systems of forces on rigid bodies, equilibrium in two dimensions, equilibrium in three dimensions, distributed forces: centroids and center of gravity, analysis of structures: trusses, frames and machines, internal forces in beams and cables, friction, moments of inertia of areas, moments of inertia of masses, method of virtual work.

Topics:

- Force and moment vectors, vector algebra
- Equilibrium of particles and rigid bodies in plane and 3D space
- Support types and reactions
- Equilibrium of structures and internal forces in trusses, and frames
- Distributed loads
- Moment of inertia
- Virtual work concept.

Experiments: If applicable it will support the theoretical topics

References: Engineering Mechanics-Statics, Hibbeler, R.C.13th Edition, Pearson Prentice Hall, 2015, ISBN-13: 978-0133918922

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	General principles: basic quantities, units and measurements, newton's law	2
2	Vectors: position vectors, force vectors, vectors operations	4
3	Equilibrium of a Particle, coplanar forces, three dimensions force systems	6
4	Force System Resultants: moment of force, principle of moment, moment about axis, moment of a couple, force couple system simplification, distributed forces.	4
5	Equilibrium of a Rigid Body, equilibrium in two dimensions, equilibrium in three dimensions, constrains and static determinacy.	4
6	Structural Analysis: simple trusses, zero force member, method of section, space trusses	6
7	Internal Forces: shear and moment equation and diagram, relation between distributed load, shear and moment	4
8	Friction: theory of friction, dry friction, rolling resistance	6
9	Center of Gravity, center of mass, centroid	4
10	Moments of Inertia of area, parallel axis theorem, product of inertia, mass moment of inertia	4
11	Work of force, work of a couple moment, virtual Work, potential energy	4

Textbook	Engineering Mechanics-Statics, Hibbeler, R.C.13th Edition, Pearson Prentice Hall, 2015, ISBN-13: 978-0133918922

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Internal combustion engines	Course Code	MMEV 322
Prerequisites	MMEV341	Credit Hours CRH	3 CTH 4
			L 2 P 2 T 0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:

The main objective of this course is discuss the parameters that define IC engine performance through identifying the distinct operating characteristics of different classifications of IC engines. Understand and predict the thermodynamic and mechanical constrains governing design. Explain the environmental issues concerning future IC engine technology and market trends.

Topics:

- Recognize the basic types of internal combustion engines.
- Estimate the performance of internal combustion engines
- Know the fundamental thermochemistry as applied to fuels.
- Follow the various operational processes from intake to exhaust
- Analyze the combustion phenomena in SI and CI engines
- Analyze and calculate the emissions for SI and CI engines

Experiments: If applicable it will support the theoretical topics

References: Heywood, John B. Internal combustion engine fundamentals. (McGraw-Hill series in mechanical engineering) Bibliography: p. Includes index. I. Internal combustion engines. I. Title. 11. Series. TJ755.H45 1988 621.43 87-15251

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Engine Types and Their Operation Introduction and Historical Perspective ,Engine Classifications, Engine Operating Cycles, Engine Components, Spark-Ignition Engine Operation Examples of Spark-Ignition, Engines Compression-Ignition, Engine Operation Examples of Diesel, Engines Stratified-Charge Engines.	2
2	Engine Design and Operating Parameters Brake Torque and Power Indicated Work Per Cycle Mechanical Efficiency Road-Load Power Mean Effective Pressure Specific Fuel Consumption and Efficiency Air/Fuel and Fuel/Air Ratios Volumetric Efficiency Engine Specific Weight and Specific Volume Correction Factors for Power and Volumetric Efficiency	2
3	Thermochemistry of Fuel –Air Mixtures Characterization of Flames Ideal Gas Model Composition of Air and Fuels Combustion Stoichiometry, The First Law of Thermodynamics and Combustion	2
4	Ideal Models of Engines Cycles Ideal Models of Engine Processes Thermodynamic Relations for Engine Processes Cycle Analysis with Ideal Gas Working Fluid, Comparison with Real Engine Cycles	2
5	Charge Motion With The Cylinder Intake Jet Flow Mean Velocity and Turbulence Characteristics , Definitions ,Application to Engine Velocity Data Swirl Swirl Measurement , Swirl Generation during Induction ,Swirl Modification within the Cylinder Squish Prechamber Engine Flows Crevice Flows and Blowby Flows Generated by Piston-Cylinder Wall Interaction	4
6	Combustion In Spark- Ignition Engines: Essential Features of Process, Thermodynamic Analysis of SI Engine Combustion, Flame Structure and Speed, Cyclic Variations in Combustion, Partial Burning, and Misfire, Spark Ignition, Abnormal Combustion: Knock and Surface Ignition	4

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
7	Combustion In Compression –Ignition Engines: Essential Features of Process, Types of Diesel Combustion Systems, Phenomenological Model of Compression-Ignition Engine, Analysis of Cylinder Pressure Data, Fuel Spray Behavior, Ignition Delay, Mixing-Controlled Combustion	**4**
8	Engines Friction and Lubrication: Friction Fundamentals, Measurement Methods, Engine Friction Data, Engine Friction Components, Accessory Power Requirements, Lubrication	**4**
9	Engine Operating Characteristics: Engine Performance Parameters, Indicated and Brake Power and MEP, Operating Variables That Affect SI Engine Performance, Efficiency, and Emissions, I Engine Combustion Chamber Design, Variables That Affect CI Engine Performance, Efficiency, and Emissions, Supercharged and Turbocharged Engine Performance.	**4**
10	Pollutant Formation and Control: Nature and Extent of Problem, Nitrogen Oxides, Carbon Monoxide, Unburned Hydrocarbon Emission, Particulate Emissions, Exhaust Gas Treatment	**4**
Textbook	Heywood, John B. Internal combustion engine fundamentals. (McGraw-Hill series in mechanical engineering) Bibliography: p. Includes index. I. Internal combustion engines. I. Title. 11. Series. TJ755.H45 1988 621.43 87-15251	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Comparison between diesel and petrol cycles	**4**
2	Plotting of engine performance characteristics for diesel and petrol engine, Plotting P-v and P-θ diagram of a single cylinder engine	**4**
3	Determination of specific fuel consumption	**4**
4	Determination of indicated and brake thermal efficiency	**2**
5	Determination of mechanical and volumetric efficiency	**2**
6	Determination of indicated and brake power of the engine	**2**
7	Determination of IMEP and BMEP	**2**
8	Determination of friction loss (in passive mode)	**4**
9	The effects of compression ratio, ignition timing and mixture composition on power output, fuel consumption, efficiency and exhaust gas composition	**2**
10	Analysis of the combustion operation in the engine	**4**
11	Plotting and drawing the valve timing diagrams of a four stroke SI and CI engine	**2**
Textbook	Lab Experiments user manual	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Control System Fundamentals	Course Code	MMEV 352
Prerequisites		Credit Hours CRH	3 CTH 4

L	2	P	2	T	0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
The main objective of this course is to allow the students to understand the fundamentals of control system to introduce the techniques that are used in the analysis and design of control systems, which is to be used to examine the behavior of a variety of control systems commonly used in automotive engineering applications.

