



INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI

ACCREDITED BY **NAAC** WITH '**A**' GRADE
Marching Beyond 25 Years Successfully

M.E Automobile Engineering

Curriculum and Syllabus

Regulations 2021

(Based on Choice Based Credit System (CBCS))

Effective from the Academic year

2021-2022

Department of Automobile Engineering

School of Engineering

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

School of Engineering

Department of Automobile Engineering

VISION OF THE DEPARTMENT

To impart excellent education in Automobile Engineering to develop competent and reliable engineers for industry requirement who will also carry out research on continuous basis for the betterment of society.

MISSION OF THE DEPARTMENT

1: To offer superlative learning experience through innovative teaching practices supported with excellent laboratory facilities and exposure to recent trends in the automotive industry.

2: To develop comprehensive knowledge in automobile engineering with equal emphasis on theoretical and practical aspects and problem solving skills.

3: To identify and develop industry attached laboratories so that students will become familiar with emerging industrial practices.

4: To focus on Industry-Institute Interaction for improved understanding of the latest technologies, training, internship, research promotion and entrepreneurship.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO-1: Independently create and blend knowledge, present methodological reports by the way of professional and ethical practices.

PEO-2: Employ recent engineering tools and critical thinking in solving engineering problems and widen solutions through novelty and creativity.

PEO-3: Exhibit valuable project management skills in modern organizational context and maintain intellectual development through lifelong learning.

PEO-4: Exhibit team work with professionalism in their chosen profession and adapt to current trends, technologies suitable for industries.

PROGRAM OUTCOMES (POS)

PO-1: Assess the problems, gather data related to the problem, generate and prioritize a set of alternative solutions, and select and implement the best alternative incorporating the recommendations of relevant codes of practice.

PO-2: Design, analyze, conduct numerical experiments, and interpret data of compound automotive engineering related problems

PO-3: Develop automotive engineering practices and principles to a project and lead the team for efficient project management considering economical and financial factors

PO-4: Justify the impact of engineering solutions on environment and the need for sustainable development.

PO-5: Implement the relevant techniques, skills, advanced modern engineering tools, instrumentation and software packages necessary for engineering practices.

PO-6: Build competent technical knowledge to practice automotive engineering business and develop ideas to amalgamate the existing and contemporary knowledge.

PROGRAM SPECIFIC OUTCOMES (PSOS)

PSO-1: Select, design, conduct experiments, and interpret data of an automotive system to meet the requirements of an automobile industry by using modern engineering tools and software.

PSO-2: Produce the appropriate techniques and modern engineering hardware and software tools in the design and integration of automotive system for the advancement of technology.

Regulation 2021

M.E. AUTOMOBILE ENGINEERING DEGREE COURSE
COURSES OF STUDY AND SCHEME OF ASSESSMENT
(MINIMUM CREDITS TO BE EARNED: 80)

Category	Course Title	Hours/Week				Maximum Marks			
		Lecture	Tutorial	Practical	Credits	CA	SEE	Total	
SEMESTER I									
Program Core	Automotive Chassis and Transmission	3	1	0	4	40	60	100	
Program Core	Automotive Engines and Accessories	3	1	0	4	40	60	100	
Foundation Course	Applied Mathematics	3	1	0	4	40	60	100	
Program Elective	Program Elective I	3	1	0	4	40	60	100	
Program Core	Automotive Chassis Components Laboratory	0	0	4	2	40	60	100	
Program Core	Automotive Engine Components Laboratory	0	0	4	2	40	60	100	
Mandatory courses	Research Methodology and IPR	2	0	0	2	40	60	100	
Audit Course	Technical Seminar I	0	0	0	0	40	60	100	
		14	4	8	22				

Category	Course Title	Hours/Week				Maximum Marks			
		Lecture	Tutorial	Practical	Credits	CA	SEE	Total	
SEMESTER II									
Program Core	Electric And Hybrid Vehicles	3	1	0	4	40	60	100	
Program Core	Automotive Electrical and Electronics	3	1	0	4	40	60	100	
Program Elective	Program Elective II	3	1	0	4	40	60	100	
Program Elective	Program Elective III	3	1	0	4	40	60	100	
Program Core	Performance & Emission Testing Laboratory	0	0	4	2	40	60	100	
Program Core	Computer Aided Vehicle Design Laboratory	0	0	4	2	40	60	100	
Program Core	Mini Project	0	0	4	2	40	60	100	
Audit Course	Technical Seminar II	0	0	0	0	40	60	100	
		12	4	12	22				

Category	Course Title	Hours/Week				Maximum Marks			
		Lecture	Tutorial	Practical	Credits	CA	SEE	Total	
SEMESTER III									
Program Elective	Program Elective IV	3	1	0	4	40	60	100	
Open Elective	Open Elective I	3	1	0	4	40	60	100	
Internship	Internship	0	0	4	2	40	60	100	
Project	Dissertation I	0	0	20	10	40	60	100	
		6	2	24	20				

