GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

School of Mechanical Engineering

Program: M. Tech Automobile Engineering

Scheme: 2018 – 2020

Curriculum

Semester 1									
Sl. No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MATH5001	Advanced Numerical and Statistical Methods	3	1	0	4	**20**	**50**	**100**
2	MAUE5001	Automotive Engine & Emission	3	0	0	3	**20**	**50**	**100**
3	MAUE5002	Transmission System Theory & Design	3	0	0	3	**20**	**50**	**100**
4	MAUE5003	Engine Design	3	0	0	3	**20**	**50**	**100**
5	MAUE5004	Chassis and Body Engineering	3	0	0	3	**20**	**50**	**100**
6	MAUE5005	Automotive Vehicle Dynamics	3	0	0	3	**20**	**50**	**100**
		Total	**18**	**1**	**0**	**19**			
Semester II									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	CENG5001	Professional and Communication Skills	0	0	4	2	**50**	**-**	**50**
2	MCDM5006	Finite Element Methods	2	1	0	3	**20**	**50**	**100**
3	MAUE5007	Combustion Engineering	3	0	0	3	**20**	**50**	**100**
4	MAUE5008	Computational Fluid Dynamics	3	0	0	3	**20**	**50**	**100**
5	MAUE5009	Transmission System Design Lab	0	0	2	1	**50**	**-**	**50**
6	MAUE5010	Engine Testing and Pollution Measurement Lab	0	0	2	1	**50**	**-**	**50**
7		Elective 1	3	0	0	3	**20**	**50**	**100**
8		Elective 2	3	0	0	3	**20**	**50**	**100**
		Total	**14**	**1**	**8**	**19**			
Semester III									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MAUE6001	Vehicle Testing Lab	0	0	2	1	**50**	**-**	**50**
2	MAUE6002	Automotive Engine and Chassis Components Lab	0	0	2	1	**50**	**-**	**50**
3	MAUE9998	Dissertation-1	-	-	-	5	**50**	**-**	**50**
4		Elective 3	3	0	0	3	**20**	**50**	**100**
5		Elective 4	3	0	0	3	**20**	**50**	**100**
6		Elective 5	3	0	0	3	**20**	**50**	**100**
		Total	**9**	**0**	**4**	**16**			
Semester IV									
Sl No	**Course Code**	**Name of the Course**					**Assessment Pattern**		
			L	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	MAUE9999	Dissertation-2	-	-	-	15	**50**	**-**	**50**
		Total				**15**			

List of Electives

Basket-1

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	MAUE5011	Simulation of Automobile Systems	3	0	0	3	**20**	**50**	**100**
2	MAUE5012	Automobile Air Conditioning	3	0	0	3	**20**	**50**	**100**
3	MAUE5013	Transport Management	3	0	0	3	**20**	**50**	**100**
4	MAUE5014	Vehicle Maintenance and Fleet Management	3	0	0	3	**20**	**50**	**100**
5	MAUE5015	Tractor and Farm Equipment's	3	0	0	3	**20**	**50**	**100**
6	MCDM5018	Design and Analysis of Experiments	3	0	0	3	**20**	**50**	**100**
7	MAUE5017	Alternative Fuels and Power Systems	3	0	0	3	**20**	**50**	**100**
8	MAUE5018	Special Purpose Vehicles	3	0	0	3	**20**	**50**	**100**
9	MAUE5019	Safety, Health and Environment	3	0	0	3	**20**	**50**	**100**
10	MAUE5020	Hydraulics and Pneumatics	3	0	0	3	**20**	**50**	**100**
11	MAUE5021	Vehicle Aerodynamics	3	0	0	3	**20**	**50**	**100**
12	MAUE5022	Automotive Safety	3	0	0	3	**20**	**50**	**100**
13	MAUE5023	Advanced Heat and mass Transfer	3	0	0	3	**20**	**50**	**100**

Detailed Syllabus

Name of The Course	**Professional and Communication Skills**			
Course Code	**CENG 5001**			
Prerequisite				
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	0	0	2	1

Course Objective:

1. To develop the professional and communicational skills of learners in a technical environment.
2. To enable students acquire functional and technical writing skills.
3. To enable students acquire presentation skills to technical and non-technical audience.