Topics:

- Fundamentals Industrial Process Control
- Basic Controllers Modes
- Transducers

Experiments: If applicable, it will support the theoretical topics.

References: Feedback systems: an introduction for scientists and engineers / Karl Johan Storm and Richard M. Murray p. cm. Includes bibliographical references and index. ISBN-13: 978-0-691-13576-2 (alk. paper).

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Fundamentals Industrial Process Control: Purpose of Automatic Control, Types Of Process control, Open-loop and closed loop control, closed loop control technology, Characteristics of Process Control Systems, What is a system?, Basic terminology, dynamic response of a controlled system	12
2	Basic Controllers Modes: Control response, Time response of a controller, Technical details of controllers, Mode of operation of various controller types, On- Of Control, The proportional control, The integral-action control, The PI control, The PD control, The PID control, Controllers, Electric controller, Synchros andservos, Pneumatic controllers, Final control Element	10
3	Transducers: Transducers Specification, Position Transducers, Force Transducers, Motion Transducers, Fluid Transducers, Temperature Transducers, Humidity Transducers, Light Transducers, Displacement ,Stress and train Transducers, Magnetism Transducers, Pressure Transducers, Liquid Level Transducers	10
Textbook	Feedback systems: an introduction for scientists and engineers / Karl Johan Åström and Richard M. Murray p. cm. Includes bibliographical references and index. ISBN-13: 978-0-691-13576-2 (alk. paper)	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Calibration of all sensors included in the lab Equipment	**2**
2	Hand on of all the actuators involved in the lab Equipment	**2**
3	Temperature Process Control: Temperature control loops Manual, On/Off, P, PI, PD,PID	**4**
4	Level Process Control: Level control loops Manual, On/Off, P, PI, PD,PID	**4**
5	Pressure Process Control: Pressure control loops Manual, On/Off, P, PI, PD,PID	**4**
6	PH Process Control: PH control loops Manual, On/Off, P, PI, PD,PID	**4**
7	PLC hardware general use and manipulation	**4**
8	PLC inputs and outputs configuration	**4**
9	PLC Programming Exercises	**4**
Textbook	Lab Experiments user manual	

Department	Mechanical Engineering	Major	Automotive Mechanics						
Course Name	Mechanics of Materials	Course Code	MMEV 342						
Prerequisites		Credit Hours CRH	3				CTH	5	
			L	2	P	2	T	1	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
The objective of the course is to study the relationship between the structure and properties of a material, and their applications through the analysis of forces on physical systems in static equilibrium and interpretation of the forces supporting objects.

Topics:

- Stress and strain
- Mechanical properties of materials
- Axial load, torsion, bending, shear
- Combined loadings

Experiments: If applicable, it will support the theoretical topics.
References: MECHANICSOF MATERIALS , NINTH EDITION, R. C. HIBBELER

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Introduction, equilibrium of deformable body, stress, Normal stress, shear stress, design stress	2
2	Deformation, strain	4
3	Tension and Compression Test, Stress–Strain Diagram, Hooke's law, Ductility, malleability, Shear Stress–Strain Diagram, creep, fatigue	4
4	Saint-Venant's Principle, Elastic Deformation of an Axially Loaded Member, Principle of Superposition, Stress Concentrations	4
5	Torsional Deformation of a Circular Shaft, Torsion Formula, Angle of Twist	4
6	Shear and Moment Diagrams, Bending Deformation of a Straight Member, Flexure Formula	6
7	Shear in Straight Members, Shear Formula	4
8	Combined Loadings	4
Textbook	Mechanics Of Materials , Ninth Edition, R. C. HIBBELER	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Tensile test	6
2	Charpy test	8
3	Bending/flexural test	6
4	Torsion test	6
5	Hardness test	6
Textbook	Lab Experiments user manual	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Computer Aided Simulation and Modeling	Course Code	MMEV 313
Prerequisites		Credit Hours CRH	2 CTH 4
			L 0 P 4 T 0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
The main objective of this course is to provide a comprehensive introduction to the MATLAB technical computing environment for automotive engineers. The Subjects of data analysis, visualization, modeling, and programming are explored throughout the course, with an emphasis on practical application to automotive engineering. The material in this course will be focused on the MATLAB and Simulink software package including basic programming and modeling.

Topics:

- MATLAB User Interface and Basics
- Calculus, Linear Algebra, ODEs
- Graphics and Visualization
- Creating Simulink Models
- Modeling a Dynamic Control System

Experiments: If applicable, it will support the theoretical topics.

References: Beucher, O, and Weeks, M., Introduction to Matlab and Simulink

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	MATLAB User Interface and Basics: Desktop interface, toolboxes, variables, vectors, matrices, operators, built-in functions, input and output.	6
2	Calculus, Linear Algebra, ODEs: Polynomials, integration, curve fitting, linear systems of equations, convolution, and differential equations.	8
3	Graphics and Visualization: 2D and 3D plotting functions, graphics customizations, property editor, figure and axes handles, animation.	8
4	Basic Programming: Function and script m-files, data types, strings, relational and logical operators, program flow control, debugging.	6
5	Programming Practice: Guide editor, graphical user interface programming, callbacks, MATLAB File Exchange.	6
6	Statistics and Data Analysis: Probability distributions, linear models, regression, confidence intervals, graphical representation, ANOVA.	6
7	Simulink User Interface and Basics: Opening Simulink Library, Opening a model, user interface, demo models.	6
8	Creating Simulink Models: Creating a new model, adding blocks, moving blocks in the model window, connecting blocks, saving model , simulating the model.	6
9	Understanding the Demo model: Running the simulation, modifying simulation parameters, import data from MATLAB workspace, export simulation data to MATLAB workspace.	6

Detailed of Practical Contents		
No.	**Contents**	**Hours**
10	Modeling Continuous and Discrete Systems: Creating Custom Libraries, Debugging Modeling Linear Continuous-State Systems and Discrete-Time Systems. Custom Libraries, Debugging.	**6**
Textbook	Beucher, O., and Weeks, M., Introduction to Matlab and Simulink, A Project Approach, 3rd edition, Infinity Science Press, 2007.	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Applied Fluid Mechanics	Course Code	MMEV 314
Prerequisites		Credit Hours CRH	3 CTH 5
			L 2 P 2 T 1

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:

This course introduces the students to the fundamental aspects of fluid motions, including important fluid properties, regimes of flow, pressure variations in fluids at rest and in motion, fluid kinematics, and methods of flow description and analysis. It deals with advantages of using dimensional analysis and similitude for organizing test data and for planning experiments. The course also covers, applications such as pipe flow, flow measurement and the fluid mechanics fundamentals associated with turbomachines.