Category	Course Title	Hours/Week				Maximum Marks			
		Lecture	Tutorial	Practical	Credits	CA	SEE	Total	
SEMESTER IV									
Project	Dissertation II	0	0	32	16	40	60	100	
		0	0	32	16				

LIST OF PROGRAM CORE COURSES

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MAPC11	Automotive Chassis and Transmission	3	1	0	4
21MAPC12	Automotive Engines and Accessories	3	1	0	4
21MAPC13	Automotive Chassis Components Laboratory	0	0	4	2
21MAPC14	Automotive Engine Components Laboratory	0	0	4	2
21MAPC21	Electric And Hybrid Vehicles	3	1	0	4
21MAPC22	Automotive Electrical and Electronics	3	1	0	4
21MAPC23	Performance & Emission Testing Laboratory	0	0	4	2
21MAPC24	Computer Aided Vehicle Design Laboratory	0	0	4	2
21MAPC25	Mini Project	0	0	4	2

LIST OF PROGRAM ELECTIVE COURSES

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MAPE01	Automotive Pollution and Control	3	1	0	4
21MAPE02	Vehicle Dynamics	3	1	0	4
21MAPE03	Vehicle Body Engineering	3	1	0	4
21MAPE04	Two and Three Wheelers	3	1	0	4
21MAPE05	Special Types of Vehicles	3	1	0	4
21MAPE06	Vehicle Control Systems	3	1	0	4
21MAPE07	Combustion Thermodynamics and Heat Transfer	3	1	0	4
21MAPE08	Simulation of IC Engines	3	1	0	4
21MAPE09	Engine Management Systems	3	1	0	4
21MAPE10	Automotive Air Conditioning System	3	1	0	4
21MAPE11	Alternative Fuels	3	1	0	4
21MAPE12	Vehicle maintenance	3	1	0	4
21MAPE13	Simulation of Vehicle systems	3	1	0	4
21MAPE14	Automotive Aerodynamics	3	1	0	4
21MAPE15	Automotive Safety	3	1	0	4
21MAPE16	Transport Management	3	1	0	4
21MAPE17	Automotive Electrical Technology	3	1	0	4
21MAPE18	IC Engine process Modelling	3	1	0	4
21MAPE19	Materials in Automotive Technology	3	1	0	4
21MAPE20	Modelling of vehicle systems	3	1	0	4
21MAPE21	Finite Element Methods in Automobile Engineering	3	1	0	4
21MAPE22	Electronics in Engine Management System	3	1	0	4
21MAPE23	Theory of Fuels and Lubricants	3	1	0	4
21MAPE24	Quality Control Process and Reliability	3	1	0	4

LIST OF OPEN ELECTIVE COURSES

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MAGE01	Hydraulic and Pneumatic Systems	3	1	0	4
21MAGE02	Total Quality System and Engineering	3	1	0	4
21MAGE03	Robotics and Sensors	3	1	0	4
21MAGE04	Mechatronics in Manufacturing Systems	3	1	0	4
21MAGE05	Rapid Prototyping and Tooling	3	1	0	4

LIST OF FOUNDATION COURSES

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MAFC01	Applied Mathematics	3	1	0	4

LIST OF MANDATORY COURSES

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MAMC01	Research Methodology and IPR	2	0	0	2

LIST OF INTERNSHIP COURSES

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MAIT01	Internship	0	0	4	2

LIST OF PROJECT COURSES

Code No.	Course	Hours / Week			Credits
		Lecture	Tutorial	Practical	
21MAPR01	Dissertation - I	0	0	20	10
21MAPR02	Dissertation - II	0	0	32	16

COURSE OBJECTIVE: (EMPLOYABILITY)

To understand the detailed concept, construction, operation of chassis components and various types of mechanical transmission components, hydrodynamic devices, hydrostatic devices and automatic transmission system

UNIT I INTRODUCTION**12**

Automotive chassis, Elements of the Chassis, **Layout with reference to power plant**, steering location and drive, frames, consideration of various loads acting on the frame, Frameless constructional details, materials, testing of frames, **integral body construction**.

UNIT II FRONT AXLE STEERING SYSTEM**12**

Front axle type, rigid axle and split axle, Constructional Details, Materials, Front wheel geometry viz., camber, castor, kingpin inclination, toe-in and toe-out. Condition for true rolling motion of road wheels during steering. Steering geometry. Ackermann and Davis steering. **Construction details of steering linkages**. Different types of steering gear box. Steering linkages layout for conventional and independent suspensions. Turning radius, instantaneous centre, wheel wobble and shimmy. Over-steer and under-steer. Power and power assisted steering

UNIT III DRIVE LINE STUDY**12**

Effect of driving thrust and torque –reaction. Hotchkiss drives. Torque tube drive, radius rods. Propeller shaft. Universal joints. Final drive- different types. Two speed rear axle. Rear axle construction-full floating, three quarter floating and semi-floating arrangements. Differential-conventional type, Non-slip type, **Differential locks and differential housing**.

