SILVER OAK UNIVERSITY
EDUCATION TO INNOVATION

Silver Oak University

College of Technology

Master of Mechanical Engineering - I.C. Engine & Automobile Engineering

Curriculum Booklet

Academic Year:
2020-21

Department of Mechanical Engineering

Vision

To be a premier center for electrical engineering excellence, fostering skilled, ethical engineers who lead in solving complex societal and industrial challenges through cutting-edge research and innovation.

Mission

1. To provide quality education for the to build their knowledge and skill.
2. To Promote and support research facility for collaborative environment and create opportunities.
3. To provide the students with the academic environment of excellence, entrepreneurship,leadership, ethical guideline and lifelong learning needed for a long productive career.

Program Educational Objectives (PEOs)

PEO1: To apply the fundamentals knowledge of Design, Manufacturing and Thermal.
PEO2: To impart a knowledge and skill for design and analysis using theoretical as well as software approach.
PEO3: To manage & develop mechanical component using conventional, non-conventional and computer aided manufacturing processes.
PEO4: To grow professionally in their career by life-long learning through continued education of technical and managerial skills also by membership & certifications of professional organizations.

Program Outcomes (POs)

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1: To create a system with their exceptional expertise and cutting-edge software abilities, they are adept at solving challenging mechanical and multidisciplinary challenges.
PSO2: Apply the Design Thinking approach, develop technical expertise in specialized fields like Manufacturing, Materials, Design, and Thermal Engineering, ultimately achieving excellence in product design and development.

Master of Mechanical Engineering - I.C. Engine & Automobile Engineering

Course Credit Structure

Sr No	Course Code	Course Name	Teaching Scheme				
			L.	T.	P.	Contact Hours	Credit
Semester 1							
1	1010127101	Advance Fluid Mechanics	3	0	2	5	4
2	1010127102	Advanced Thermodynamics and Combustion	3	0	2	5	4
3	1010127103	Computational Methods	3	0	2	5	4
4	1010127136	Alternative Fuel and Emission	3	0	2	5	4
5	1010127137	Automobile Engineering Maintenance	3	0	2	5	4
6	1010127138	Fundamentals of I.C.Engine & Automobile	3	0	2	5	4
7	1010007196	Research Methodology	2	0	0	2	2
		Total	**20**	**0**	**12**	**32**	**26**
Semester 2							
1	1010127104	Automobile Engineering System Design	3	0	2	5	4
2	1010127105	Experimental Techniques and Instrumentations in Automobile Engineering	3	0	2	5	4
3	1010127106	Vehicle Dynamics	3	0	2	5	4
4	1010127139	Automotive Chassis and Body Engineering	3	0	2	5	4
5	1010127140	Design and Optimization of Thermal Systems	3	0	2	5	4
6	1010127141	Automotive Manufacturing	3	0	2	5	4
7	1010127191	Mini Project With Seminar	0	0	4	4	2
		Total	**18**	**2**	**16**	**34**	**26**
Semester 3							
1	1010127236	Electric Vehicle Technology	3	0	2	5	4
2	1010127237	Modern Vehicle Design	3	0	2	5	4
3	1010127238	I.C. Engine Modeling & Simulation	3	0	2	5	4
4	1010127291	Dissertation Phase-I	0	0	24	24	12
		Total	**9**	**0**	**30**	**39**	**24**
Semester 4							
1	1010127292	Dissertation Phase-II	0	0	30	30	15
		Total	**0**	**0**	**30**	**30**	**15**

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
I.C. Engine & Automobile Engineering
Course Name: Advance Fluid Mechanics
Course Code: 1010127101
Semester: 1st

Prerequisite:

1. Fluid Mechanics
2. Gas Dynamics

Course Objective:

1. Establish an understanding of the fundamental concepts of fluid mechanics.
2. Understand and apply the potential flow equations to basic flows.
3. Understand and apply the differential equations of fluid mechanics including the ability to apply and understand the impact of assumptions made in the analysis.
4. Understand the boundary layer concepts with respect to fluid flow
5. Understand and apply the compressible flow equations.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Review of Basic Concepts and Fluid Properties:** Basic law of Fluid Motion, Internal stresses and external forces on fluid elements, Review of Concepts of Kinematics of fluid motion, vorticity, circulation, velocity potential and stream function, irrotational flow.	5	13
2	**Governing Equations of Fluid Flow in Differential Form:** Navier – Stokes Equation and exact solutions, Energy equation and solution of fluid flow with thermal effects.	4	10

3	**Dynamics of Ideal Fluid Motion:** Applications, Integrations of Euler's Equation of Motion, Generalized form of Bernoulli Equation, Potential flows, Principle of Superposition.	5	13
4	**Transition to Turbulence:** Introduction to Theory of Hydrodynamic Stability, Orr Sommerfeld equation, Results from transition studies, factor affecting transition and its control.	5	13
5	**One Dimensional Isentropic Flow:** General features, Working equations, Choking in Isentropic flow, Operation of nozzle, diffuser under varying pressure ratio, performance of real nozzles, applications of isentropic flow.	7	17
6	**Normal Shocks:** Introductory remarks, Governing equations, Rankine Hugoniot, Prandtl and other relations, weak shocks, thickness of shocks, normal shocks in ducts, performance of convergent divergent nozzle with shocks, moving shock waves, shocks problems in one dimensional supersonic diffuser, supersonic pilot tube	7	17
7	**Flow in constant area duct with friction:** Governing equations, Working Formulas and tables, Choking due to friction, Performance of long duct, Isothermal flow in long duct and flow in constant area duct with heating and cooling.	6	17

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Apply the fundamentals of kinematics and conservation laws of fluid flow systems.	1,2, 3
CO-2	Review the concepts of boundary layer and flow in transition.	4
CO-3	Analyse and apply the fundamentals of turbulent flow to various fluid flow systems.	4
CO-4	Apply the fundamentals of one dimensional isentropic flow to variable area duct.	5, 7
CO-5	Analyse the principles of normal shock formation and its effects.	6

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	To study the effect of angle of attack on Lift and Drag force.
2	To study the loss of energy in wake region behind various models (car, jeep, bus etc.) in the wind tunnel.
3	To draw profile of NACA Aero foils.
4	To Investigate on Recent development and advances in rarefied gas dynamics.
5	To visualize and plot the pattern of flow around an object in a fluid stream using Hale-Shaw apparatus.
6	To develop temperature distribution in thermal boundary layer for the flow over a flat plate.
7	To develop a Gas Table (Isentropic flow, Normal shocks, Fanno flow, Rayleigh flow) for different γ values.
8	A case study: Performance of real nozzle.

Major Equipment:

1. Matlab.
2. Reynolds's experiment test rig.
3. Test rig-comprising facilities to verify Bernoulli's theorem.

Books Recommended:

1. YunusCengel and John Cimbala, Fluid Mechanics, McGraw Hill Publishing Co. Ltd.
2. F M White, Viscous Fluid Flow, McGraw Hill Publishing Co. Ltd.
3. H Schlichting, Boundary Layer Theory, McGraw Hill Publishing Co. Ltd.
4. F M White, Fluid Mechanics, McGraw Hill Publishing Co. Ltd.
5. Fox, Pritchard and McDonald, Introduction to Fluid Mechanics, John Wiley & Sons
6. Zucker&Biblarz, Fundamentals of Gas Dynamics, John Wiley & Sons, Inc.
7. James John and Theo Keith, Gas Dynamics, Pearson Prentice Hall
8. S M Yahya, Fundamentals of Compressible Flow, New Age International Publishers
9. J D Anderson, Computational Fluid Dynamics, McGraw Hill Publishing Co. Ltd

List of Open-Source Software/learning website:

1. https://nptel.ac.in/
2. https://www.nfpa.com/home.htm

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	2	2	1	1	1	1				2	3	2
CO-2	3	2	3	2	1	1	1				1	2	2	2
CO-3	3	3	3	2	2	1	1		1			2	3	3
CO-4	3	3	2	2	2	1	1				1	2	3	2
CO-5	3	3	3	3	2	1	1					2	3	2

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Advanced Thermodynamics and Combustion
Course Code: 1010127102
Semester: 1st

Prerequisite:

1. Thermodynamics.
2. Heat Transfer

Course Objective:

1. Detailed understanding of thermodynamics laws and principles.
2. Fundamentals of combustion reaction rates and mechanisms.
3. Understanding of combustion processes and phenomena.
4. Combustion of liquid fuel droplets, solid fuels, and IC engine chambers.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Entropy:** A Measure of Disorder: Increases of entropy principle and its application, Tds relation, entropy change of solid, liquid andideal gas, entropy transfer with heat transfer, entropygeneration in open and closed system , entropy balance. **Energy:** A Measure of Work Potential: Energy transfer by heat, work &mass, decrease of energy principle and energy destruction, applications of Gouy–Stodola theorem, energy balance forsteady flow and closed processes, second law efficiency Law of Corresponding States	9	20