Topics:

- To understand the behavior, properties, and definition of a fluid including density, viscosity, Specific gravity, pressure, shear stress, and fluid forces.
- To be able to define the different types of fluid flow (laminar, turbulent and transition).
- To be able to describe and distinguish between pressurized and free surface flow.
- To become familiar with the use of various measurement devices for the determination of fluid velocity.
- To understand the derivation of the energy equation (Bernoulli equation) and its application to pressurized flow and open channel flow systems. To be able to solve for losses in energy head due to friction and minor losses

Experiments: If applicable, it will support the theoretical topics.

References: Applied Fluid Mechanics, 6/E. Robert L. Mot. ISBN10/13: 0131146807/9780131146808

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Fluid Properties and Hydrostatics.	4
2	Static Pressure Forces.	4
3	Fluid Dynamics & Bernoulli Equation.	4
4	Flow Measurement.	4
5	Forces and Momentum of Moving Fluids.	4
6	Viscous Pipe Flows.	4
7	Pumps and Turbines.	4
8	Flow Over Immersed Bodies.	4
Textbook	Applied Fluid Mechanics, 6/E. Robert L. Mot. ISBN10/13 : 0131146807 / 9780131146808	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Measurement of the pressure loss for laminar and turbulent flow Determination of the critical Reynolds' number.	**2**
2	Measurements using a tube manometer. Measurement of the static and dynamic pressure component in a fluid.	**4**
3	Experiments on the Boyle-Marriotte law. Determination of the buoyancy of various bodies.	**4**
4	Investigations on the density of liquids. Demonstration of capillary effects.	**4**
5	Demonstration Pascal's law. Determination of the center of pressure.	**4**
6	Demonstration of Bernoulli's law. Display of the pressure characteristic using the venturi tube.	**4**
7	Determination of the flow rate factor. Effect of bodies of different shape on the flow. Effect of sources and sinks. Comparison of different flow rate measuring devices.	**4**
8	Flow rate measurement with nozzle/orifice, venture flow meter. Depiction of laminar, transition and turbulent flow.	**2**
9	Velocity profile in a pipe flow. Demonstration that the flow velocity is proportional to the pressure difference between the total pressure and the static pressure.	**2**
10	Determination of drag coefficients of various objects. Measurement of lift and resistance on various wing sections. Examination of aerodynamic lifting aids such as slats or flaps.	**2**
Textbook	Lab Experiments user manual	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Advanced Engine Management and Emission Control	Course Code	MMEV 322
Prerequisites	MMEV 352	Credit Hours CRH	4 CTH 6
			L 2 P 4 T 0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
This course focuses on the advanced engine management systems in the modern automobile. An emphasis will be made on the emission control.
The student will be able to test and diagnose engine control systems of various manufactures.

Topics:

- Fundamentals of automotive electronics
- Engine control systems
- Multiplexing
- Emissions standards, measurement and control
- Engine and emission control system diagnostic

Experiments: If applicable, it will support the theoretical topics.

References: Automotive mechatronics, (Bosh2015)
Halderman, J. & Linder, J. (2012). Automotive Fuel and Emissions Control Systems (3rd Edition) Upper Saddle River, NJ: Pearson Education. [ISBN 13:978-0-13-254292-0]

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Electronic control unit: Design, data processing, digital modules in the control unit, control unit software.	4
2	Automotive networking: cross system function, requirement for bus systems, classification of bus systems, CAN bus, LIN bus, MOST bus, other bus systems (Bluetooth, TTP/C, Flexray), diagnostic interface.	10
3	Engine Control Systems: Electronic control Fuel Injection, ESA (Electronic Spark Advance), ETCS-I (Electronic Throttle Control System-intelligent), Dual VVTi (Variable Valve Timing-intelligent), ACIS (Acoustic Control), Induction System, Fuel Pump Control, Air Injection Control, Starter Control (Cranking Hold Function), Air-fuel Ratio Sensor and Heated Oxygen Sensor Heater Control, Air Conditioning Cut-off Control, Evaporative Emission Control, Engine Immobilizer.	10
4	Fault diagnostic: On-board diagnosis system, Diagnostic Management software, Data Streams Analysis, Output Data Signals Analysis.	8

Textbook	Automotive mechatronics, (Bosh2015) Halderman, J. & Linder, J. (2012). Automotive Fuel and Emissions Control Systems (3rd Edition) Upper Saddle River, NJ: Pearson Education. [ISBN 13:978-0-13-254292-0] Halderman, J. D. (2011). Diagnosis &Troubleshooting of Automotive Electrical, Electronic, & Computer Systems (6th Edition) Upper Saddle River, NJ: Pearson Education. [ISBN 13:978- 0132551557]

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Measuring and testing devices.	**8**
2	Engine control computer: memories, interfaces, power supply.	**8**
3	Engine control systems inspection and testing: Readiness Test Status, monitor status, component status, monitor result information, Readiness Monitor Status, DTC, Current data, Freeze Frame Data, fail-safe mode.	**16**
4	Reading and analysis of all sensors signals.	**20**
5	Emission tests and analysis.	**12**
Textbook	Lab Experiments user manual	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Automotive Noise and Vibration	Course Code	MMEV 412
Prerequisites	MMEV 342	Credit Hours CRH	3 CTH 4

L	2	P	2	T	0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
The main objective of this course is to provide the student with the fundamentals of Mechanical Vibration theory through the study of free and forced systems, damped and Undamped systems, single and multi-degree of freedom. In addition, the course provides the basic concepts of the harmonic excitation and torsional vibration.

Topics:

- Basic concepts of vibration.
- Free Vibration of Single-Degree-of-Freedom Systems.
- Harmonically Excited Vibration.
- Design for vibration suppression.
- Vehicles NVH.