UNIT IV CLUTCH AND GEAR BOX**12**

Requirement of Transmission system. Different types of clutches: Principle, construction and operation of friction clutches. Gear box. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications. **Different types of gear boxes**.

UNIT V HYDRODYNAMIC DRIVES**12**

Principles, performance and limitations of fluid coupling Constructional details of a typical fluid coupling. Reduction of drag torque, Principle, construction and advantages of hydrodynamic torque converters. **Performance characteristics, converter couplings**. Multi-stage Torque converter and poly phase torque converter

TOTAL: 60 Hours**COURSE OUTCOME:**

- CO-1:** Compare the different types of frame and chassis used in Automotive.
- CO-2:** Judge the different types of drive lines and drives used in Automotive.
- CO-3:** Differentiate the types of front axle and rear axles used in motor vehicles.
- CO-4:** Examine the working principle of conventional and independent suspension systems.
- CO-5:** Distinguish the working principles of clutch, gearbox and hydrodynamic drives.

TEXT BOOKS:

1. K. Newton, W.Steeds and T.K.Garret, "The Motor Vehicle", 13th Edition, Butterworth Heinemann,2004
2. P.M.Heldt, "Automotive Chassis", Chilton Co., New York, 1982.

3. W.Steed, "Mechanics of Road Vehicles", Illiffe Books Ltd., London. 1992.
4. Heldt P.M, Torque Converters, Chilton Book Co., 1992.

REFERENCES:

1. Harban Singh Rayat, "The Automobile", S. Chand & Co. Ltd, New Delhi, 2000.
2. G.J.Giles, "Steering Suspension and Tyres", Illiffe Books Ltd., London, 1975.
3. Kirpal Singh, "Automobile Engineering", Standard publishers, Distributors, Delhi, 12th Edition, 2011.
4. G.B.S.Narang, "Automobile Engineering", Khanna Publishers, New Delhi, 5th Edition, 2014.
5. R.P.Sharma, "Automobile Engineering", Dhanpat Rai & Sons, New Delhi, 2000.
6. Heinz Heisler, "Advanced Vehicle Technology", second edition, Butterworth – Heinemann, New York, 2002
7. Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers, Delhi, 2005

21MAPC12

AUTOMOTIVE ENGINES AND ACCESSORIES

**L T P C
3 1 0 4**

COURSE OBJECTIVE (EMPLOYABILITY)

To impart knowledge on various automotive engine types, its performance characteristics and engine subsystems.

UNIT I ENGINE BASIC THEORY

12

Engine types - operating cycles of SI and CI Engines - **Engine design** and operating parameters - Two and four stroke engines - Typical performance curves for automobile engines- two stroke engine - **performance and pollution aspects.**

UNIT II FUEL SUPPLY AND IGNITION SYSTEM

12

Fuel supply system of I.C. engine and elements, Theory of carburetion and **carburetors** — Design aspects — **Petrol Injection and diesel fuel injection** - pumps and injectors, gasoline direct injection system - conventional and electronic ignition systems for SI engine.

UNIT III COOLING AND LUBRICATING SYSTEM

12

Air cooling and water cooling - thermosympon cooling, forced **cooling systems.** Fins and radiator - design aspects. Theory of lubrication — types of lubrication, splash lubrication system, petroil lubrication system, forced feed **lubrication system.**

UNIT IV AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS

12

Premixed combustion, diffused combustion, laminar and turbulent combustion of fuels in engines. **Droplet combustion** — combustion in SI and CI engines. - Cylinder pressure data and heat release analysis. Optimized design of **combustion chambers.**

UNIT V NEW ENGINE TECHNOLOGY

12

Lean Burn engine – Different approaches to lean burn – LHR engine – Surface ignition concept – catalytic ignition – homogenous charge compression ignition in diesel engines – variable valve timing – electronic engine management.

TOTAL: 60 Hours

COURSE OUTCOME:

CO-1: Use the I.C engine basics

CO-2: Distinguish the fuel and ignition system thoroughly

CO-3: Demonstrate the knowledge on cooling and lubricating system

CO-4: Differentiate the air motion combustion and combustion chambers

CO-5: Develop the knowledge on new engine technology

TEXTBOOKS:

1. J.B.Heywood, 'Internal combustion engine Fundamentals', McGraw Hill Book Co, 1989.
2. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, 3rd Edition, 2007.

REFERENCES:

1. Edward F.Obert, 'Internal combustion engines and air pollution' Harber and Row Publishers, 1973.
2. M.Khovakh, 'Motor Vehicle Engines', Mir Publishers, Mascow,1976
3. W.H.Crouse and A.L.Anglin, 'Automotive Emission control', McGraw Hill Book Co, 1995.

21MAPC13

AUTOMOTIVE CHASSIS COMPONENTS LAB

L	T	P	C
0	0	3	2

COURSE OBJECTIVE: (SKILL DEVELOPMENT)

To train the Students to know the details of different chassis components, dismantling and assembling them.