2	**Combustion thermodynamics:** Stoichiometry; first and second laws of thermodynamics applied to combustion; Ignition and combustion in SI engine; Flame travel; turbulent flame propagation; flame stabilization; vaporization; Review of detonation and Diesel knock; effect of various factors; Combustion chambers for SI engines; Combustion in CI engine; Ignition delay and diesel knock; Excess air supply and air motion; Combustion chamber for CI engines-Construction and Performance aspects; M-combustion chamber; latest combustion chamberand technology.	10	26
3	**Fundamentals of combustion kinetics:** Combustion products in equilibrium; rate of reactions; chain reactions; opposing reactions; consecutive reactions, competitive reactions; Conservation equation for multi component reacting systems.	9	20
4	**Combustion of liquid fuel droplet:** Fuel atomization; types of injectors; spray formation and characteristics; Oil – fired furnace combustion; gas turbine spray combustion; direct injection engine combustion; detonation of liquid gaseous mixture.	7	17
5	**Combustion of solid fuels:** Coal combustion; combustion of pulverized coal; combustion of coal on bed in a fluidized bed and in a cyclone burners; stabilization of pulverized coal combustion; design consideration of coal burners; combustion generatedpollution.	7	17

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Apply entropy principle to various thermal engineering applications	1
CO-2	Apply the concept of second law efficiency and exergy principle to various thermal engineering applications	1,2
CO-3	Apply the fundamentals of combustion phenomenon and principles of combustion kinetics	2,3
CO-4	Review the concepts of combustion of liquid fuels and solid fuels	4,5
CO-5	Analyse and apply the fundamentals combustion of liquid fuels and solid fuels	4,5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	To study about Entropy.
2	To study about Exergy.
3	Verify Second law efficiency and state Gouy–Stodola theorem.
4	Why the efficiency is found using 2nd law efficiency is always less than the normal thermal efficiency.
5	To study about IC Engine Knocking.
6	To study about different types of fuel atomization process and fuel injectors.
7	To study about solid fuel

Major Equipment:

1. Matlab.

Books Recommended:

1. YunusCengel& Boles, Thermodynamics – An Engineering Approach, McGraw Hill Publishing Co. Ltd.
2. Sonntag, Borgnakke& Van Wylen Fundamentals of Thermodynamics, John Wiley & Sons(Asia) Pvt. Ltd.
3. P.K. Nag, Engineering Thermodynamics, by McGraw-Hill, New Delhi
4. Kenneth K. Kuo, Principles of Combustion, John Wiley & Sons.
5. S. P. Sharma &Chander Mohan, Fuels & Combustion, Tata McGraw Hill.

List of Open-Source Software/learning website:

1. https://nptel.ac.in/.
2. www.vlab.co.in

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	2	2	1	1	1	1	1	1	1	2	3	2
CO-2	3	2	3	2	1	1	1	1	1	1	1	2	3	2
CO-3	3	3	3	2	2	1	1	1	1	1	1	2	3	3
CO-4	3	2	2	2	1	1	1	1	1	1	1	2	2	2
CO-5	3	3	3	3	2	1	1	1	1	1	1	2	3	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Computational Methods
Course Code: 1010127103
Semester: 1st

Prerequisite:

1. Engineering mathematics.

Course Objective:

1. The course intends to provide mathematical foundations to graduate students.
2. The course should enhance their ability to develop mathematical models.
3. The course should solve problems using analytical and numerical methods.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Differential Equations:** Basic Concepts: Modelling, Differential Equations, Ordinary and Partial differentiation, Order of the equation, Solution, Existence and Uniqueness of Solution, Initial Value problem, Boundary Value Problem, Linear and Non-Linear Equation. 1st Order ODE: Geometric Meaning of y'= f(x, y), Direction Fields, Euler's Method; Separable ODEs; Exact ODEs (Integrating Factors Method, Existence and Uniqueness of Solution); Linear ODEs(Homogeneous and Non- Homogeneous, Reduction to Linear problems); Orthogonal Trajectories. 2nd Order ODE: Linear Dependence and Linear Independence; Homogeneous Linear ODEs of Second Order (Principal of Superposition, Initial Value Problem, Boundary Value Problem); Homogeneous Linear ODEs with Constant Coefficients (Euler's formula and review of the circular and hyperbolic function, Exponential Solutions, Repeated Roots and Stability); Differential Operator; Modelling of Free Oscillations of Spring-Mass System; Homogeneous Linear	11	30

	ODEs with Non-constant Coefficient (Cauchy-Euler Equation, Existence and Uniqueness of Solutions)		
2	**Laplace Transforms:** Laplace Transform, Linearity, First Shifting Theorem (s- Shifting); Transforms of Derivatives and Integrals, ODE; Unit Step Function (Heaviside Function), Second Shifting Theorem (t-Shifting); Short Impulses, Dirac's Delta Function, Partial Fractions; Convolution, Integral Equations; Differentiation and Integration of Transforms, ODEs with Variable Coefficients; Systems of ODEs.	05	10
3	**Linear Algebra:** Matrices and Vectors: Vectors in 2-Space and 3-Space; Addition and Scalar Multiplication, Matrix Multiplication; Linear Systems of Equations and Gauss Elimination, Ill- Conditioning, Linear Independence, Rank of a Matrix, Solutions of Linear Systems: Existenceand Uniqueness; Determinants and Cramer's Rule; Inverse of a Matrix, Gauss– Jordan Elimination; Solution by Iteration. Vector Spaces, Inner Product Spaces, Norms, Linear Transformations; Matrix Eigenvalues, Determining Eigenvalues-Eigenvectors and their applications; Power Method for Eigenvalues; Symmetric, Skew-Symmetric, and Orthogonal Matrices	06	15
4	**Vector Calculus:** Vector Product; Vector and Scalar Functions and Their Fields, Vector Calculus: Derivatives; Curves, Arc Length, Curvature, Torsion; Gradient of a Scalar Field, Directional Derivative; Divergence of a Vector Field, Curl of a Vector Field. Line Integrals, Path Independence of Line Integrals; Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals; Triple Integrals, Divergence Theorem of Gauss, Further Applications of the Divergence Theorem, Stokes' Theorem.	05	10
5	**Fourier Analysis and PDE:** Fourier Series; Arbitrary Period, Even and Odd Functions, Half-Range Expansions; Forced Oscillations; Approximation by Trigonometric Polynomials; Sturm–Liouville Problems, Orthogonal Functions; Orthogonal Series, Generalized Fourier Series; Fourier Integral; Fourier Cosine and Sine Transforms; Fourier Transform, Discrete and Fast Fourier Transforms. Basic Concepts of PDEs; Modeling: Vibrating String, Wave Equation; Solution by Separating Variables; Use of Fourier Series; D'Alembert's Solution of the Wave Equation, Characteristics; Modelling: Heat Flow from a Body in Space, Heat Equation: Solution by Fourier Series. Steady Two-Dimensional Heat Problems	06	10
6	**Numeric Analysis:** Introduction, Solution of Equations by Iteration, Interpolation, Newton's Divided-Difference Interpolating Polynomials, Lagrange Interpolating Polynomials, Coefficients of an Interpolating Polynomial, Inverse Interpolation; Spline Interpolation, Numeric Integration and Differentiation. Numeric Methods for: First-Order	02	5

	ODEs, Multistep Methods, Systems and Higher (up to second) Order ODEs, Elliptic PDEs		
7	**Probability & Statistics:** Data Representation, Average, Spread; Experiments, Outcomes, Events; Probability, Permutations and Combinations; Random Variables. Probability Distributions; Mean and Variance of a Distribution; Binomial, Poisson, and Hypergeometric Distributions; Normal Distribution. Introduction, Random Sampling; Point Estimation of Parameter, Confidence Intervals; Testing Hypotheses, Decisions; Goodness of Fit, X2 - Test, Nonparametric Tests, Regression, Linear Regression, Polynomial Regression, General Linear Regression Nonlinear Regression, Correlation	07	20

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	To solve ordinary and partial differential equations analytically as well as numerically for Mechanical applications	1,6
CO-2	To apply Laplace transforms for solution of ODE.	2
CO-3	To explain fundamentals and applications of linear algebra and vector calculus for Mechanical engineering problems.	3,4
CO-4	To apply Fourier transformation to Mechanical systems.	5
CO-5	To explain fundamentals of statistics and probability for nondeterministic Mechanical systems	7

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	Solution of first order differential equation using numerical techniques.
2	Solution of nonlinear equation using bisection method, false position and Newton Raphson method.
3	Interpolation by Lagrange, Newton's divided-difference and spline method.
4	Numerical integration by trapezoidal and Simpson's rules.
5	Matrix operations and power method for Eigen values and Eigen vectors.
6	Finding DFT of one dimensional signal.
7	Solving linear systems of equation using elimination and iteration methods.

8	Solution of PDE by finite difference method.
9	Fitting a straight line and quadratic curve to the given data.
10	Finding mean and variance of binomial, Poison & hyper geometric distribution.

Books Recommended:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons Inc.
2. M D Greenberg, Advanced Engineering Mathematics, Pearson Education.
3. S C Chapra, and R C Canale, Numerical Methods for Engineers, McGraw Hill Publishing Co. Ltd.