Experiment: If applicable, it will support the theoretical topics.
References: Vehicle Noise, Vibration, and Sound Quality,Gang Sheng.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Introduction to mechanical vibrations.	4
2	Free undamped vibration of Single-Degree-of-Freedom Systems.	4
3	Free damped vibration of Single-Degree-of-Freedom Systems.	4
4	Forced Vibration of Single-Degree-of-Freedom Systems.	4
5	Harmonic excitation.	4
6	Simple Pendulum vibration.	4
7	Types of Noise, Vibration, and Harshness(NVH) in vehicles. Steps of the NVH systematic diagnostic approach.	4
8	Engine vibration, vehicle speed vibration, all wheels drive systems vibration NVH diagnosing tools.	4

Textbook	Fundamentals of Vibrations, Leonard Meirovitch Mechanical Vibrations, Singiresu S. Rao Vehicle Noise, Vibration, and Sound Quality,Gang Sheng. Noise, Vibration, and Harshness. (Volkswagen of America, Inc.ServiceTraining Printed in U.S.A.Printed 03/2005, Course Number 861503)

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Introduction to free, forced, damped and undamped vibration Discovery of the lab equipment.	**2**
2	Spring stiffness determination.	**2**
3	Resonance frequency with inactive dynamic absorber.	**2**
4	Estimation of the damping ratio.	**4**
5	Phase shift determination.	**2**
6	Tuning active dynamic absorber.	**4**
7	Resonance frequency with active dynamic absorber.	**2**
8	Torsional stiffness of a shaft.	**2**
9	Modulus of rigidity G (fixed/fixed condition) using torque and using oscillations.	**2**
10	Length of a supporting rod.	**2**
11	Mass moment of inertia.	**4**
12	Diameter of a supporting rod.	**2**
13	Damped torsional oscillation.	**2**
Textbook	Lab Experiments user manual	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Applied Computer aided Vehicle Design (Solidworks)	Course Code	MMEV 413
Prerequisites		Credit Hours CRH	2 CTH 4
		L 0 P 4 T 0	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
This course deals with how to use the SOLIDWORKS mechanical design automation software to build parametric models of parts and assemblies, and how to make drawings of those parts and assemblies. In addition, this course will provide an in-depth coverage on the basics of Finite Element Analysis (FEA), covering the entire analysis process from meshing to evaluation of results for parts and assemblies.

Topics:
- Sketching and 3D modeling.
- Shelling and ribs.
- Assembly and animation.
- Finite elements analysis.

Experiments: If applicable, it will support the theoretical topics.
References: Practical user manuals -Solidworks essentials training**.**

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Solidworks basics and the user interface.	4
2	Sketching.	4
3	Part modeling.	4
4	Symmetry and draft.	6
5	Patterning.	6
6	Revolved features.	6
7	Shelling and ribs.	6
8	Repairs.	4
9	Design changes.	4
10	Configurations.	4
11	Global variables and equations.	4
12	Drawing Bottom up assembly modeling.	4
13	Using assembly.	4
14	Finite elements analysis using Solidworks (linear stress analysis, heat transfer analysis).	4
Textbook	Practical user manuals -Solidworks essentials training .	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Advanced chassis and body control	Course Code	MMEV 462
Prerequisites		Credit Hours CRH	4 CTH 6
			L 2 P 4 T 0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
This course focuses on the advanced control of chassis and body systems, It includes the control of traction, steering, suspension, stability, drive, adjustment and security systems, This course also provides students with diagnostic procedure and fault analysis related to these systems.

Topics:

- Suspension and steering control.
- Vehicle dynamic integrated management.
- Electronic control of drive and adjustment systems, vehicle security systems.
- Fault diagnostic.

Experiments: If applicable, it will support the theoretical topics.
References: Automotive mechatronics, Conrad Reifed**.**

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Suspension and steering control: Vehicle Height Control, Damping Force Control, Spring Rate Control, 4-wheel Related Control and VGRS (Variable Gear Ratio Steering control systems).	**4**
2	Vehicle dynamic integrated management: Brake Control System, Multi-terrain ABS (Antilock Brake System), EBD (Electronic Brake force Distribution), Brake Assist, A-TRAC (Active Traction Control), VSC (Vehicle Stability Control), Hill-start Assist Control, CRAWL.	**8**
3	Electronic control of drive and adjustment systems, vehicle security systems, air conditioning system: power window, power sunroof, seat and steering column adjustment, electronic heater, electronic air conditioning, locking and central locking system, biometric system, lighting system, combination meter (multi display), Bluetooth hands-free system, wiper, washer, monitor system, intuitive parking assist system, the smart access system, pre-collision system, The cruise control, power seat system, pressure warning Systems.	**10**
4	Fault diagnostic.	**4**
5	Electronic Transmission Control : Shift Timing Control, Clutch Pressure Control, Line Pressure Optimal Control, Engine Torque Control, Flex Lock-up Clutch Control, Lock-up Timing Control, Powertrain Cooperative Control, Coast Downshift Control, AI (Artificial Intelligence)- SHIFT Control, Multi-mode Automatic Transmission, R to D Squat Control, N to D Squat Control,2nd Start Control, 4WDControl ECU, 4WD control ECU actuates and Fail-safe.	**6**
Textbook	Automotive mechatronics, Conrad Reifed	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Use of measuring and testing devices.	**4**
2	suspension control system diagnosis and testing.	**10**
3	Steering control system diagnosis and testing.	**10**
4	Vehicle dynamic integrated management diagnosis and testing.	**10**
5	Diagnosis and testing of Electronic control of drive and adjustment systems; and vehicle security systems.	**10**
6	Electronic Transmission Control diagnosis and testing.	**10**
7	conditioning system Control diagnosis and testing.	**10**
Textbook	Lab Experiments user manual	

Department	Mechanical Engineering	Major	Automotive Mechanics						
Course Name	Vehicle Parts Design	Course Code	MMEV 434						
Prerequisites	MMEV 342	Credit Hours CRH	2		CTH	5			
			L	2	P	0	T	3	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:

The course includes an overview of the design process, engineering mechanics, and failure prevention under static and variable loading, shafts, bearings, transmission elements, lubrication, and characteristics of the principal types of mechanical elements.