Course Outcomes:

CO1	Improve their reading fluency skills through extensive reading
CO2	Use and assess information from academic sources, distinguishing between main ideas and details
CO3	Compare and use a range official support through formal and informal writings
CO4	The students will be able to exhibit language proficiency in comprehending, describing, and investigating.

Text Books

Rajendra Pal and J.S.Korlahalli. Essentials of Business Communication. Sultan Chand & Sons. New Delhi.

Reference Books

1. Kaul. Asha. Effective Business Communication.PHI Learning Pvt. Ltd. New Delhi.2011.
2. Murphy, Essential English Grammar, CUP.
3. J S Nesfield, English Grammar: Composition and Usage
4. Muralikrishna and S. Mishra, Communication Skills for Engineers.

Course Content:

UNIT 1: Aspects of Communication; Sounds of syllables; Past tense and plural endings; Organizational techniques in Technical Writing; Paragraph Writing, Note taking, Techniques of presentation
UNIT 2: Tense, Voice, conditionals, Techno-words; Basic concepts of pronunciation; word stress; Business letters, email, Techniques for Power Point Presentations; Dos and don'ts of Group Discussion
UNIT 3: An introduction to Modal and Phrasal verbs; Expansion; Word formation; Technical Resume; Company Profile Presentation; Interview Skills

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	**-**	**50**	**100**

Name of The Course	Advanced Numerical and Statistical Methods			
Course Code	MATH5001			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	1	0	4

Course Objective:

With ever growing demand of computational techniques, scope of numerical methods is penetrating aggressively into major and important fields including Science, Engineering &Technology, Medical, Space Science, Economics, Business and Environment. The objective is to achieve knowledge and understanding of numerical methods and to apply appropriate methods to model and solve problems where ordinary analytical methods fail.

Statistical methods are used in manufacturing, development of food product, computer software, energy sources, pharmaceuticals and many other areas. The objective of statistics and probability is to analyze data to make scientific judgments in the face of uncertainty and variation for the improvement of the desired quality.

Course Outcomes:

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

CO1	Apply various numerical methods to solve system of linear and non-linear equations.
CO2	Apply standard interpolation methods to interpolate required/ missing value.
CO3	Apply appropriate methods of numerical differentiation /integration to solve related problems.
CO4	Solve ordinary differential equations and partial differential equations using appropriate numerical methods.
CO5	Identify the type of distributions and apply a suitable test to draw the conclusion.

Text Books

1. Cormen, Leiserson, Rivest and Stein, “Introduction to Algorithms”, 2nd Edition, by, McGraw-Hill, 2000.
2. E. Horowitz, and S. Sahni, “Fundamentals of Computer Algorithms”, Computer Science Press (1978).

Reference Books

1. Jon Kleinberg and Eva Tardos. Algorithm Design. Pearson Education, 2007.
2. Sanjoy Das Gupta, Christos Papadimitriou, Umesh Vazirani, Algorithms 1st Edition, Mcgraw Higher Ed, 2006.
3. Alfred V. Aho, John E. Hopcroft, Jeffery D.Ulman, Data Structures and Algorithms, Pearson; 1st edition, 2001.

Course Content:

Unit –I

System of Linear Equations: Direct Methods- Gauss elimination – Pivoting, Partial and Total Pivoting, Triangular factorization method using Crout LU decomposition, Cholesky method, Iterative Method- Gauss-Seidel and Jacobi method, ill conditioned matrix System of Non-linear equation- Newton Raphson and Modified Newton Raphson Method. Iterative methods