List of Open-Source Software/learning website:

1. https://nptel.ac.in/

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3	2	2	2	1	1	1	1	1	1	2	3	2
CO-2	3	3	2	2	1	1	1	1	1	1	1	2	3	2
CO-3	3	2	3	2	2	1	1	1	1	1	1	2	3	3
CO-4	3	2	2	2	2	1	1	1	1	1	1	2	3	2
CO-5	3	2	2	2	1	1	1	1	1	1	1	2	3	2

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Alternative Fuel and Emission
Course Code: 1010127136
Semester: 1st

Prerequisite:

1. Materials Technology

Course Objective:

1. To educate the students about the use of alternate fuel in I.C engines.
2. Understand the use of such fuels and its role in combustion, performance and emissions in I.C engines.
3. This course is imparting knowledge on energy storage and its utilization in modern vehicles.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Unit 1: Conventional fuels** Estimation of conventional fuels; advantages and disadvantages of conventional fuels; Need for Alternate fuel; Availability and Comparative properties of Alternate fuels; Use of Alcohols; LPG, Hydrogen; CNG and LNG; Vegetable oils and Biogas in Automotive Engines;, Relative merits and demerits of various alternate fuels.	12	25
2	**Unit 2: Alcohol** Manufacture of Alcohols; Properties as engine fuels Alcohols and Gasoline blends; Performance in S. I. Engines: Methanol and gasoline blends; Effect of compression ratio; Alcohols in Stratified charge engines; Combustion characteristics in engines; Reformed alcohols use in CI Engines; Ignition accelerators; Alcohol Diesel emulsions; Dual fuel systems.	12	25

3	**Unit 3: Bio Energy systems:** Various vegetable oils for engines; Esterification Performance in engines; Biogas in engines; Performance and Emission characteristics; Shale oil, coal liquid and Tars and fuel; Performance and Emission characteristics	5	15
4	**Unit 4: Gaseous Fuels:** Availability of CNG; Properties; Modification required to use in Engines; Performance and Emission characteristics of CNG, LPG in SI and CI Engines; Performance and Emission data for LPG; Hydrogen Production methods; Storage and handling; Performance; Safety aspects.	8	20
5	**Unit 5: electric vehicle** Layout of an electric vehicle; Advantages and limitation; specifications; System components; Electronic control system; High energy and power density batteries; Hybrid vehicles; Solar energy based vehicles; Hydrogen energy based vehicles; Latest development	5	15

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Know the properties and application of conventional fuels	1
CO-2	Know the properties and application alternative fuels	2
CO-3	Know the production method of various alternative fuels	3
CO-4	Know about various electric and hybrid vehicles	4,5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	To study and performance analysis of Biodiesel used in 4 Stroke Petrol Engine
2	To study and performance analysis of Hydrogen used in 4 Stroke Petrol Engine
3	To study and performance analysis of CNG used in 4 Stroke Petrol Engine
4	To study and performance analysis of Ethanol used in 4 Stroke Petrol Engine

Major Equipment:

1. Multi / single cylinder four stroke petrol engine
2. Exhaust gas analyzer.

Books Recommended:

1. Bechtold R.L, Alternate fuels guide book, SAE.
2. Duffie& Beckman John Wiley , Solar Engineering of Thermal Processes
3. Lysen Georgia Inst., Introduction to Wind Energy Technology
4. Fowler, Energy & Environment, McGraw Hill
5. S.P. Sukhatme, Solar Energy, McGraw Hill Publishing Co. Ltd.

List of Open-Source Software/learning website:

1. https://nptel.ac.in/content/storage2/courses/112104033/pdf_lecture/lecture40.pdf.
2. https://nptel.ac.in/courses/103/107/103107157/

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	2	1	2	3	2			1		2	3	2
CO-2	3	2	2	1	2	3	3			1		2	3	2
CO-3	3	2	2	1	2	3	3		1			2	3	2
CO-4	3	2	2	1	3	3	2					2	2	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Automobile Engineering Maintenance
Course Code: 1010127137
Semester: 1st

Prerequisite:

1. Automobile System .
2. IC engines basics.

Course Objective:

1. Understand maintenance methods and garage practices in automobile engineering.
2. Learn about different documents used and records required in modern service stations.
3. Develop practical skills for effective vehicle maintenance and service management.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Vehicular Maintenance Practices:** Requirements and importance of service & maintenance, Preventive, Predictive & Breakdown maintenance, daily, weekly and monthly maintenance schedule, Periodic maintenance scheduled chart.	6	15
2	**Measuring Instruments:** Measuring instruments for wear, Fuel consumption, speed, acceleration, vibration, noise. Methods used for measurement of fuel consumption.	4	9
3	**Maintenance & Overhauling of engine components:** (a)Maintenance & Overhauling of engine components: Measurement of cylinder bore, cylinder boring and honing, liners fitting. Cylinder head facing, valve seat lapping. Adjustment of valve timing and fuel injection pump timing. Rocker arm gap	22	46

	adjustment/setting procedure. Tuning of carburetor. Fuel injection pumps and fuel injector's calibration. Engine Lubrication circuit and it components, Fuel supply circuit of petrol, Diesel, Bi-Fuel engines, Cooling system layout and its components, Air intake & Exhaust systems and components (b)Maintenance & Overhauling of drive lines: Adjustment of clutch, repair & replacement of clutch parts. Overhauling of all types of gear boxes. Repair & maintenance of Propeller shaft & universal joint. Differential back lash adjustment. Repair & maintenance of differential. Repair & maintenance of final drive/axles. (c)Maintenance & Overhauling of various systems: Lubrication and maintenance of suspension system. Study and adjustment of steering geometry; toe in, toe out, caster, camber, and king pin inclination. Maintenance of steering system. Maintenance of wheel and tyre. Tyre rotation, tyre re-treading, effect of tyre inflation & tyre wear. Wheel balancing. Maintenance of hydraulicbrakes; brake adjustments and bleeding of brakes. Study of air brake circuit & system components. Maintenance of radiator and water cooling system. Maintenance of lubrication system; chassis greasing, wheel bearing greasing etc. Hydraulic and Air Brake circuits and its components. Maintenance of electrical system components. (d)Diagnosis, Causes, and Remedies : Causes & remedies of different problems related engine (high fuel consumption, high engine oil consumption, Over heating of engine), clutch, gearbox, propeller shaft, differential, final drive, brakes, suspension, steering, wheels & tires, battery, Starting circuit & Charging circuit etc. (e)Maintenance & repair of vehicle body : Maintenance of vehicle body; minor and major repairs. Body repair tools &equipments. Introduction to denting & painting process of vehicles.		
4	**Electrical system maintenance - servicing and repairs** Testing methods for checking electrical components - checking batter - starter motor - charging systems - DC generator and alternator - ignitions system - lighting systems. Fault diagnosis and maintenance of modern electronic controls - checking and servicing of dash board instruments.	5	15
5	**Garage Practices:** Types, functions, operations and activities of service stations. Layouts of modern service station/workshop. Criteria and 06 15 requirements of service station and its layout. Study of service tools, measuring & gauging instruments and service/repair equipments with testing andrepairing processes.	5	15

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Learning of maintenance types/techniques.	1
CO-2	Learn about general maintenance and safety of car.	2,3
CO-3	To study about various maintenance techniques for different engine components and remedies for it.	3
CO-4	To study about various electrical systems and its remedies in case of failure	4
CO-5	Learning of different garage equipments and practices.	5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning.

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	Study of modern workshop layout.
2	Study of different types of job cards & maintenance schedule chart.
3	Study of measuring, gauging & service equipment.
4	Demonstration on tyre inflator and hydraulic hoist.
5	Demonstration on tyre changer and car washer unit.
6	Performance on wheel balancer.
7	Performance on wheel aligner.
8	Cleaning and testing of petrol injector.

Major Equipment:

1. Hydraulic hoist
2. Electronic tyre inflator
3. Tyre changer
4. Wheel aligner
5. Wheel balancer
6. Petrol injector cleaner test setup
7. Diesel nozzle tester and cleaner setup

Books Recommended:

1. William H. Crouse & Donald L. Anglin ,Automotive Mechanics ; Tata McGrawHill Publishing Company Ltd.
2. Anil Chikara ,Automobile systems , SatyaPrakashan.