Topics:

- Introduction to mechanical engineering design: load, stress...
- Failure prevention
- Design of mechanical elements: clutches, brakes, shafts, gears, bearings, flexible elements, belts, ropes and chains.
- Transmission, steering and suspension design

References: Mechanical engineering design, Budynas, Nisbett, tenth edition, ISBN-13: 978-0073398204

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Introduction.	2
2	Design based on strength and stiffness. Factor of safety. Stress concentration.	2
3	Theories of failure. Failure due to static loading. Fatigue failure, dynamic loading.	4
4	Shafts design and calculation.	4
5	Clutch design and calculation.	4
6	Brakes design and calculation (disk brake, drum brake).	4
7	Transmission, Suspension and steering design.	4
8	Design and selection of bearings and flexible elements.	4
9	Design and selection of belt and chain drives.	4

Textbook	Mechanical engineering design, Budynas, Nisbett, tenth edition, ISBN-13: 978-0073398204 Design of Machine Elements by V. B. Bhandari, TMH Mechanical Engineering Design by Shigley and Mischke, TMH Theory and Problems of Machine Design by Hall, Holowenko and Laughlin, TMH Machine Design by T.H. Wentzell, Cenage Learning. Design of Machine Elements by M. F. Spotts, Prentice Hall

Department	Mechanical Engineering	Major	Automotive Mechanics						
Course Name	Fluid Power	Course Code	MMEV 443						
Prerequisites	MMEV 314	Credit Hours CRH	3		CTH	4			
			L	2	P	2	T	0	

CRH: **Credit Hours** L: **Lecture** P: **Practical** T: **Tutorial** CTH: **Contact Hours**

Course Description:
This course provides the student with the basic knowledge concerned with the function, processes, and applications of the hydraulic and pneumatic components. The principle of fluid power is the transmission of forces ad motions using a confined, pressurized fluid. This is achieved by analyzing the performance of hydraulic and pneumatic components. Also included in this course is performing the design and constructing the principle circuit in the lab

Topics:

- Basic principles of fluid power.
- Fluid power components.
- Hydraulic circuit analysis.
- Pneumatic circuit analysis.
-

Experiments: If applicable, it will support the theoretical topics.
References: Fluid power system dynamics , William Durfee, Zongxuan Sun and James Van De**Ven**

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Introduction: Overview, Fluid Power Examples and Analyzing Fluid Power Systems.	**2**
2	Basic principles of fluid power: Pressure and flow, Power and efficiency, Hydraulic and air fluids, and fluid behavior.	**4**
3	Basic principles of fluid power: fluid behavior(viscosity, Bulk Modulus, Pascal's law and high forces).	**4**
4	Basic principles of fluid power: Conduit flow and pressure losses in conduits.	**4**
5	Basic principles of fluid power: Orifice flow, bends and fittings.	**2**
6	Fluid power components cylinders, pumps, motors, and control valves.	**4**
7	Fluid power components: Accumulators, filters, reservoirs, hoses and fitting.	**4**
8	Hydraulic circuit analysis: fluid resistance, fluid capacitance, fluid inertance, connections laws and states.	**4**
9	Pneumatic circuit analysis: fluid resistance, fluid capacitance, fluid inertance, connections laws and states.	**4**
Textbook	Fluid power system dynamics , William Durfee, Zongxuan Sun and James Van De Ven.	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Symbols and Components of Hydraulic Circuits: Analyze and explain the meanings of the symbols of the valves, cylinders, motors, filters and other components.	**2**
2	Hydraulic Circuits: • Understand the functional performance of the hydraulic circuits. • Know the symbols of the hydraulic circuit components. • Design and construct and implement the circuits.	**10**
3	Pneumatic Circuits: Control in single acting cylinder, Regulate the speed in single acting cylinder, Control in double acting cylinder, Speed control, Indirect control in single and double acting cylinders, Automatic return to the double acting cylinder using limit valves (switches),Control depending on pressure or without ensuring the final position, Control depending on time or without ensuring the final position.	**10**
4	Representing the Circuits Diagrams: The methods of numbering and symbolling of elements in the circuit diagram according to the standards, Writing the sequence of processes using one the following methods(1-Listing with time order, 2-Listing a tabulated form, 3-Direction diagram, 4-Sequence chart, 5-Functional performance chart). Draw the sequence of functions using the following method (1-Motiondiagram, 2-Displacement-step, diagram.3-Displacement-time diagram, 4-Control diagram).	**10**
Textbook	Lab Experiments user manual.	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Vehicle Dynamics	Course Code	MMEV 442
Prerequisites		Credit Hours CRH	3 CTH 6
		L 2 P 2 T 2	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
The main objectives of this course are describe and analyses the operation of a vehicle suspension and predict vehicle ride behavior and steady state handling performance. In this course, the physical principles of road vehicle aerodynamic design are explained.

Topics:

- The fundamental and application of vehicle motion analysis
- vehicle acceleration and braking performance.
- The fundamental of vehicle handling characteristics.
- The vehicle steady state stability conditions.
- The performance index of vehicle suspension and steering system.
- quasi-static rollover.
- Tires.

Experiments: If applicable, it will support the theoretical topics.
References: Fundamentals of vehicle dynamics by Thomas D. Gillesnie.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Introduction to vehicle dynamics: Fundamental approach to modeling, Dynamic axle loads.	4
2	vehicle acceleration performance: Power and traction-limited acceleration. vehicle braking performance: Deceleration equation, Braking forces and tire-road friction.	4
3	vehicle braking performance: Deceleration equation, Braking forces and tire-road friction.	2
4	The fundamental of vehicle handling characteristics: Aerodynamics, Drag, side and lift force, rolling resistance and total road loads.	4
5	The fundamental of vehicle handling characteristics: Ride excitation sources, vehicle response properties and perception of ride.	2
6	The vehicle steady state stability conditions: low-speed turning, high-speed cornering, and suspension effects on cornering	2
7	Vehicle suspension system: solid axles, independent suspensions, anti-squat and auto-pitch suspension geometry, anti-dive suspension geometry, roll center analysis, and active suspensions.	4
8	Vehicle steering system: the steering linkages, steering geometry error, front wheel geometry, steering system forces and moments, steerig system models, influence of front-wheel drive and four-wheel steer.	2
9	Rollover: quasi-static rollover of a rigid vehicle, quasi-static rollover of a suspended, transient rollover and accident experience.	4

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
10	Tires: tire construction, size and load rating, terminology and axis system, mechanics of force generation, tractive properties, cornering properties, camber thrust, alignig moment, combined braking and cornering, conicity and ply steer, durablility forces and tire vibrations.	**4**
Textbook	Fundamentals of vehicle dynamics by Thomas D. Gillesnie.	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Using Engine and chassis Dynamometers.	**8**
2	Using ADAMS/CAR software package.	**6**
3	Using Universal Transmission Dynamometers.	**6**
4	Using Car Sim software.	**6**
5	Using Suspension Sim software.	**6**
Textbook	Lab Experiments user manual.	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Automotive workshop management	Course Code	MMEV 483
Prerequisites		Credit Hours CRH	2 CTH 2

L	2	P	0	T	0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:

This course is designed to provide students with management skills such as planning, organizational structure, workshop layout design, scheduling and controlling which will be needed in Automotive Workshops. Calculating cost and expenditures of the workshops and the process of supplying spare parts to these workshops and maintenance scheduling of various vehicle's groups will be discussed.