LIST OF EXPERIMENTS

1. Study and measurement of Heavy duty vehicle frame (Leyland, Tata etc)
2. Study and measurement of Light duty vehicle frame (Ambassador, Maruti van etc)
3. Dismantling and assembling of Front Axle
4. Dismantling and assembling of Front Rear Axle
5. Dismantling and assembling of Differential
6. Dismantling and assembling of Steering Gearbox
7. Study of Braking systems – hydraulic servo vacuum, compressed air power brakes.
8. Study of Leaf spring, coil spring, torsion bar spring, Hydraulic shock absorber
9. Dismantling and assembling of Diaphragm Clutch assembly
10. Dismantling and assembling of Gear Box and Transfer case

THE LIST OF EQUIPMENTS - Each 1 No (For a batch of 15 Students)

1. Heavy duty vehicle chassis frame (Leyland or Tata)
2. Light duty vehicle chassis frame
3. Front axle
4. Rear axle
5. **Steering system**
2. Steering gear box (Rack and pinion, re-circulating Ball type)
3. Hydraulic brake system
4. Air brake system
5. Leaf spring, coil spring, torsion bar
6. Hydraulic shock absorber
7. Diaphragm clutch assembly
8. Gear box (light duty, heavy duty)
9. Transfer case

TOTAL: 30 Hours

COURSE OUTCOME:

- CO-1: Classify the Heavy duty and Light duty vehicle frame
- CO-2: Assess the Front Axle, Rear Axle and Differential
- CO-3: Distinguish the Steering systems and Braking systems
- CO-4: Select the Leaf spring, coil spring, torsion bar spring, Hydraulic shock absorber
- CO-5: Build the Clutch, Gear Box and Transfer case assemblies

21MAPC14	AUTOMOTIVE ENGINE COMPONENTS LAB	L	T	P	C
		0	0	3	2

COURSE OBJECTIVE: (SKILL DEVELOPMENT)

To train the Students to know the details of different engine components, dismantling and assembling them.

LIST OF EXPERIMENTS

1. Dismantling of 4 cylinder petrol engine.
2. **Assembling of 4 cylinder petrol engine.**
3. Dismantling of 6 cylinder diesel engine.
4. **Assembling of 6 cylinder diesel engine.**
5. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI
6. Study of ignition system components – coil, magneto and electronic ignition systems.
7. **Study of engine cooling system components**
8. Study of engine lubrication system components
9. Ovality and taper measurement of cylinder bore and comparison with standard specifications
10. Ovality and taper measurement of engine crank shaft and comparison with standard specification

LIST OF EQUIPMENTS - Each 1 No

1. Four cylinder petrol engine
2. Six cylinder diesel engine
3. Fuel filter, fuel injection pump, injector, carburetor, MPFI component
4. Ignition coil, magneto, electronic ignition system components
5. Water pump, thermostat, radiator, temperature gauge
6. Lub oil pump, pressure relief valve, filter, oil pressure gauge
7. Internal micrometer, external micrometer, dial gauges.

TOTAL: 30 Hours

COURSE OUTCOME:

- CO-1: Classify the petrol and diesel engine.
CO-2: Differentiate the 2-stroke and 4-stroke engines
CO-3: Assess the fuel injection system and ignition system components
CO-4: Select the engine cooling and lubrication system components
CO-5: Evaluate the measurement of cylinder bore and engine crank shaft.

COURSE OBJECTIVE: (EMPLOYABILITY)

To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, charging System, Ignition System, Lighting System and Dash – Board Instruments, Electronic ignition system, various sensors and the role of ECU.

UNIT I BATTERIES AND STARTING SYSTEM 12

Different types of Batteries – Principle, Construction and **Electrochemical action of Lead** – Acid battery, Electrolyte, Efficiency, Rating, Charging, Testing and Maintenance. Starting System, **Starter Motors** – Characteristics, Capacity requirements. Drive Mechanisms. Starter Switches.

UNIT II CHARGING SYSTEM, LIGHTING SYSTEM AND ACCESSORIES 12

D.C. Generators and Alternators their Characteristics. Control cutout, Electrical, Electro-mechanical and electronic regulators. **Regulations for charging**. Wiring Requirements, Insulated and earth return system, details of head light and side light, **LED lighting system**, head light dazzling and preventive methods. Lighting design, Dash board instruments, Horns, wiper, Trafficators, **Warning system** and safety devices

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEMS 12

Electronic ignition system and components, Spark plugs, Advance mechanisms. Different types of electronic ignition systems - **variable ignition timing**, distributor less ignition. Spark timing control. Electronic fuel injection systems. Engine mapping

UNIT IV SENSORS IN AUTOMOBILES 12

Basic sensor arrangement. **Types of sensors** – Oxygen sensor, fuel metering/Vehicle speed sensor, mass air flow sensor, temperature sensor, altitude sensor, pressure sensor and detonation sensor. **Various actuators** and its application in automobiles

UNIT V MICROPROCESSOR IN AUTOMOBILES 12

Microprocessor And Microcomputer controlled devices in automobiles such as instrument cluster, Voice warning system, **Travel information system**, Keyless entry system, Automatic Transmission. **Environmental requirements** (vibration, Temperature and EMI)

TOTAL: 60 Hours

COURSE OUTCOME:

CO-1: Differentiate the batteries and starting system

CO-2: Compare the working of charging system, lighting system and accessories

CO-3: Examine the electronic ignition and injection systems

CO-4: Review the concept of sensors in automobiles

CO-5: Demonstrate the knowledge on microprocessor in automobiles

TEXT BOOKS:

1. A.W. Judge, Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.
2. William B. Ribbons -Understanding Automotive Electronics, 5th edition- Butter worth Heinemann, 1998
3. A.P.Young & L.Griffiths, Automobile Electrical Equipment, English Language Book Society & New Press, 1990.