3. K.K.Ramlingan ,Automobile Engineering , SciTech Publication.
4. Joseph Heitner ,Auto mechanics, East West Press.
5. Pattern and Donald ,Automotive Service Basics, Pearson Publications.
6. James D Halderman ,Advanced Engine Performance Diagnosis, PHI

List of Open-Source Software/learning website:

1. https://nptel.ac.in/
2. https://www.nfpa.com/home.htm

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	3	2	2	2	2	1				3	3	3
CO-2	3	2	2	2	2	3	3	1		1		2	3	3
CO-3	3	3	3	2	2	2	2					3	3	2
CO-4	3	3	3	2	2	2	2			1		3	3	3
CO-5	3	2	3	2	2	2	2		1			3	3	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Fundamentals of I.C.Engine & Automobile
Course Code: 1010127138
Semester: 1st

Prerequisite:

1. Automobile Engineering
2. Thermal Engineering.

Course Objective:

1. Build necessary fundamentals for understanding internal combustion engine components and air cycles.
2. Understand the fuel supply system of engines.
3. Learn about the automotive electrical system.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Introduction to I.C Engine**: Engine types and their operation; classification; Actual cycle; air fuel cycle; combustion charts (Equilibrium); Two stroke engines; four stroke engine; characteristics of engines; air capacity of engine, valve timing diagram; Fundamentals of Automotive Electronics, Microprocessor and micro computer applications in automobiles, Components for engine management system	8	17
2	Engine Components, Material, construction and design aspects; piston assembly, connecting rod, crankshaft, cylinder head, cylinder block, flywheel, ports, valves, valve actuating mechanism, cams, camshaft drives, vibration damper	9	20

3	**Fuel Supply in SI Engines:** Carburetion and mixture requirements; Transfer pump, Carburetors - types, constructional and design aspects; Mixture distribution and inlet manifold; The concept of multipoint fuel injection system, Fuel Supply in CI Engines, Injection system components; Jerk and Distributor pumps, Mechanical and Pneumatic governors, Injectors	10	27
4	Stratified Charged Low heat rejection engine; four / three valve engine, OHC engine, MPFI, VVT, cam less engine, New engine technology, Recent developments in I. C. engines	10	26
5	Automotive electrical system, Basic transmission systems, suspension systems, steering systems, tyre and wheel, handling and maintenance, troubleshooting and repairs.	5	10

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Understand the engine fundamentals and their performance	1
CO-2	Understand the various engine components	2
CO-3	Understand the fuel supply and the ignition systems	3
CO-4	Understand the cooling and lubrication system	4
CO-5	Understand the turbo charging, supercharging and new engine technology	5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning.

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	Testing of Internal combustion engine according to Indian and International standards.
2	Study and Performance analysis of two stroke Petrol Engine.
3	Study and Performance analysis of four stroke Petrol Engine.
4	Study and Performance analysis of four stroke Diesel Engine.
5	To Study various engine components, material and design aspects.
6	Study of MPFI and CRDI systems
7	Study of ignition, cooling, lubrication systems

8	Study of clutch and Transmission systems
9	Study of automotive brakes, suspension and steering systems
10	Study of Recent developments in the field of I.C. Engine and Automobile

Major Equipment:

1. Multi / single cylinder four stroke petrol engine
2. Multi / single cylinder four stroke diesel engine
3. Exhaust gas analyzer

Books Recommended:

1. C. Fayette Taylor & Edward S. Taylor ,I.C. Engines –, International text book com
2. E. F. Obert, Harper ,I.C. Engine & Air Pollution, Row Publishers, New York
3. - Herbert E. Ellinger ,Automotive Engines
4. Young, Griffitns Automobile Electrical & Electronic Equipments - - Butterworths, London
5. V.A.W.Hilliers - Hatchin Fundamentals of Automotive Electronics -, London
6. R.K.Singhal ,I.C Engine.

List of Open-Source Software/learning website:

1. https://nptel.ac.in/
2. https://www.nfpa.com/home.htm

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	3	2	1	2	2	1				3	1	3
CO-2	3	2	2	2	1	3	3	1		1	1	2	1	3
CO-3	3	3	3	2	1	2	2				1	3	1	2
CO-4	3	3	3	2	1	2	2			1		3	1	3
CO-5	3	2	3	2	1	2	2		1			3	1	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Research Methodology
Course Code: 1010007196
Semester: 1st

Prerequisite:

1. Fundamental understanding of mechanical engineering principles.
2. Familiarity with advanced topics in thermodynamics and heat transfer as applied to engines and automobiles.
3. Basic knowledge of mechanical testing and experimental techniques.
4. knowledge of vehicle dynamics, control systems, and emission control technologies.

Course Objective:

1. The purpose of this subject is to orient the students to the scientific methodology of research and presenting their thesis.
2. Research constitutes primarily of literature review, giving critical comments on the literature reviewed and identifying the gap, problem formulation, modeling in either an analytical or experimental set up, validating the model and solving the problem you set for yourself.
3. Student should be able to present and defend the solution he/she has found, in a simple and easy manner.
4. Communicating the research outcomes, is an art wherein, you do not want to either undermine or over emphasize the content, within the short time limit given for such presentations.
5. The balance of critical technicality and overall outcomes is the key to an effective presentation. The language, content and articulation should be such as to convey in a unified manner, the gist of your work.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
2	0	0	2	2

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Starting Research** **Find what is expected of you:** Identify specific requirements for evaluation/review and what constitutes completion of your work.	5	13

	Find where the source is available Establish proper methods for finding the relevant material from the source. Determine the nature and extension of papers that you should read. **Identify the gaps:** Learn to Critique existing knowledge and how to find the gap. **Analyse the question:** Identify key areas in your field. Determine the nature and extension of papers that you should read. **Formulate the Problem Statement:** Understand what should be the key aspects of your problem statement. Examples of effective and ineffective Titles. **Validation**: Identify problem and experimental/theoretical data for comparison with your model Learn how to extrapolate/scale data for validation Find what is acceptable level of error and justification.		
2	**Finding Good Literature** **Decide which sources you will need** Differentiate between journals, conferences, books, magazines and their quality Understand how to establish their quality and authenticity **Finding Information** How to conduct effective searches How to find relevant papers related to your area of research How to capture critical information **Identify main ideas in scholarly literature** Understand and identify the bias, theoretical position and evidence produced **Write notes to organize your ideas** Compare ideas and concepts from different papers	4	10
3	**Writing and Presenting your Work** **Effective technical writing** How to write Report, Paper, Developing a Research Proposal, Format of research proposal **Build your argument** Recognise the importance of emphasizing your point Distinguish between your point and the evidence available Acknowledge the evidence	5	13
4	**Review and finalize your work** Know and follow the Process of reviewing and proof reading your work Use feedback to improve your work **Check the logistics of your presentation** Identify the key message of your presentationUnderstand the expectations and what will be the key review points	5	13
5	**Develop the structure of your presentation** Understand the key components of an oral presentation Know the usual structure of a good presentation. **Prepare for delivery of your Oral presentation** Rehearse and time your presentation	7	17

	Prepare to answer questions from the audience: Fundamental concepts should be spoken from memory as reviewer will be looking for evidence of your thorough understanding Read more than the content you are presenting; keep sources ready on hand for reference.		

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Conduct a quality literature review and find the research gap.	1
CO-2	Identify an original and relevant problem and identify methods to find its solution	2
CO-3	Present and defend the solution obtained in an effective manner in written or spoken form.	3
CO-4	Follow research ethics & Validate the model.	4
CO-5	Understand IPR protection for further research and better products.	5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

Books Recommended:-

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
3. Mayall, "Industrial Design", McGraw Hill, 2019.
4. Niebel, "Product Design", McGraw Hill, Sixth edition.
5. Asimov, "Introduction to Design", Prentice Hall, Fifth edition.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Propertyin New Technological Age", 2016.
7. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Automobile Engineering System Design
Course Code: 1010127104
Semester: 2nd

Prerequisite:

1. Machine Design and Industrial Drafting.
2. Automobile System.

Course Objective:

1. Establish an understanding of the fundamental concepts of Machine Design.
2. To make student get acquainted with to standardize the automobile part after designing the system component like clutch and propeller shaft.
3. To make student get acquainted with to standardize the automobile part after designing the system component like axle, steering linkages, braking parts, suspension system etc. within the space limitations and optimize it.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Design of clutch system** Design of various clutch system components (Single plate, multiple plates, centrifugal clutch, lining material) and Pressure Plate Assembly components. Hydraulic Clutch system components (Master Cylinder, Slave cylinder, and reservoir) clutch fluid – its properties, hydraulic pipes. Clutch Pedal &Clutch hand lever design. Clutch cable Design/ selection considerations.	8	15
2	**Design of propeller shaft:** Design of propeller shaft for bending, torsion, rigidity andcritical speed criteria. Design of universal joint and slip joint.	4	10

3	**Design of Axle:** Front Axle beam, Steering Knuckle, King pin.Rear Axle (drive Axle) tube, Design of fully floating, half floating axle and dead axle. Design of Final drive and differential: Design of spiral bevel and hypoid type of final drive/differential.	6	15
4	**Design of steering system:** Condition for true rolling, Turning circle radius, Principle of Ackermann steering, Ackermann-linkage geometry, Steering gear ratio, Steering box torque, Design of various steering gear box.	4	10
5	**Design of braking system:** Brake balance, Stopping distance, Brake fade, Work done in braking, Braking efficiency, Braking of vehicle, Braking ofvehicle moving in a curved path, Design of drum brake, Design of disc brake, Design of hydraulic brake system, Design of hand brake or parking brake.	9	20
6	**Design of suspension system:** Function of suspension, Forces act on suspension, Suspension springs (laminated or leaf, coil, torsion bar, rubber spring, pneumatic spring), Design of laminated or leafspring, Design of helical or coil spring, Design.	9	20
7	**Ignition, Lubricating and cooling systems:** Types of ignition system, electronic ignition system, components of ignition system, starting system, Functions & properties of lubricants, methods of lubrication-splash type, pressure type, dry sump, and wet sump & mist lubrication. Oil filters, oil pumps, oil coolers.	5	10

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Design clutch systems and their components, including single plate, multiple plates, centrifugal clutches, and hydraulic clutch systems.	1
CO-2	Develop and analyze the design of propeller shafts, including considerations for bending, torsion, rigidity, and critical speed.	2
CO-3	Design and evaluate the components of front and rear axles, including axle tubes, floating axles, and differential systems.	3
CO-4	Analyze and design various steering systems, including Ackermann steering geometry, steering gear ratios, and steering gear boxes.	4,5
CO-5	Design and optimize braking and suspension systems, including drum and disc brakes, hydraulic brake systems, and various suspension springs.	6,7

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	To standardize the any automobile system part for size, torque and power point of view.
2	To design the clutch for given situation of automobile vehicle.
3	To design the propeller shaft for given situation of automobile vehicle.
4	To design the Axle for given situation of automobile vehicle.
5	To design the steering system for given situation of automobile vehicle.
6	To design the braking system for given situation of automobile vehicle.
7	To design the suspension system for given situation of automobile vehicle.
8	To optimize the part from above design given situation of automobile vehicle.