Topics:

- Introduction to feasibility studies for automotive workshops.
- The design concepts of planning, organizational structure of automotive workshops.
- Automotive Workshop Health and Safety.
- Maintenance methods.
- Workshop management software.
- Workshop design and layout project.

Experiments: If applicable, it will support the theoretical topics.

References:

-Automotive Workshop Design Equipment Installation, ©2011 Alemlube Pty Ltd. REMA TIP TOP GmbH.

-Business Unit Automotive 85586 Poing/Germany, design, construction and equipment of modern workshop.

- AUTOMOTIVE WORKSHOP SAFETY, Fix the Risks Work Safe.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Introduction to feasibility studies for automotive workshops: Feasibility Study process, Feasibility Analysis, Aims and objectives, type of business, Preliminary steps, Finance and Money, case Study	6
2	the design concepts of planning, organizational Structure of automotive workshops: Vehicle Operations Facilities, Vehicle Maintenance Facilities, Planning and Programming considerations, Vehicle Operations and Vehicle Maintenance Complex, Vehicle Operations Administrative Facility Functions, Vehicle Maintenance Facility Functions, Space Criteria for Vehicle Operations Facilities and Vehicle, Site Evaluation Maintenance Facilities, Site Design, Building Design and systems, Layout planning.	8
3	Automotive Workshop Health and Safety: Health and safety requirements and information, Determine the appropriate health and safety practices and equipment, Fire prevention and emergency procedure, Management of outdoor Areas Health and Safety, Disposal of waste systems, Handling and storing chemic, Management of indoor areas Health and Safety.	6
4	ORGANIZATION STRUCTURE WORKSHOP: Goal of Organization Structure Workshop, Definition of Organization Structure, Organizational Structure,	6

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
	Organizational Elements, Hierarchical Structure, Maintenance Structure, Operations and Procedures.	
5	Maintenance methods: What is maintenance, Management Objectives, Types of Maintenance, Reactive Maintenance, Preventive Maintenance, Predictive Maintenance, Maintenance Procedures and Documentation.	**6**
Textbook	-Automotive Workshop Design Equipment Installation, ©2011 Alemlube Pty Ltd. REMA TIP TOP GmbH -Business Unit Automotive 85586 Poing/Germany, design, construction and equipment of modern workshop - AUTOMOTIVE WORKSHOP SAFETY, Fix the Risks Work Safe	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Alternative Fuel Technologies ,Hybrid and Electrical Vehicles	Course Code	MMEV 431
Prerequisites		Credit Hours CRH	3 CTH 4
			L 2 P 2 T 0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
This course is designed to provide students with knowledge of the theory and principles description of hybrid vehicles and electric vehicles, which are presently as a revolution in Automotive technology sectors In addition to that, the course, introduces current trends in alternative fueled vehicles. The course includes an overview of current alternative fueled vehicles in production. The theory of operation of different types of hybrid vehicles will be covered, battery types, Fuel Cell Vehicles, Hydrogen-ICE vehicles, Alternative Fuels and Flex Fuel vehicles.

Topics:
Alternate-Fuels.
Hybrid Electric Vehicle Systems.
Integrated Hybrid systems from many manufactures**.**

Experiments: If applicable, it will support the theoretical topics.

References: Toyota Hybrid System, Toyota Motor Corporation, Public Affairs Division 4-8 Koraku 1-chome,Bunkyo-ku, Tokyo, 112-8701 Japan
Hybrid and Alternative Fuel Vehicles, Second Edition, James D. Halderman&

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Alternative Fuel Vehicles: Introduction to the fundamentals, Alternative Fuels, Alternative Fuel Definitions, Alternative Fuel kinds, Fuel Use in Public Transportation, Pollution Effects, Emissions from Alternative Fuels.	6
2	Introduction to Hybrid Vehicles: Hybrid Engine Systems, Hybrid Auxiliary and High-Voltage Batteries, Electric Motors, Generators, and control, Regenerative Braking System, Hybrid Vehicle Transmissions and Transaxles, Hybrid Vehicle Heating and air Conditioning, Honda Hybrid Vehicles.	8
3	Toyota/Prius Hybrid Vehicles.	12
4	Fuel Cells and Advanced Technologies Electrical vehicles.	6
Textbook	Toyota Hybrid System, Toyota Motor Corporation, Public Affairs Division 4-8 Koraku 1-chome, Bunkyo-ku, Tokyo, 112-8701 Japan. Hybrid and Alternative Fuel Vehicles, Second Edition, James D. Halderman & Tony Martin, Prentice Hall, 2011. Hybrid and Alternative Fuel Vehicles (3rd Edition) [Paperback] James D. Halderman.	

Detailed of Practical Contents		
No.	**Contents**	**Hours**
1	Demonstrate the appropriate use of personal protection equipment compare and contrast the different types of high voltage batteries used in hybrid and electric vehicles.	**4**
2	Perform a removal of, and the appropriate tests to, the high voltage battery perform a removal of the Converter/Inverter assembly.	**6**
3	Perform a cooling system service for the Converter/Inverter system.	**6**
4	In depth, scan data analysis and trouble code procedures Manufacturer specific symptom and information code diagnostics.	**6**
5	Motor Generator diagnostics and loss of isolation (LOI) testing.	**6**
6	Hybrid vehicle networking, reprogramming and module coding Removal and replacement of HV Battery Packs and inverter assemblies.	**4**
Textbook	Lab Experiments user manual.	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Heating, Ventilation and Air Conditioning	Course Code	MMEV 472
Prerequisites		Credit Hours CRH	2 CTH 2

L	2	P	0	T	0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
Review of basic thermodynamics, vapor compression cycles, Refrigerants and their characteristics, Basic vapor compression equipment, Introduction to absorption refrigeration, Psychometrics and psychometric processes, Human comfort, Heat gain-through walls and fenestrations, Cooling load calculations, Duct design and air distribution system, Load calculation using software packages, Laboratory work.

Topics:

- Introduction – unites and dimensions, fundamental concepts.
- basic principles of thermal engineering.
- Air conditioning systems.
- Moist air properties and conditioning process.
- Refrigeration cycles.
- Components of refrigeration cycles and air conditioning systems.
- Heat transmission in Building structures.
- Solar radiations.
- Space heating and cooling load.