Unit -II Interpolation and Approximation: Lagrange, Spline and Hermite interpolation, Approximations, Error of approximation, Norms for discrete and continuous data, Least square approximation.
Unit -III Numerical Integration: Newton Cotes closed Quadrature, Gauss Legendre Quadrature, Multiple Integration An introduction to Modal and Phrasal verbs; Expansion; Word formation; Technical Resume; Company Profile Presentation; Interview Skills
Unit -IV Numerical Solution of Differential Equations: Finite Difference Schemes, Numerical solution of Ordinary differential equation using Modified Euler's method, Runge-Kutta method of 2nd, 3rd and 4th orders, Predictor- Corrector method, Solution of Laplace's and Poisson's equations by Liebman's method, Solution of one dimensional time dependent heat flow.
Unit -V Probability and statistics: Review of concept of probability, Random Variables, Continuous and discrete distribution function, moments and moments generating functions, Binomial, Poisson, Negative Binomial, Geometric and Hyper-geometric Distributions, Uniform, Normal, Exponential, Gamma and Beta distributions. Point and Interval estimation, Testing of Hypothesis (t-test and chi square test), Analysis of variance and Introduction of Design of experiments

Text Books:

1. Numerical Methods for Scientific and Engineering Computation (6^{th} edition) by Jain, Iyengar & Jain, New Age International publishers.
2. Probability & Statistics for Engineers & Scientists (9^{th} edition) by R.E.Walpole, R,H,Myers & K.Ye.

Reference Books:

1. Numerical Methods by E Balagurusamy, Tata McGraw Hill
2. Curtis F. Gerald and Patrick O Wheatley, Applied Numerical Analysis, Pearson Education Ltd.
3. Introductory Methods of Numerical Analysis by S.S. Sastry, PHI learning Pvt Ltd.
4. Numerical methods for Engineers (6^{th} edition), Steven C. Chapra and Raymond P. Caynale.
5. Numerical Methods in Engineering & Science (9^{th} edition), by B.S.Grewal
6. Statistical Methods by S.P. Gupta, Sultan Chand and Sons
7. Probability and Statistics by Schaum's series (3^{rd} edition)

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	**30**	**50**	**100**

Name of The Course	Automotive engines and emission				
Course Code	MAUE5001				
Prerequisite	IC Engines				
Corequisite	-				
Antirequisite	-				
		L	T	P	C
		3	0	0	3

Course Objectives:

This subject is taught to impart knowledge of working principle of engines, fuel combustion, emission and emission control.

Course Outcomes

CO1	Summarize the principle and need of carburetion, lubrication and cooling in vehicles (K3)
CO2	Analyze different combustion mechanisms and flame propagation (K4)
CO3	Investigate the emission characteristics of vehicle engine and control mechanisms (K4)
CO4	Identify the need for alternative fuels, their sources and properties(K3)
CO5	Solve the heat transfer problems using FEM (K3)

Text Book (s) and Reference Book (s)

1. Richard Stone, *Introduction to Internal Combustion Engines*, McMillan, London. ISBN-978-0-333-37593-8.
2. Hein Heister, *Vehicle and Engine Technology*, Butterworth-Heinemann Ltd ISBN- 978-0-340-69186-1.
3. Hein Heister, *Advance Vehicle Technology*, Society of Automotive Engineers Inc. ISBN- 978-0-768-01071-8.
4. E. F. Obert, (1973), *I. C. Engine & Air Pollution*, Harper & Row Publishers, New York. ISBN 0-352-04560-0.
5. C. Fayette Taylor & Edward S. Taylor, *I. C. Engines*, International text book com, ISBN-978-0-700-22096-0.
6. V. L. Maleev, *I.C. Engine*, McGraw Hill Book, Co. ISBN- 978-0-070-85471-0.
7. Ferguson, *Internal Combustion Engines: Applied Thermosciences*, John Wiley & Sons, ISBN- 978-0-471-35617-2.
8. Charles A. Fisher, *S.I. Engine – Fuel Injection Development*, Chapman & Hall.
9. Herbert E. Ellinger, *Automotive Engines*. ISBN- 978-0-130-55426-0.
10. John B. Heyhood, *Internal Combustion Engines Fundamentals*, McGraw Hill. ISBN-978-0-070-28637-5.