Major Equipment:

1. Matlab.
2. Cut section of various automobile systems.

Books Recommended:

1. N.K.GIri, Automotive Mechanics, Khanna Publishers.
2. R.B. Gupta, Auto Design, Satya Prakashan.
3. Joseph E. Shigley& Larry D.Mitchell "Mechanical Engineering Design", Fourth Edition, McGraw Hill Publishing Co. Ltd.
4. P.M.Heldt, Automotive Chassis, Chilton Co., NY.
5. R S KhurmiJ.K.Gupta, Machine Design ,S chand& Co.

List of Open-Source Software/learning website:

1. https://nptel.ac.in/www.learnerstv.com
2. http://auto.howstuffworks.com/
3. nptel.iitk.ac.in/

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	3	2	2	1	1	1		1		2	3	2
CO-2	3	3	3	2	2	1	1					2	3	3
CO-3	3	3	3	2	2	1	1		1			2	3	3
CO-4	3	3	3	3	3	1	1			1	1	2	3	3
CO-5	3	3	3	3	3	1	1	1				2	3	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Experimental Techniques and Instrumentations
Course Code: 1010127105
Semester: 2nd

Prerequisite:

1. Mechanical measurement and metrology.
2. Automobile System.

Course Objective:

1. The course is designed to provide the fundamental knowledge of experimentation techniques, related instruments used for thermal engineering applications.
2. To present a problem oriented in depth knowledge of Experimental Techniques and Instrumentations.
3. To address the underlying concepts and methods behind Experimental Techniques and Instrumentations.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Experimentation Planning:** Planning of experiments, various stages in experimental investigations; preliminary, intermediate and final, steady state and transient techniques, selection of measuring devicesbased on static, dynamic characteristics and allowable uncertainties, basics of Taguchi method for design of experiments	8	17
2	**Instrumentation & Measurements:** Fundamental elements of a measuring instrument, static and dynamic characteristics, principles of temperature measurement, calibration of thermocouple, RTD, Orifice plate and Pressure gauge, design of temperature measuring instruments, thermo positive elements, thermocouples in series & parallel, pyrometry, steady	10	26

	state and transient method of measuring heat flux, measurement of thermal radiation and associated parameters, measurement of turbulence, measurement of thermal conductivity of solids, liquids and gases, measurement of thermo-physical properties, measurement of solar radiation.		
3	**Advancement in measurements:** Data logging and acquisition, use of sensors for error reduction, elements of microcomputer interfacing, intelligent instruments and their use, Basics of P, PI, PID controllers,pneumatic and hydraulic controllers, electronic controllers	8	17
4	**Advanced measurement techniques and analysis:** Shadowgraph, Schlieren, Interferometer, Laser Doppler Anemometer, Hot wire Anemometer, Telemetry in measurement, Gas Analyzers Smokemeters, gas chromatography, spectrometry.	8	20
5	**Uncertainty in measurements:** Errors in instruments, Analysis of experimental data and determination of overall uncertainties in experimental investigation, uncertainties in measurement of measurable parameters like pressure, temperature, flow etc. under various conditions	8	20

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Discuss experimentation techniques for various thermal systems.	1,2
CO-2	Discuss the various instruments used for measuring different properties significant for evaluation of performance of thermal systems and to carry out uncertainty analysis.	2,5
CO-3	Appraise the computing facilities for measurement and acquisition of different properties.	3
CO-4	Appraise advanced measurement techniques and systems.	4

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	To calibrate and measure temperature using thermocouple, RTD.
2	To carry out calibration of pressure measuring devices: U-tube manometer, pressure gauge.
3	To measure the thermal conductivity of any fluid.
4	To carry out calibration of flow measuring devices: orifice meter and rotameter.
5	To measure the direct and diffuse solar radiation using pyranometer and pyrheliometer.
6	To study and familiar with data logging and acquisition system.
7	To develop a Gas Table (Isentropic flow, Normal shocks, Fanno flow, Rayleigh flow) for different γ values.
8	To study various electronics controllers used in thermal measurements.
9	To study and compare various advanced measurement techniques.
10	To perform experiment with any thermal system and to carry out uncertainty analysis for the same.

Major Equipment:

1. Calibration set-ups for various thermo-physical properties
2. Pyranometer
3. Pyrheliometer
4. Gas chromatographer
5. Gas analyzer
6. Data acquisition system
7. Interferometer
8. Laser Doppler anemometer
9. Hot-wire Anemometer

Books Recommended:

1. Buck & Beckwith, Mechanical Measurements, Pearson
2. E O Doebelin, Measurement systems, Application and Design, McGraw-Hill.
3. Raman C S, Sharma G R, Mani V S N, Instrumentation Devices and Systems, McGraw- Hill
4. R K Jain, Mechanical and Industrial Measurements, Khanna Publishers
5. Huge W Coleman, W Glenn Steele, Experimentation and Uncertainty Analysis for Engineers, John Wiley & Sons.
6. Raman C S, Sharma G R, Mani V S N - Instrumentation Devices and Systems - McGraw- Hill.

List of Open-Source Software/learning website:

1. www.asme.org/thermal_science
2. http://auto.howstuffworks.com/
3. nptel.iitk.ac.in/

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3	2	3	2	1	1	1	1	2	1	2	3	2
CO-2	3	3	3	3	3	1	1	1	1	2	1	2	3	3
CO-3	3	2	3	3	3	1	1	1	1	2	1	2	3	3
CO-4	3	2	3	3	3	1	1	1	1	2	1	2	3	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Vehicle Dynamics
Course Code: 1010127106
Semester: 2nd

Prerequisite:

1. Fundamentals of Engineering Mechanics.
2. Theory of Machines.

Course Objective:

1. This course is intended to build up to understand basic mechanisms of passenger car vehicles which are concerned with acceleration, braking, ride and turning of automobile vehicle
2. Vehicle Dynamic behavior is determined by the forces imposed on the vehicles from the tires, gravity and aerodynamics.
3. The knowledge of this subject is essential to design aerodynamic shapes of the car body, to calculate equivalent weight and maximum acceleration, desired power to propel the vehicle.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Unit-I Introduction:** Introduction to Vehicle Dynamics, Lumped mass, Vehicle fixed coordinates system, Earth fixed coordinates system, Forces, Dynamic Axle loads, Static loads, low speed acceleration, Grade Loads.	6	14
2	**Unit-II Vehicle Performance**: Acceleration Performance: Power limited acceleration; Traction limited acceleration, Braking Performance: Basic braking equations, Braking forces, Tire-Road Friction, Brake Proportioning, Anti-lock Brake System (ABS), Cruise Control and Adaptive Cruise Control (ACC).	7	17

3	**Unit-III Road Loads**: Aerodynamic Performance: Mechanics of air flow around a vehicle, pressure distribution on a vehicle, Aerodynamics forces, Drag force, Lift force, Side force **Rolling Resistance:** Factors affecting Rolling Resistance,Tire Temperature, Tire inflation pressure/loads, Tire material and design, Velocity. Effects of Total road loads on fuel economy. **SUSPENSION SYSTEM -** requirements, types, air suspension, rubber suspension, Shock absorbers; compensated suspension systems; design of leaf spring; coil spring and torsionbar; types of drives-Hotchkiss and torque tube.	10	24
4	**Unit-IV Ride Characteristics**: Excitation Sources: Road Roughness, Tire/Wheel Assembly, Driveline excitation, Engine transmission. Vehicle Response properties: Suspension Isolation, Suspension Stiffness, Suspension damping, Wheel hop resonance, Suspension nonlinearity, and Rigid body bounce. Perception of Ride: Tolerance to Seat Vibrations, Other Vibration forms	7	17
5	**Unit-V Cornering**: Introduction, low speed turning, high speed turning, Suspension effects on cornering, Methods for measurement of understeer gradients: Constant radius method, Constant Speed Methods	6	14
6	**Unit-VI Stability of Vehicles**: Load distribution, calculation of tractive effort and Reactions for different drives, stability of a vehicle on a slope, on a curve and on a banked road.	6	14

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Understanding of Vehicle Dynamics, Vehicle fixed coordinates system and loads acting on vehicle	1
CO-2	Acquire knowledge of Acceleration performance,braking performance, Anti-lock Brake System (ABS), Cruise Control and Adaptive Cruise Control(ACC).	2
CO-3	Understanding Aerodynamic Performance of automobile	3
CO-4	Understanding ride characteristics, vehicular response, and calculation of seat tolerances	4
CO-5	Knowledge , calculation of cornering and stability of vehicle	5,6

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning

4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	Study of mechanism for air flow over different geometry of vehicles.
2	Study of measurements of drag and lift coefficient for different geometry vehicle.
3	To study Anti-lock Brake System (ABS) used in automobile vehicles
4	To study Cruise Control and Adaptive Cruise Control (ACC) used in automobile vehicles.
5	To study advanced cornering and parking system used in automobile vehicles.
6	To study automatic wheel alignment and balancing system.