References: Faye C. M. et. Al. Heating Ventilation and Air Conditioning: Analysis and Design, Wiley, ISBN 978-0471470151, 2004.

P. G. Down, Heating and cooling load calculations, 2008.

Roger W.H., Design Handbook, MC Graw Hill, 2006.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Introduction – Unites and dimensions- Fundamental concepts.	2
2	Air conditioning systems.	2
3	Moist air properties and conditioning processes.	2
4	refrigeration cycle.	4
5	Indoor air quality .	4
6	Heating transmission in building structures.	4
7	Solar radiation.	4
8	Space heating load.	4
9	EES and EXCEL in solving open-ended design problems.	4
10	Applications .	2

Textbook	Faye C. M. et. Al. Heating Ventilation and Air Conditioning: Analysis and Design, Wiley, ISBN 978-0471470151, 2004. P. G. Down, Heating and cooling load calculations, 2008 Roger W.H., Design Handbook, MC Graw Hill, 2006.

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Renewable Energy	Course Code	MMEV 461
Prerequisites		Credit Hours CRH	2 CTH 2
			L 2 P 0 T 0

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
Review of Heat Transfer, Solar angles, and solar radiation on earth's surface, Solar radiation on tilted surfaces, Radiation measurements, Solar collectors and concentrators, Storage, Photovoltaic, Wind energy, Geothermal energy, Other renewable energy sources.

Topics:

- Review of Heat Transfer.
- Basics of Radiation Heat Transfer.
- Overview of the energy situation.
- Determine energy requirements.
- Effect of government regulation on the renewable energies industry.
- Solar basics and solar thermal power.
- Wind power.
- Hydropower.
- Biomass.
- Photovoltaic and fuel cells.
- State of the industry.

References: Schaeffer, John, The Complete Guide to Renewable Energy Technologies and Sustainable Living (30th Ed.).
Real Goods Solar Living Sourcebook, 2007.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Introduction and basic heat transfer concepts.	2
2	Introduction to radiation heat transfer applicable to solar systems.	2
3	Renewable energy; background and overview.	2
4	Depletion of traditional energy sources e.g. fossil fuels.	2
5	Solar heating and air conditioning, Solar electric generation.	2
6	Photovoltaic (PV), PV modules and integrated systems.	2
7	Solar thermal, Solar farming.	2
8	Geothermal power, Heat pumps.	4
9	Wind energy.	2
10	Hydropower, Ocean generation systems.	2
11	Fuel cells.	2
12	Biomass, waste and other resources.	2

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
13	Using renewable energy.	2
14	Managing renewable energy.	2
15	Future energy mix: global energy scenarios.	2
Textbook	Schaeffer, John, The Complete Guide to Renewable Energy Technologies and Sustainable Living (30th Ed.). Real Goods Solar Living Sourcebook, 2007. Boyle, Godfrey, Bob Everett, and Janet Ramage (eds.). Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press, 2004.	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Turbocharging and engine boosting	Course Code	MMEV 473
Prerequisites		Credit Hours CRH	2 CTH 2
		L 2 P 0 T 0	

CRH: Credit Hours L: Lecture P: Practical T: Tutorial CTH: Contact Hours

Course Description:
This course provides a technical education in the field of turbochargers and turbocharging for automotive professionals. It will start from the fundamental requirements of turbocharger systems and focuses on automotive application and will look at recent developments.

Topics:
The course structure will include:

- Reasons for turbocharging and supercharging.
- Basic mechanical and aerodynamic design features.
- Turbocharger strip down and benchmarking.
- Design aspects and consideration of turbine, compressor and bearing systems.
- Failure modes and their identification.
- Waste gating, variable geometry and multistage turbocharging.
- Turbo installation.
- Recent developments and the influence of future engine technologies.

References: Fundamentals of Turbocharging, Nicholas C. Baines**.**

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Reasons for turbocharging and supercharging.	4
2	Basic mechanical and aerodynamic design features.	4
3	Basic mechanical and aerodynamic design features.	4
4	Design aspects and consideration of turbine, compressor and bearing systems.	4
5	Failure modes and their identification.	4
6	Waste gating, variable geometry and multistage turbocharging.	4
7	Turbo installation.	4
8	Recent developments and the influence of future engine technologies.	4
Textbook	Fundamentals of Turbocharging, Nicholas C.Baines**.**	

Department	Mechanical Engineering	Major	Automotive Mechanics
Course Name	Advanced topics in automotive technology	Course Code	MMEV482
Prerequisites		Credit Hours CRH	2 CTH 2
			L 2 P 0 T 0

CRH: **Credit Hours** L: **Lecture** P: **Practical** T: **Tutorial** CTH: **Contact Hours**

Course Description:
This course deals with the analysis of technological trends in the automotive industry and how technological changes may affect the future technician's job duties, manager's decisions, how business and society will adapt to emerging technology and society as a whole. To promote understanding of the course content, course projects, study of engineering functions and collection of technical data may be integrated when appropriate.

Topics:

- Applications of advanced and smart materials in modern vehicles.
- How aerodynamics affects modern car design.
- Advanced topics in an internal combustion engine (ICE).

References: Dhananjay Kumar Srivasta and others (Editors), Advances in internal combustion engines research, ISBN 2522-8366.

Detailed of Theoretical Contents		
No.	**Contents**	**Hours**
1	Advanced topics in the following: 1- Advanced internal combustion engine (ICE). The objective of this topic is to provide knowledge on development of a high efficiency, low emissions and low fuel consumption engine utilizing renewable energy sources such as hydrogen fuel, biogas fuel or new techniques. 2- Modern cars exterior design. The objective of this topic is focusing on aerodynamics and shape design, which affects engine efficiency and fuel consumption. 3- Advanced and smart materials. The objective of this topic is focusing on new materials used in manufacturing new car parts, such as electromagnetic bearing, electromagnetic damper, MRF damper and MRF gearbox.	32

Textbook	1-J. Paulo Davim Editor, Modern Mechanical Engineering, ISBN 978-3-642-45176-8. 2- Sanford L. Moskowitz, Advanced materials innovation, ISBN 0470508922. 3- Peter L. Reece smart materials and structures, new research, ISBN 1-60021-107-0