Course Content:

Unit-1 Introduction	**6 hours**
Fuel Supply, Ignition, Cooling2 and Lubrication Systems – Theory of carburetion and carburettors, A/F ratio, petrol injection, diesel fuel injection pumps, conventional and electronic ignition systems for SI engines, cooling systems, design aspects, lubrication systems.	
Unit-2 Combustion of fuel and combustion chambers	**6 hours**
Air Motion Combustion and Combustion Chambers: Swirl and turbulence – swirl generation, combustion in SI & CI engines, flame travel and detonation, Ignition delay, Knock in CI engines, combustion chamber design.	
Unit-3 Automobile emission and control	**9 hours**
Sources of Emission, Exhaust gas constituents & analysis, Ingredients responsible for air pollution, Smoke, odour, Smog formation. Exhaust Emission Control: Basic method of emission control, catalytic converter, After burners, reactor manifold, air injection, crank case emission control, evaporative loss control, Exhaust	

gas recirculation, Fuel additives. Pollution Norms : European pollution norms, Indian pollution norms as per Central Motor Vehicle Rules (C.M.V.R.).
Unit-4 Exhaust Emission Measurement and alternative fuel 10 hours
Instrumentation for Exhaust Emission Measurement: Measurement procedure, Sampling Methods, Orsat Apparatus, Infrared Gas analyzer, Flame Ionization Detector (FID), Smoke meters. Alternative Fuels: CNG, LPG, Bio-Diesel, Hydrogen, fuel cells, Eco-friendly vehicles, Electric & Solar operated vehicle.
Unit-5 Dynamic Analysis using Finite Elements 9 hours
Introduction to vibration problems, Consistent and Lumped mass matrices, Form of finite element equations for vibration problems, Eigen value Problems, Transient vibration analysis and unsteady heat transfer problem

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Transmission system theory and design**				
Course Code	**MAUE5002**				
Prerequisite	**Machine Design, Dynamics of Machinery**				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

The objective of teaching this subject to the students is to acquaint them with the detailed knowledge of transmission systems, braking system and steering system of an automobile.

Course Outcomes

CO1	Identify the various elements of transmission system of an automobile
CO2	Summarize the different joints and axles
CO3	Apply different breaking system in different vehicles
CO4	Explain various component of steering system

Text Book (s) and Reference Book (s)

1. Reimpell J., *The Automotive Chassis – Engineering Principle*, ISBN- 978-0-750-65054-0.
2. P. Lukin, G. Gasparyarts, V. Rodionov, *Automotive Chassis-Design & Calculation*, MIR Publishing, Moskow ISBN- 978-5-030-00081-7.
3. P. M. Heldt, *Automotive Chassis*, Chilton Co. NK
4. W. Steed, *Mechanics for Road Vehicles*, Illiffe Books Ltd., London

Unit-1 Introduction Transmission system **6 hours**
Transmission systems : Clutch, types of clutch, clutch design, Gear box, types of gear boxes, gear box design, overdrive gears, Fluid flywheel & torque converter, Epicyclic gear box, semi-automatic & automatic transmission.
Unit-2 Propeller Shaft and Final Drive **6 hours**
Propeller shaft, design of propeller shaft, slips joint, universal joint, Final drive, differential, Dead & live axle, axle design, Constant velocity joints.
Unit-3 Braking System **9 hours**
Braking system – types of brakes, brake-actuating mechanisms, factors affecting brake performance, power & power assisted brakes, Brake system design, recent developments in transmission & braking system
Unit-4 Steering System **9 hours**
Steering systems : Front axle types, constructional details, front wheel geometry, Condition for True rolling, skidding, steering linkages for conventional & independent suspensions, turning radius, wheel wobble and shimmy, power and power assisted steering

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Engine Design**				
Course Code	**MAUE5003**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

This subject acquaints students with the engine design and various parameters dealing with the engine design.

Course Outcomes

CO1	Examine basic design parameter of engine cylinder head
CO2	Calculate forces and moments in the design of cylinder head, cylinder block, piston, piston ring, fly wheel and valve mechanism.
CO3	Point out the correct firing order based on forces and design principal of cooling system, inlet and outlet valve system.
CO4	Calculate various dimensions of fuel injection systems.