Major Equipment:

1. Matlab.

Books Recommended:

1. Thomas D. Gillespie, 2013 Fundamentals of Vehicle Dynamics, Society of Automobile Engineers Inc., ISBN:978-1560911999 .
2. J. G. Giles, Steering, Suspension &Tyres, Ilete Books Ltd.,London .
3. W. Steed, Mechanics of Road Vehicles, Ilete Books Ltd.London .
4. P. M. Heldt, Automotive Chassis, , Chilton Co.NK
5. Gillespie.T.D., “Fundamental of vehicle dynamic society of Automotive Engineers ", USA,1992.
6. Reza N Jazar, Vehicle Dynamics : Theory and Application, Springer publication.
7. J. Y. Woung, Theory of Ground Vehicles, John Willey & Sons,NY.

List of Open-Source Software/learning website:

1. https://nptel.ac.in/www.learnerstv.com
2. http://auto.howstuffworks.com/

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	3	2	2	2	2	1	1	1	2	3	3	3
CO-2	3	3	3	3	2	2	2	1	1	1	2	3	3	3
CO-3	3	2	3	3	2	2	2	1	1	1	2	3	3	3
CO-4	3	3	3	3	2	2	2	1	1	1	2	3	3	3
CO-5	3	3	3	3	2	2	2	1	1	1	2	3	3	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Automotive Chassis and Body Engineering
Course Code: 1010127139
Semester: 2nd

Prerequisite:

1. Fundamentals of Engineering Mechanics.
2. Automobile System.

Course Objective:

1. The knowledge and skills of vehicle body technology is required to manage vehicle body fabrication and repair. Chassis and body forms the core of automobile engineering.
2. The subject aims at imparting knowledge and skills regarding chassis and body structure, viz, improving the driver visibility, safety aspect in design.
3. This course is designed to provide students the required level of knowledge and skills of automotive chassis and body engineering.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Unit-I Vehicle Aerodynamics**: Objects- vehicle drag and types; various types of forces and moments; effects of forces and moments; various body optimization techniques for minimum drag; principle of wind tunnel technology; flow visualization techniques; tests with scale models.	10	28
2	**Unit-II Car Body Details**: Types of car bodies; visibility; regulation;, driver's visibility; methods of improving visibility; safety design; constructional details of roof; under floor; bonnet; boot; wings etc; Classification of coach work.	10	28

3	**Unit-III Design of Vehicle Bodies**; Vehicle body materials; Layout of the design; preliminary design; safety; Idealized structure; structural surface; stress analysis of bus body structure under bending and torsion; stress analysis in integral bus body; Design of chassis frame; Rules and regulations for body; Recent safety measures; Testing of body	8	24
4	**Unit-IV Optimum design:** Optimum design for automotive elements like shaft-springs, helical or coil spring, laminated or leaf spring etc, Johnson's method of optimum design.	7	10
5	**Unit-V Load calculation of Vehicle Bodies**; shear panel method; symmetric and asymmetrical vertical loads in car; longitudinal loads; different loading situations; load distribution on vehicle structure; Calculation of loading cases;	7	10

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Understand , analyze , evaluate vehicle aerodynamics	1
CO-2	Acquire knowledge of various optimization techniques for minimizing flow visualization techniques	2
CO-3	Understanding of car bodies its accessories, safety considerations	2,3
CO-4	Understanding of vehicular design; preliminary design with safety considerations	3,4
CO-5	Force analysis, load calculation, design of chassis and vehicular testing	4,5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	To take measurements of an automotive vehicle Chassis.
2	To study about testing of Vehicle body.
3	To study various optimization techniques for minimizing flow visualization techniques.
4	To study Types of car bodies, visibility and its regulation.
5	To study design aspects of roof, under floor and bonnet.
6	To study different types of aerodynamics drag reducing device used in modern car.
7	To study different types of load conditions in car.
8	To study and demonstrate different types of safety systems used in modern car.

Major Equipment:

1. Matlab.
2. Internal combustion engines.
3. cut section of various automobile systems.

Books Recommended:

1. Pawloski J. ,Vehicle Body Engineering, Business Books Ltd.
2. Reimpell J., The Automotive Chassis: Engineering Principles.
3. John Fenton,Vehicle Body Layout and Analysis , Mechanical Engg. Publications Ltd. London
4. P.M.Heldt, Automotive Chassis, Chilton Co., NY (1992).
5. Giles J. G ,Body Construction and Design, Illife Books, Butterworth and Co.

List of Open-Source Software/learning website:

1. https://nptel.ac.in/www.learnerstv.com
2. http://auto.howstuffworks.com/
3. nptel.iitk.ac.in/

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3	3	3	2	2	2	1	1	1	2	3	3	3
CO-2	3	3	3	3	3	2	2	1	1	1	2	3	3	3
CO-3	3	2	3	2	2	2	3	2	2	1	2	3	3	3
CO-4	3	3	3	3	2	2	3	2	2	1	2	3	3	3
CO-5	3	3	3	3	3	2	2	1	1	1	2	3	3	3

SILVER OAK UNIVERSITY

College of Technology(01)

Master of Technology in Mechanical Engineering
(I.C. Engine & Automobile Engineering)

Subject Name: Design and Optimization of Thermal Systems
Subject Code: 1010127140
Semester: II

Prerequisite: Thermodynamics, Heat Transfer

Objective: The course is designed to give fundamental knowledge, relevant technologies and design aspects of various thermal systems used in engineering.

Teaching and Examination Scheme:

Teaching Scheme					Evaluation Scheme				Total Marks
					Theory		Practical		
L	T	P	Contact Hours	Credit	CIE (TH)	ESE (TH)	CIE (PR)	ESE (PR)	
3	0	2	5	4	40	60	20	30	150

Content:

Unit No.	Course Contents	Teaching Hours	Weightage %
1	**Introduction:** Engineering Design, Design as Part of Engineering Enterprise, Design versus analysis, need for optimization, basic characteristics of thermal system, Formulation of the Design Problem, Steps in the Design Process, Computer-Aided Design	8	19
2	**Modeling & Simulation of thermal systems:** Basic considerations in design, importance of modeling in design, types of models, mathematical modeling, physical modeling and dimensional analysis, solution procedure, merging of different models, accuracy and validation, system simulation, curve fitting, methods of numerical simulation, numerical simulation versus real systems.	11	29
3	**Optimization:** Introduction, Formulation of optimization problems, Calculus techniques: Lagrange multiplier method,	15	38

	Search methods, Concept of interval of uncertainty, reduction ratio, reduction ratios of simple search techniques like exhaustive search, dichotomous search, Fibonacci search and Golden section search, numerical examples Method of steepest ascent/steepest descent, conjugate gradient method: examples, New generation optimization techniques: Genetic algorithm and simulated annealing, Introduction to Bayesian framework for optimization.		
4	**Economic Considerations:** Calculation of Interest, Worth of Money as a Function of Time, Series of Payments, Raising Capital, Taxes, Economic Factor in Design, Application to Thermal Systems, Carbon Credit Calculation.	5	14

Course Outcome:

Sr. No.	CO statement	
CO-1	Explain engineering design of thermal systems.	1
CO-2	Discuss different models used in modeling of thermal systems.	2
CO-3	Appraise various optimization techniques and apply the same to thermal system design.	3
CO-4	Determine costing of thermal systems.	4

List of Experiments:

1. To evaluate need for optimization in engineering enterprise.
2. Exercise on mathematical modeling and problem formulation for optimization of various thermal systems.
3. Write a program to implement single variable optimization technique.
4. Write a program to implement multivariable optimization techniques.
5. Write program to implement genetic algorithm.
6. To discuss different economics considerations used for design and optimization of thermal systems.
7. To apply various methods of numerical simulation for thermal systems optimization.\
8. To apply reduction ratios of simple search techniques used for optimization.
9. To calculate carbon credit for specific case study.
10. To appraise different types of modeling techniques.