REFERENCES:

1. G.W.Vinal, Storage Batteries, John Wiley & Sons inc., New York, 1985.
2. W.H.Crouse, Automobile Electrical Equipment, McGraw Hill Book Co Inc., New York, 1980.
3. Robert N Brady Automotive Computers and Digital Instrumentation, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
4. P.L.Kohli , "Automotive Electrical Equipment", Tata McGraw Hill Publishing Co., Delhi, 2004
5. Tom Denton, 'Automobile Electrical and Electronic Systems', Routledge press , 2013.

COURSE OBJECTIVE: (SKILL DEVELOPMENT)

To conduct performance test and emission test on the IC engines.

LIST OF EXPERIMENTS

1. Study of Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers used for IC engine testing.
2. Performance study of petrol and diesel engines both at full load and part load conditions.
3. Morse test on petrol and diesel engines.
4. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in engines.
5. Heat balance test on an automotive engine.
6. Testing of 2 and 4 wheelers using chassis dynamometers.
7. Study of NDIR Gas Analyzer and FID
8. Study of Chemiluminescent NO_x analyzer
9. Measurement of HC, CO, CO₂, O₂ using exhaust gas analyzer
10. Diesel smoke measurement.

TOTAL: 30 Hours

COURSE OUTCOME:

CO-1: Demonstrate the Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers.

CO-2: Assess the performance of petrol/diesel engines both at full and part load conditions.

CO-3: Examine the Morse test on petrol and diesel engines.

CO-4: Rate the compression ratio, volumetric efficiency in engines.

CO-5: Compare the Heat balance test on an automotive engine.

COURSE OBJECTIVE: (SKILL DEVELOPMENT)

To learn the basic procedures of computer aided design related to automobile components

Design calculation, model and analyze the following automobile components

1. Piston, piston pin and piston rings
2. Connecting rod.
3. Automobile valves
4. Crank shaft
5. Cam shaft
6. Vehicle Chassis
7. Leaf spring, coil spring and torsion bar.
8. Front axle system of a typical 4 Wheeled vehicle
9. Rear axle system of a typical 4 wheeled vehicle
10. Three speed and four speed gear boxes of a heavy vehicle

THE LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

1. Computer nodes - 25 Nos.
2. Software like CATIA or Pro-E – 20 licenses

TOTAL: 30 Hours

COURSE OUTCOME:

- CO-1: Develop the drawing of piston, piston pin and piston rings
- CO-2: Review the drawing of Piston connecting rod.
- CO-3: Compare the design of crankshaft, balancing weight calculations.
- CO-4: Complete the design and drawing of camshaft
- CO-5: Demonstrate the vehicle chassis design steps

COURSE OBJECTIVE: (SKILL DEVELOPMENT)

The objective of the project work is to enable the students on a project involving **theoretical** and **experimental studies** related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, **laboratory work**, computer analysis or **field work** as assigned by the guide and also to present in periodical seminars on the progress made in the project. Each student shall finally produce a **comprehensive report** covering background information, literature survey, **problem statement**, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines. The continuous assessment shall be made as prescribed by the regulation.

COURSE OBJECTIVE: (SKILL DEVELOPMENT)

To equip the students with standard concepts and tools at an advanced level of mathematics and applications that they would find useful in their disciplines

UNIT I MATRIX THEORY**12**

Eigen values using QR transformations – generalized eigenvectors – canonical forms – singular value decomposition and applications – **pseudo inverse** – least square approximations.

UNIT II DIFFERENTIAL EQUATIONS**12**

Introduction – **Equations**, with separable variables – Equations reducible to linear form – Bernoulli's equation – Riccati's equation – Special forms of Riccati's equation – Laplace transform methods for one dimensional wave equation – **Displacement in a long string** – Longitudinal vibration of an elastic bar.

UNIT III CALCULUS OF VARIATION**12**

Introduction – **Euler's equation** – several dependent variables Lagrange's equations of Dynamics – Integrals involving derivatives higher than the first – Problems with constraints – **Direct methods** and eigen value problems.

UNIT IV INTERPOLATION AND INTEGRATION**12**

Hermite's Interpolation, Simple case and General case – **Cubic Spline Interpolation**, Algorithm of interpolating cubic spline – Gaussian Quadrature – Cubature.