Appendix Laboratory Equipment, Workshops and Laboratories

No.	Laboratory name / workshop	Capacity of training	Number of trainers	Training courses benefiting from the laboratory / workshop / lab
1	Thermodynamics Lab	15	1	Thermodynamics course
2	Fluid Mechanics lab	15	1	Fluid Mechanics course
3	Vibration lab	15	1	Vibration Mechanics course
4	Internal Combustion Engines lab	15	1	Internal Combustion Engines course
5	Principle of control lab	15	1	Principle of control
6	Advance Engines Management lab	15	1	Advance Engines Management Course
7	Vehicle Dynamics lab	15	1	Vehicle Dynamics Course
8	Vehicle Design lab	15	1	Vehicle Design Course
9	Hydraulic and pneumatic Lab	15	1	Hydraulic and pneumatic system Course
10	Hybrid Vehicles lab	15	1	Alternative fuels and Hybrid –electric Vehicles Course

List of Detailed Equipment for Each Laboratory, Workshop or Lab

Thermodynamics Lab		
No.	**Product's Name**	**Quantity**
1.	Free and Force Heat transfer device	1
2.	Linear and Radial Heat transfer device	1
3.	Radiation Heat transfer device	1
4.	Heat exchanger device	1
5.	Heat measurements sensors	1

Vibration Lab		
No.	**Product's Name**	**Quantity**
1	Free and Forced Vibration Apparatus	1
2	Torsional Vibration Apparatus	1

Internal Combustion Lab		
No.	**Product's Name**	**Quantity**
1	Engine dynamometer	1

Principle of control Lab		
No.	**Product's Name**	**Quantity**
1	Automation Studio Software	1

Advance Engines Management lab		
No.	**Product's Name**	**Quantity**
1	Automotive electric and electronic integrated components interface system	1
2	Oscilloscope	1
3	OBD II Tester	1
4	Automatic Transmission Dynamometer	1

Vehicle Dynamics lab		
No.	**Product's Name**	**Quantity**
1	Vehicle dynamics simulator	1
2	Chassis Dynamometer	1
3	Adams Software	1
4	TCS /ABS / ASC Simulator	1

Vehicle Design Lab		
No.	**Product's Name**	**Quantity**
1	Solidworks Software	1

Hybrid Vehicles Lab		
No.	**Product's Name**	**Quantity**
1	Hybrid Simulator	1

Hydraulic and pneumatic Lab		
No.	**Product's Name**	**Quantity**
1	Hydraulic Apparatus	1
2	Pneumatic Apparatus	1

Fluid Mechanics lab		
No.	**Product's Name**	**Quantity**
1	Manometer	1
2	Bernoulli Theorem Demonstration	1
3	Hydraulic Bench	2
4	Hydrostatic Pressure	1
5	Dead Weight Calibrator	1
6	Horizontal Osborne -Reynolds Demonstration	1
7	Orifice and Free Jet Flow	1
8	Flow meter Demonstration	1
9	Hydrostatic Bench	1
10	Pressure measurement unit	1

Fluid Mechanics lab		
No.	**Product's Name**	**Quantity**
11	Energy losses in pipes	1
12	Flow over wire	1

References

Textbooks	**1.**	College physics by Serway and Faughn.
	2.	Thermodynamics: An Engineering Approach. Yunus Cengel / Michael Boles ISBN10/13: 0077986695 / 0-07-798669-5.
	3.	Automobile Electrical and Electronic Systems, Tom Denton, Fourth Edition
	4.	Engineering Mechanics-Statics, Hibbeler, R.C.13th Edition, Pearson Prentice Hall, 2015, ISBN-13: 978-0133918922.
	5.	Heywood, John B. Internal combustion engine fundamentals. (McGraw-Hill series in mechanical engineering) Bibliography: p. Includes index. I. Internal combustion engines. I. Title. 11. Series. TJ755.H45 1988 621.43 87-15251.
	6.	Feedback systems: an introduction for scientists and engineers / Karl Johan Åström and Richard M. Murray p. cm. Includes bibliographical references and index. ISBN-13: 978-0-691-13576-2 (alk. paper).
	7.	Mechanics Of Materials, Ninth Edition, R. C. HIBBELER.
	8.	Beucher, O., and Weeks, M., Introduction to Matlab and Simulink, A Project Approach, 3rd edition, Infinity Science Press, 2007.
	9.	Applied Fluid Mechanics, 6/E. Robert L. Mot. ISBN10/13: 0131146807/9780131146808.
	10.	Automotive mechatronics, (Bosh2015) Halderman, J. & Linder, J. (2012). Automotive Fuel and Emissions Control Systems (3rd Edition) Upper Saddle River, NJ: Pearson Education. [ISBN 13:978-0-13-254292-0].
	11.	Halderman, J. D. (2011). Diagnosis &Troubleshooting of Automotive Electrical, Electronic, & Computer Systems (6th Edition) Upper Saddle River, NJ: Pearson Education. [ISBN 13:978- 0132551557].
	12.	Fundamentals of Vibrations, Leonard Meirovitch.
	13.	Mechanical Vibrations, Singiresu S. Rao.
	14.	Vehicle Noise, Vibration, and Sound Quality, Gang Sheng.
	15.	Noise, Vibration, and Harshness. (Volkswagen of America, Inc.Service Training Printed in U.S.A.Printed 03/2005, Course Number 861503)
	16.	Practical user manuals Solidworks essentials training.
	17.	Fundamentals of Turbocharging, Nicholas C. Baines.
	18.	Schaeffer, John, The Complete Guide to Renewable Energy Technologies and Sustainable Living (30th Ed.). Real Goods Solar Living Sourcebook, 2007.
	19.	Faye C. M. et. al. Heating Ventilation and Air Conditioning: Analysis and Design, Wiley, ISBN 978-0471470151, 2004.
	20.	P. G. Down, Heating and cooling load calculations, 2008.
	21.	Automotive mechatronics, Conrad Reifed.

	22.	fluid power system dynamics , William Durfee, Zongxuan Sun and James Van De Ven.
	23.	Fundamentals of vehicle dynamics by Thomas D. Gillesnie.
	24.	Toyota Hybrid System, Toyota Motor Corporation, Public Affairs Division 4-8 Koraku 1-chome,Bunkyo-ku, Tokyo, 112-8701 Japan. Hybrid and Alternative Fuel Vehicles, Second Edition, James D. Halderman & Tony Martin, Prentice Hall, 2011. Hybrid and Alternative Fuel Vehicles (3rd Edition) [Paperback] James D. Halderman.
	25.	Automotive Workshop Design Equipment Installation, ©2011 Alemlube Pty Ltd. REMA TIP TOP GmbH Business Unit Automotive 85586 Poing/Germany, design, construction and equipment of modern workshop. AUTOMOTIVE WORKSHOP SAFETY, Fix the Risks Work Safe.