Students are expected to use simulation software like Scilab, MATLAB etc. for practical work

Major Equipment: Computational facility and simulation software

Books Recommended:-

1. Design and optimization of thermal systems, Y Jaluria, McGraw Hill.
2. Elements of thermal fluid system design, L C Burmeister, Prentice Hall
3. Essentials of Thermal System Design and Optimization, C Balaji, Ane Books/CRC Press
4. Design of thermal systems, W F Stoecker, McGraw Hill
5. Introduction to optimum design, J S Arora, McGraw Hill

List of Open Source Software/learning website:

1. https://nptel.ac.in/

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Automotive Manufacturing
Course Code: 1010127141
Semester: 2nd

Prerequisite:

1. Manufacturing Processes.

Course Objective:

1. Learn basic processes for automotive part and product manufacturing.
2. Develop skills to select the best manufacturing process based on quality, time, cost, and mechanical properties.
3. Understand the principles of optimizing manufacturing processes for automotive applications.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**MACHINING:** General principles of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Slotter, Milling, Drilling and Grinding machine. Principles and application of Capstan and Turret lathe. Basics of NC, CNC machines with Application and advantages. Super finishing Technology: Introduction and application: Lapping, Horning, Buffing, Barrel Tumbling, Burnishing, Powder coating, Polishing. General principles and applications of the following processes: Abrasive Jet machining, Water Jet Machining, Ultrasonic machining, electric discharge machining, electro chemical machining, Plasma arc machining, electron beam machining and laser beam machining	13	31

2	**CASTING:** Steps involved in making a casting, Advantage of casting and its applications. Patterns and Pattern making, Types of patterns, Materials used for patterns, core and core making, casting design considerations. Casting processes, Sand, centrifugal, die, investment, lost foam, gravity, squeeze, and shell. Methods of Melting: Crucible melting and cupola operation.	8	17
3	**FORMING AND SHAPING PROCESSES:** Stamping, forming and other cold working processes: Blanking and piercing, Bending and forming, Rolling, Drawing and its types, wire drawing and Tube drawing, coining, Hot and cold spinning, Types of presses and press tools. Basic extrusion processes and its characteristics. Forging processes: Principles of forging, tools and dies, Types of forging, Open, closed, drop forging, roll forging.	9	22
4	**WELDING:** Classification of welding processes. Principles and Application of Oxyacetylene gas welding. A.C metal-arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, Thermit welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.	8	17
5	**PLASTIC TECHNOLOGY:** Introduction, Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, Transfer moulding, Injection moulding, Extrusion moulding, Blow moulding, Calendaring, Thermoforming, slush moulding, laminating.	4	13

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Interpret basics of metal cutting processes and machining operations for different machine tools	1
CO-2	Understand basics of foundry shop	2
CO-3	Make use of basics of sheet metal forming and welding processes and application	3 & 4
CO-4	Identify basics of Plastic technology and application	5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	Job making on lathe
2	Job making on casting
3	Job making by using press tool
4	Job making on welding.
5	Job making by using plastic moulding.
6	Job making on forming.
7	Job making on shaping.

Major Equipment:

1. Lathe Milling, Shaper, Drilling machine,
2. Unconventional Machine
3. Mechanical Press
4. Mini Foundry
5. Welding machine

Books Recommended:

1. Schey A John, Introduction to Manufacturing Processes, Tata McGraw Hill, Noida, 2012.
2. R L Timing Manufacturing Technology, , Volume 1 and 2, Pearson Education
3. S K Garg, Workshop technology (Manufacturing Processes),University science press.
4. P C Sharma, A Text book of Production Engineering,S Chand Publication.
5. Banga T.R; and Agrawal R.L, Foundry Engineering, Khanna Publishers, New Delhi, 2007
6. Lindberg Roy A.; Processes and Materials of Manufacture; Prentice-Hall India.
7. J S Campbell, Principles of Manufacturing Materials and Process.

List of Open-Source Software/learning website:

1. https://nptel.ac.in/www.learnerstv.com
2. http://auto.howstuffworks.com/

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	2	2	2	1	1	1		1		2	3	3
CO-2	2	2	2	2	2	1	1				1	2	2	2
CO-3	3	3	2	2	2	1	1	1				2	3	2
CO-4	3	3	2	3	3	1	1			1	1	2	3	2
CO-5	3	2	2	3	3	1	1		1			2	3	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Mini Project with Seminar
Course Code: 1010127191
Semester: 2nd

Prerequisite:

1. Fundamental understanding of mechanical engineering principles.
2. Basic knowledge of mechanical testing and experimental techniques.
3. Fundamental understanding of research methodologies.

Course Objective:

1. Equip students with the ability to identify and analyze engineering problems using available literature and various analytical techniques.
2. Develop proficiency in solving complex, real-world problems using software, analytical, and computational tools, applying core engineering principles.
3. Enhance skills in technical report writing, presentation, and defense of their work to a technically qualified audience.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
0	0	4	4	2

Content:

A mini project requires comparatively less time than major projects. They are comparatively simpler and have shorter duration. Mini Project helps students to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. Mini Project can help them to boost their skills and widen their horizon of thinking. It will act like a beginners guide to undertake the major project/dissertation during the final year and will ensure preparedness of students to undertake major projects/dissertation. Students will be required to select the topic relevant to their specialization and that has value addition. Students will get an opportunity to work in actual industrial environment if they opt for internship. Based on the selected topic student will also prepare seminar report based on the literature survey Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution. Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

Course Outcome:

Sr. No.	CO statement
CO-1	Identify engineering problems reviewing available literature.
CO-2	Study different techniques used to analyze complex systems.
CO-3	Solve a live problem using software/analytical/computational tools and present solution by using his/her technique applying engineering principles.
CO-4	Learn to write technical reports and develop skills to present and defend their work in front of technically qualified audience.

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Electric Vehicle Technology
Course Code: 1010127236
Semester: 3rd

Prerequisite:

1. Basic of Electrical Engineering.
2. Basic mechanical engineering.

Course Objective:

1. This course introduces the fundamental concepts, principles of hybrid vehicles.
2. This course introduces the analysis and design of hybrid vehicles.
3. This course introduces the fundamental concepts, principles of electric and fuel cell vehicle.
4. This course introduces the analysis and design of electric and fuel cell vehicles.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Electric and Hybrid Electric Vehicles** Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains	6	15
2	**Energy storage for EV and HEV** Energy storage requirements, Battery parameters, Types of Batteries, Modeling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modeling of PEMFC, Super Capacitors	6	15

3	**Electric Propulsion** EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance MotorDrive for Electric Vehicles, Configuration and control of Drives	8	20
4	**Design of Electric and Hybrid Electric Vehicles** Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design	12	30
5	**Power Electronic Converter for Battery Charging** Charging methods for battery,Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z-converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology.	10	20

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Understand working of Electric Vehicles and recent trends.	1,2
CO-2	Understand working of Hybrid Vehicles and recent trends.	1,2
CO-3	Analyze different power converter topology used for electric vehicle application	3,4
CO-4	Develop the electric propulsion unit and its control for application of electric vehicles	5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

Books Recommended:

1. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2005
2. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003
3. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
4. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press, 2001.

5. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Wiley Publication, 2011.

List of Open-Source Software/learning website:

1. E-materials available at the website of NPTEL- http://nptel.ac.in/
2. MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	2	2	2	1	2	1	1	1	1	2	3	3
CO-2	3	2	2	2	2	1	2	1	1	1	1	2	3	3
CO-3	3	3	3	2	2	1	2	1	1	1	1	2	3	3
CO-4	3	3	3	3	3	1	2	1	1	1	1	2	3	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Modern Vehicle Design
Course Code: 1010127237
Semester: 3rd

Prerequisite:

1. Mechanics of deformable bodies.
2. Design of machine elements.
3. Basics of computer programming language.

Course Objective:

1. Apply engineering principles to the design and analysis of automobiles to meet performance specifications.
2. Develop and integrate advanced technologies such as computer-aided design, hybrid power systems, and environmentally friendly solutions in vehicle design.
3. Innovate in the use of advanced materials and transportation technologies to support the growing automotive market globally.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Unit-I** Engine Components; Material, construction and design aspects of engine components; Determination of engine power; Engine selection swept volume, stroke, bore & no. of cylinders; Arrangement of cylinders stroke to bore ratio.	8	19
2	**Unit-II** Design procedure and considerations, material selection & actual design of components; cylinder block deign; Design of Piston; piston assembly; Cylinder, Cylinder liner, Cylinder head, Combustion Chamber, Connecting rod, Crank Shaft, Fly Wheel, valves, valve actuating mechanism, cams, camshaft drives,	10	24

	vibration damper, Gearbox design, Constant-mesh gearboxes, synchromesh gearboxes, heavy vehicle gearboxes.		
3	**Unit-III** Design of couplings; design of fluid couplings; torque converter; differential axle; Suspension system design; Tandem axle suspension; adaptive suspension system; shock dampers; Steering system design – power assisted steering, four wheel steering system.	8	19
4	**Unit-IV** Design of Brakes – Hydraulic brakes, air and endurance brake, antilock brakes; vehicle structure; chassis frames; Principle of vehicle Aerodynamics; Aerodynamic design of vehicle, latest developments.	8	19
5	**Unit-V** Introduction to CAD; The product cycle and CAD; Automation and CAD; Finite element analysis; Stress analysis on Automobile Components.	8	19