UNIT V LINEAR PROGRAMMING PROBLEM**12**

Simplex algorithm, Fundamental property of the **simplex method** – Graphical, Two phase and Big M Techniques – **Duality theory** – Dual simplex method – Integer programming.

TOTAL: 60 Hours**COURSE OUTCOME:**

CO-1: Develop the use of Fourier transformation

CO-2: Select the concepts of differential equations

CO-2: Evaluate the concepts of Calculus of Variations

CO-4: Construct the concepts of interpolation and integration

CO-5: Classify the linear programming problem.

TEXT BOOKS:

1. G.Stephenson, P.M.Radmore, Advanced Mathematical Methods for Engineering and Science students, Cambridge University Press 1999.
2. R.Bronson, Matrix Operations, Schaum's outline series, McGraw Hill, New York, 1989.
3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley, 10th Edition, 2011.

REFERENCES:

1. C.E.Froberg, Numerical Mathematics, The Benjamin/Cummings Publishing Co., Inc., 1985.
2. M.K. Jain, S.R.K. Iyengar, and R.K. Jain, Numerical Methods for Scientific & Engineering computation, Wiley Eastern Ltd., 1987.
3. A.S. Gupta, Calculus of Variations with Applications, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
4. K. Sankara Rao, Introduction to Partial Differential Equations, Prentice Hall of India Pvt Ltd., New Delhi 1997.
5. Boyce & Di Prima, Elementary Differential Equations and Boundary value problems, with ODE Architect CD, 9th Edition, 2014.

21MAPE01

AUTOMOTIVE POLLUTION AND CONTROL

L T P C
3 1 0 4

COURSE OBJECTIVE: : (EMPLOYABILITY)

To impart knowledge on automotive pollutant formation, control and to impart knowledge on various emission instruments and techniques

UNIT I EMISSION FROM AUTOMOBILES

12

Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, **global warming**, various emissions from Automobiles — Formation, transient operational effects on pollution.

UNIT II EMISSIONS FROM SPARK IGNITION ENGINE AND ITS CONTROL

12

Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon Nitric oxide. Lead particulate—Poly-nuclear Aromatic hydrocarbon emissions—Effects of design and operating variables on emission formation- **controlling of pollutants** from Engine- Thermal reacts — Catalytic converters — Charcoal Canister Control for evaporative emission — Positive Crank case ventilation system for UBHC emission reduction.

UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL

12

Physical and Chemical delay — Significance — Intermediate Compounds Formation — emission formation due to **incomplete Combustion** — Effect of Operating variables on Emission formation — White, Blue, and Black Smokes. Nitric Oxide and Particulate controlling of Emission — Operating Behavior- **Fumigation** EGR- Air Injection — Cetane number Effect.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES

12

Causes for Noise from Automobiles—Traffic Noise—Engine Noise—Transmission Noise—**vehicle structural Noise**, Exhaust Noise, Noise reduction in Automobiles — Encapsulation technique for noise reduction — **Silencer Design** on Sound reduction in automobiles.

UNIT V TEST PROCEDURES AND EMISSION MEASUREMENTS

12

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Seven mode and thirteen mode cycles for Emission Sampling — **Sampling problems** — Quantifying Emissions — Measurement of CO, CO by NDIR. **Hydrocarbon emission by FID**- Chemiluminescent detector for Measurement of NOR— Smoke meters — Dilution Tunnel Technique for particulate Measurement- Sound level meters.

TOTAL: 60 Hours

COURSE OUTCOME:

- CO-1:** Develop the various emissions formed in IC engines
- CO-2:** Review the effects of Emission formation in SI Engines
- CO-3:** Compare the control techniques for minimizing emissions
- CO-4:** Use the emission norms
- CO-5:** Explain the suitable methods for emission measurements.

TEXT BOOKS:

1. G.P.Springer and D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York, 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.

REFERENCES:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, 3rd Edition, 2007.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987
6. Chilton, 'Automotive Emission Controls Manual', Haynes Techbooks, 1st Edition, 2014.

21MAPE04

TWO AND THREE WHEELERS

L T P C
3 1 0 4

COURSE OBJECTIVE: : **(EMPLOYABILITY)**

To study and understand the constructional details, operating characteristics and design aspects of two and three wheelers.

UNIT I INTRODUCTION

12

Two and three wheelers Classifications- design considerations of the two and three wheelers – weight and dimension limitations –requirements stability problems, **gyroscopic effect**-pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS

12

2 stroke and 4 stroke SI engines and CI engines design criteria for engines – design of cylinders, cylinder head, **cooling fins**, crank case, connecting rod and crank shaft. Carburettor types and design. Battery coil ignition, magneto ignition and electronic ignition. **Lighting and other electrical system**.

UNIT III CLUTCHES AND TRANSMISSION **12**

Clutch, Types of clutches for 2 and 3 wheelers. Design of clutch system. Gears for two and three wheelers. **Design of gear box** and gear change mechanism. Belt drive, **chain drive** and shaft drive. Freewheeling devices, starting systems.

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES **12**

Types of frames used for two wheelers. Wheel frames- construction design of frames for fatigue strength **torsional stiffness and lateral stability**. Front and rear forks. Springs for **suspension**, Dampers, constructional details of wheel and tyres.

UNIT V THREE WHEELERS **12**

Three wheelers, types of three wheelers, Auto rickshaws, different types of Auto rickshaws, Pick-Ups and delivery type vehicle, **frames and transmission** for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

TOTAL: 60 Hours

COURSE OUTCOME:

- CO-1:** Distinguish the two wheelers and its technology along with its functions.
- CO-2:** Review power plant for different applications.
- CO-3:** Compare the transmission units used in two wheelers.
- CO-4:** Assess the different types of frames and suspension system used in two wheelers.
- CO-5:** Demonstrate the knowledge on various three wheelers.

TEXT BOOKS:

1. P.E. Irving, "Motor Cycle Engineering", Temple Press Book, London, 1964.
2. Marshal Cavandedish, 'Encyclopedia of Motor cycling', New York, 1989
3. S.Srinivasan, 'Motor cycle, Scooter, Mobeds', New century book house, 1988.

REFERENCES:

1. M.M.Griffin., 'Motor cycles from inside and outside', Prentice Hall Inc, New Jersey, 1978.
2. Servicing Manuals- various motor cycles, Scooters, Mopeds and three wheelers.

COURSE OBJECTIVE: : (EMPLOYABILITY)

The Main objective of this course is to provide the wider knowledge of safety concepts, safety equipments comfort and convenience system of automotive system.

UNIT I INTRODUCTION

12

Design of the body for safety, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction.

UNIT II SAFETY CONCEPTS

12

Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT III SAFETY EQUIPMENTS

12

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety, antiskid braking system, regenerative braking system, speed control devices.

UNIT IV COLLISION WARNING AND AVOIDANCE

12

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions, driver fitness detection.

UNIT V COMFORT AND CONVENIENCE SYSTEM

12

Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system, manual and automated wiper system, satellite control of vehicle operation for safe and fast travel.

TOTAL: 60 Hours**COURSE OUTCOME:**

CO-1: Examine the design of the bumper for safety.

CO-2: Select the concept of crumple zone, and also the effect of acceleration and deceleration.

CO-3: Analyze the various types of safety aspects such as active and passive safety.

CO-4: Evaluate the fundamentals of collision warning and avoidance.

CO-5: Apply the concept of the comfort and convenience system.

TEXT BOOK:

1. Bosch, "Automotive HandBook", 6th edition, SAE, 2004.

REFERENCES:

1. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.
2. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.
3. ARAI Safety standards

COURSE OBJECTIVE: : (EMPLOYABILITY)

The course objective is to introduce the essential principles of hydraulic and pneumatic system which related to automobile applications.

UNIT I INTRODUCTION**12**

Introduction to fluid power, properties - **hydraulic fluids**, air. Selection of hydraulic fluids, comparison between hydraulics and pneumatics. Symbols of pneumatic elements and **hydraulic elements**.

UNIT II PNEUMATIC SYSTEMS**12**

Basic requirement of pneumatic system. **Elements of pneumatics**, constructional details of air compressors, air motors, control valves, actuators and mountings, filter, lubricator, regulator. General approach of system design, **travel step diagram**. Types - sequence control, cascade, step counter method. K.V.Mapping for minimization of logic equation. Simple circuits.

UNIT III HYDRAULIC SYSTEMS**12**

Pumps and motors- types, characteristics. Cylinders, types, construction details. Valves for control of direction, flow and pressure, types, construction details. Power pack-elements, design. Pipes- material, **pipe fittings**. Seals and packing. **Maintenance of hydraulic systems**. Selection criteria for cylinders, valves, pipes.

UNIT IV ADVANCED TOPICS IN HYDRAULICS AND PNEUMATICS**12**

Electro pneumatics, **ladder diagram**. Servo and Proportional valves - types, operation, application. Hydro-Mechanical servo systems. **PLC-construction**, types, operation, programming.

UNIT V AUTOMOTIVE APPLICATIONS**12**

Hydraulic tipping mechanism, power steering, fort lift hydraulic gear, hydro-pneumatic suspension, air brake and **maintenance and troubleshooting** of pneumatic circuits.

TOTAL: 60 Hours**COURSE OUTCOME:**

CO-1: Summarize the basics of hydraulic and pneumatic systems

CO-2: Examine the working of hydraulic power drives

CO-3: Apply knowledge on fluid power elements

CO-4: Design the hydraulic and pneumatic systems.

CO-5: Evaluate the concept of programming in PLC circuits.

TEXT BOOKS/ REFERENCES:

1. Anthony Espisito, "Fluid Power with Application", Pearson Education (Singapore) Pte.Ltd, Delhi, India, Fifth Edition, First Indian Reprint, 2003.
2. S.R. Majumdar, "Oil Hydraulic Systems: Principles and Maintenance", Tata McGraw- Hill Publishing Company Ltd., New Delhi, Fourth Reprint, 2003.
3. KG. Festo, "Pneumatic Tips", Festo, Germany, 1987.
4. Andrew Parr, "Hydraulic and Pneumatics", Jaico publishing house, 1999.