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Calculation of Basic design aspects of different engine components	1
CO-2	Selection , evaluation , force analysis of different engine parts	2
CO-3	Force analysis, and Design of suspension system components	3
CO-4	Evaluation and calculation of I.C. engine Brakes and its recent developments.	4
CO-5	Knowledge of CAD Automation, Finite element analysis of Automobile Components.	5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

Books Recommended:

1. ReimpellJ., The Automotive Chassis – Engineering Principle –
2. P. Lukin, G. Gasparyarts, V. Rodionov, Automotive Chassis – P. M. Heldt, Chilton Co.NK
3. W. Steed , Mechanics for Road Vehicles –, Illiffe Books Ltd.,London
4. Kolchin and Demodov , Design of Automotive engines.
5. Jiles.J.G ,Automotive design.
6. Pandya and Shah,Machine Design,

7. Khurmi and Gupta, Machine Design

List of Open-Source Software/learning website:

1. E-materials available at the website of NPTEL- http://nptel.ac.in/
2. MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3	3	2	2	2	2	1				2	3	3
CO-2	3	3	3	3	3	2	2	1			1	2	3	3
CO-3	3	2	3	3	2	2	3	1			1	2	3	3
CO-4	3	3	3	3	2	2	3		1	1		2	3	3
CO-5	3	3	3	3	3	2	2				1	2	3	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: I.C. Engine Modeling & Simulation
Course Code: 1010127238
Semester: 3rd

Prerequisite:

1. Fundamentals of IC Engine.
2. Automobile Systems & Aerodynamics.

Course Objective:

1. Understand different types of modeling and their applications in automobile engineering.
2. Gain knowledge in the simulation of various systems and components of internal combustion engines.
3. Explore new engine concepts through advanced modeling and simulation techniques.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit	Topics	Teaching Hours	% Weightage
1	**Introduction to modeling;** importance of modeling; Spray equation model; Thin and thick spray model; Droplet turbulence interactions; Droplet impingement on walls.	6	14
2	**Modeling of IC Engines:** Classifications; zero dimensional modeling; quasi dimensional modeling, Comparison of different combustion systems; Combustion efficiency. Heat of reaction - adiabatic, constant volume combustion, constant pressure combustion, temperature drop due to fuel vaporization, adiabatic flame temperature, mean effective pressure, torque and thermal efficiency at full throttle, part throttle and supercharged conditions., flow models and combustion models.	14	34
3	**Laminar flow modeling;** K-e model, probability density functions; effective viscosity; vortex structures; Compression generated turbulence.	7	16

4	**Simulation of IC Engines** SI & CI engine simulation – air standard cycle, fuel-air cycle, progressive combustion cycle and actual cycle simulation – part throttle, full throttle and supercharged conditions.	8	19
5	**Simulation of New Engine Concepts** Dual fuel engine, low heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine, controlled auto ignition engine.	8	19

Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Basic understanding engine modeling;	1
CO-2	Understating and evaluation of different flow models and combustion models of engines	2
CO-3	Understanding Laminar flow modeling;	3
CO-4	Demonstrate and analyze air standard cycle, fuel-air cycle, progressive combustion cycle and actual cycle simulation	4
CO-5	Knowledge of Simulation of New Engine Concepts	5

Teaching & Learning Methodology:

1. Problem-based Learning
2. Design Thinking
3. Cooperative-based Learning
4. Competency-based Learning

List of Experiments/Tutorials: Total Hours: 28

Sr. No.	Practical Name
1	To study Weibe's combustion model.
2	To study Single zone and Multi zone combustion models for SI engine.
3	To study Premixed-Diffusive models for CI engine.
4	To study characterizing of spray using thin and thick spray combustion model.
5	To study different turbulence combustion models.
6	To study droplet breakup, collision and wall interaction model.
7	Prepare a computer code (Using any software like Matlab or open source software like Scilab) to simulate any stroke (i.e. Suction, Compression, Power or Exhaust) of Auto cycle

Books Recommended:

1. J.I Ramos – Internal Combustion Engine Modeling- Hemisphere Publishing Corporation,1989.
2. James N Mattavi and Charles A Amann – Combustion Modeling in Reciprocating Engines – Plenum Press.
3. Pkandylas G C Koltsakis and A M Stamatelos – Mathematical modeling of Precious metals catalytic converters for diesel Nox reduction – Proc. Institution of Mechanical Engineers.

4. Ganesan V, “Computer Simulation of spark ignition engine process“, Universities Press Ltd, Hyderabad, 2010.
5. Heywood J B, “Internal Combustion Engine Fundamentals” McGraw Hill Book Co., USA – 2010.

List of Open-Source Software/learning website:

1. E-materials available at the website of NPTEL- http://nptel.ac.in/
2. MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

CO PO-PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	2	2	3	2	2	1			1	3	3	2
CO-2	3	3	2	3	3	2	2	1				3	3	2
CO-3	3	2	2	3	2	2	2				1	3	3	2
CO-4	3	3	2	3	2	2	2		1	1		3	3	2
CO-5	3	3	2	3	3	2	2	1				3	3	3

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Dissertation Phase 1
Course Code: 1010127291
Semester: 3rd

Prerequisite:

1. Successful completion of core courses in I.C. Engine & Automobile Engineering.
2. Fundamental understanding of research methodologies.
3. Basic knowledge of advanced topics in internal combustion engines and automobile engineering.
4. Principles of vehicle dynamics, including suspension, steering, and braking systems.

Course Objective:

1. Equip students with the ability to conduct independent, cutting-edge research specifically in the field of I.C. Engine & Automobile Engineering, addressing current challenges and innovations.
2. Enhance skills in advanced data collection, analysis, and interpretation, particularly as they apply to engine performance, emissions, and vehicle dynamics.
3. Foster innovation and critical thinking by encouraging the development of new technologies, alternative fuels, and advanced powertrain solutions within the automotive industry.
4. Prepare students for the final dissertation by establishing a strong foundation in specialized research techniques and methodologies pertinent to I.C. Engine & Automobile Engineering.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
0	0	24	24	12

Content:

Dissertation Phase I review shall be carried out by the review committee.

The students are required to prepare a written report of their work and present it, based on which they shall be examined by the review committee.

Dissertation Phase I reports should include following:

1. Literature Review citing at least 4-5 papers.
2. Scope of thesis work.
3. Work Plan for various stages including Dissertation Phase I and Phase II.

4. Number of visits to industry/ experts along with their full details and purpose.
5. Thesis Work done so far.

The report should be submitted at the time of Dissertation Phase I examination, along with a detailed Power point presentation of work done. At least 40% work should be completed at the time of examination.

Course Outcome:

Sr. No.	CO statement
CO-1	The student shall be capable of identifying a problem related to the program of study.
CO-2	To carry out Design and develop an experimental set up/ equipment/test rig
CO-3	Conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
CO-4	Either work in a research environment or in an industrial environment.
CO-5	Present and convince their topic of study to the engineering community.

SILVER OAK UNIVERSITY

College of Technology
Master of Technology
M.E. (I.C. Engine & Automobile Engineering)
Course Name: Dissertation Phase 2
Course Code: 1010127292
Semester: 4th

Prerequisite:

1. Successful completion of Dissertation Phase-1.
2. Comprehensive understanding of research methodologies.
3. Advanced knowledge in I.C. Engine & Automobile Engineering topics such as Advanced Thermodynamics and Heat Transfer, Internal Combustion Engines, Automotive Electronics and Control Systems, Vehicle Dynamics and Control, Emission Control Technologies, and Alternative Fuels and Power Systems.
4. Experience in technical report writing and presentation.

Course Objective:

1. Ensure the completion of an extensive, in-depth research project in the field of I.C. Engine & Automobile Engineering.
2. Provide a platform for students to apply their theoretical and practical knowledge to solve complex engineering problems.
3. Develop detailed research plans, execute them, and document the findings in a structured manner.
4. Present the research findings effectively through well-prepared written reports and professional presentations.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
0	0	30	30	15

Content:

Dissertation Phase II review shall be carried out by the review committee.

The students are required to prepare a written report of their work and present it, based on which they shall be examined by the review committee.

Dissertation Phase II reports should include following:

1. Literature Review citing at least 4-5 papers.
2. Scope of thesis work.
3. Work Plan for various stages including Dissertation Phase I and Phase II.
4. Number of visits to industry/ experts along with their full details and purpose.
5. Thesis Work done with whole implementation.

The report should be submitted at the time of Dissertation Phase II examination, along with a detailed Power point presentation of work done. 100% work should be completed at the time of examination.

Course Outcome:

Sr. No.	CO statement
CO-1	The student shall be capable of identifying a problem related to the program of study.
CO-2	To carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.
CO-3	Implementing the solution proposed in Dissertation-I in 3rd semester idea and getting results.
CO-4	To improve the existing ones or solve chosen problem efficiently.
CO-5	Analyze and validate solution and show why your approach works, and in what cases itworks and where/when it won't!