COURSE OBJECTIVE: : (SKILL DEVELOPMENT)

To impart scientific, statistical and analytical knowledge for carrying out research work effectively.

UNIT I INTRODUCTION TO RESEARCH 6

The hallmarks of scientific research – **Building blocks** of science in research – Concept of Applied and Basic research – Quantitative and **Qualitative Research Techniques** – Need for theoretical frame work – Hypothesis development – Hypothesis testing with quantitative data. Research design – Purpose of the study: Exploratory, Descriptive, Hypothesis Testing.

UNIT II EXPERIMENTAL DESIGN 6

Laboratory and the **Field Experiment** – Internal and External Validity – Factors affecting Internal validity. **Measurement of variables** – Scales and measurements of variables. Developing scales – Rating scale and attitudinal scales – Validity testing of scales – Reliability concept in scales being developed – Stability Measures.

UNIT III DATA COLLECTION METHODS 6

Interviewing, Questionnaires, etc. Secondary sources of data collection. Guidelines for Questionnaire Design – Electronic Questionnaire **Design and Surveys**. Special Data Sources: Focus Groups, Static and Dynamic panels. Review of Advantages and Disadvantages of various Data-**Collection Methods** and their utility. Sampling Techniques – Probabilistic and non-probabilistic samples. Issues of Precision and Confidence in determining Sample Size. Hypothesis testing, Determination of Optimal sample size.

UNIT I V RESEARCH REPORT 6

Purpose of the written report – Concept of audience – Basics of written reports. Integral parts of a report – Title of a report, **Table of contents**, Abstract, Synopsis, Introduction, Body of a report – Experimental, **Results and Discussion** – Recommendations and Implementation section – Conclusions and Scope for future work.

UNIT V PRINCIPLES OF IPR, COPYRIGHT LAW AND PRACTICES 6

Introduction to **Intellectual Property Rights**, Concept and Theories Kinds of Intellectual Property Rights, Economic analysis of Intellectual Property Rights, **Advantages and Disadvantages of IPR**, Copyright and Neighboring Rights, Concept and Principles, Historical background and **Development of Copyright Law**, Leading International Instruments, Berne Convention, Universal Copyright Convention

Total: 30 Hours

COURSE OUTCOME:

CO-1: Propose to formulate research problem

CO-2: Select to carry out research analysis

CO-3: Classify to follow data collection methods

CO-4: Implement to understand multivariate statistical techniques

CO-5: Represent to understand about research report.

TEXT BOOKS/ REFERENCES

1. C.R.Kothari, Research Methodology, Wishva Prakashan, New Delhi, 2001
2. Donald H.McBurney, Research Methods, Thomson Asia Pvt. Ltd. Singapore, 2002
3. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property Eastern Book Company, Lucknow, 2009

21MAAC01

TECHNICAL SEMINAR - I

L T C P
0 0 0 0

COURSE OBJECTIVE: : (SKILL DEVELOPMENT)

Students should present the **specific topics** assigned by the department through the **power point presentation** by collecting information/details from various academic, **relevant industry** and open sources.

21MAAC02

TECHNICAL SEMINAR - II

L T C P
0 0 0 0

COURSE OBJECTIVE: : (SKILL DEVELOPMENT)

Students should present the specific topics assigned by the department through the **power point** presentation by collecting information/details from various **academic**, relevant industry and **open sources**.

21MAIT01

INTERNSHIP

L T P C
0 0 4 2

COURSE OBJECTIVE: : (EMPLOYABILITY)

The objective of the in-plant training is to enhance and improve the skill set and **knowledge** of the **automobile engineering** students which boost their performance and consequently helping them to meet their **career objectives**. Training helps learners to acquire the **latest techniques, skills, methodologies** and to build a strong foundation for their career growth. Three periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the faculty. The student has to undergo a training of 10 to 12 days during the semester in the **automotive related industries** and submit a **detailed report** based on the industry, products and services, things learned from the industry. This final report shall be typewritten form as specified in the guidelines

COURSE OBJECTIVE: : (EMPLOYABILITY)

The objective of the project work is to enable the Student who individually carryout the project. This Project which involves **theoretical and experimental studies** related to the branch of study. Every **project work** shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on **library reading, laboratory work, computer analysis or field work** as assigned by the guide and also to present in periodical seminars on the progress made in the project. Each student shall finally produce a **comprehensive report** covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines. The continuous assessment shall be made as prescribed by the regulation.

OBJECTIVE: : (EMPLOYABILITY)

The objective of the project work is to do a project individually which involves theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, **laboratory work, computer analysis or field work** as assigned by the guide and also to present in periodical seminars on the progress made in the project. Each student shall finally produce a **comprehensive report** covering background information, **literature survey, problem statement, project work details and conclusion**. This final report shall be typewritten form as specified in the guidelines.

The continuous assessment shall be made as prescribed by the regulation.