Text Book (s) and Reference Book (s)

1. E. F. Obert, (1973), *I. C. Engine & Air Pollution*, Harper & Row Publishers, New York. ISBN 0-352-04560-0.
2. Giles J. G., *Engine Design*, Lliffe Book Ltd.
3. W. H. Crouse ,*Engine Design*, Tata McGraw Publication, Delhi ISBN-978-0-070-14671-6.
4. V. L. Maleev, *I.C. Engine*, McGraw Hill Book, Co. ISBN- 978-0-070-85471-0.
5.Litchy, *I. C. Engine*
6. SAE Handbooks

Course Content:

Unit-1 Engine Cylinder Design **10 hours**
Determination of engine power, Engine selection, swept volume, stroke, bore & no. of cylinders, Arrangement of cylinders stroke to bore ratio.
Unit-2 Engine Head Design **10 hours**
Design procedure of theoretical analysis, design considerations, material selection & actual design of components - cylinder block deign, cylinder head design, piston & piston pin design, piston ring design, connecting rod design, crankshaft design, flywheel design, design of valve mechanism.
Unit-3 Various Forces and Moments in Engine Design **9 hours**
Engine balancing, firing order, longitudinal forces, transverse forces, pitching moments, yawing moments, Engine layout, major critical speed & minor critical speed, design of engine mounting, design of cooling system, design principles of exhaust & inlet systems
Unit-4 Fuel Injection Design **9 hours**
Primary design calculation of major dimensions of fuel injection system.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Chassis and body engineering**				
Course Code	**MAUE5004**				
Prerequisite	**Automobile Engineering**				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

This subject makes students familiar with the aerodynamics, body details, body design and stress analysis of the automobile.

Course Outcomes

CO1	Identify the various types of aerodynamics drag, forces and moment in vehicle body. (K3)
CO2	Understand the details of vehicle body, roofs, under floor, bonnet, boot and wings (K2)
CO3	Summarise various design parameters of vehicle body (K3)
CO4	Analyze the stresses in the bus body under bending and torsion (K4)
CO5	Demonstrate various case studies on chassis frame related to stress and deflection analysis (K3)

Text Book (s) and Reference Book (s)

1. J. Y. Woung, *Theory of Ground Vehicles*, John Willey & Sons, NY ISBN- 978-0-471-35461-1.
2. J. G. Giles, *Steering, Suspension & Tyres*, Illefe Books Ltd. London ISBN- 978-0-592-00620-8.
3. W. Steed, *Mechanics of Road Vehicles*, Illefe Books Ltd. London
4. P. M. Heldt, *Automotive Chassis*, Chilton Co. NK

Course Content:

Unit-1 Vehicle Aerodynamics **7 hours**
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
Unit-2 Car Body Details **6 hours**
Car Body Details : Types of car bodies, visibility, regulations, driver's visibility, methods of improving visibility, safety design, constructional details of roof, under floor, bonnet, boot, wings etc, Classification of coach work.
Unit-3 Design of Vehicle Bodies **9 hours**
Design of Vehicle Bodies: Vehicle body materials, Layout of the design, preliminary design, safety, Idealized structure- structural surface, shear panel method, symmetric and asymmetrical vertical loads in car, longitudinal loads, different loading situations- load distribution on vehicle structure.
Unit-4 Stress Calculation and Analysis **9 hours**
Calculation of loading cases, 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
Unit-5 Case study report and review **9 hours**
Case study on Heavy commercial vehicle chassis frame, detailed design of chassis frame, stress and deflection analysis of chassis frame.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Automotive Vehicle Dynamics**				
Course Code	**MAUE5005**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

The aim of teaching this subject is to make students aware of the suspension system, handling characteristics of an automobile like steering geometry and vibrations.

Course Outcomes

CO1	Summarize different types of suspension systems used in automobiles.
CO2	Demonstrate the geometry and handling characteristics of steering system.
CO3	Analyze the human response to vibration during motion of vehicle.

Text Book (s) and Reference Book (s)

1. J. Y. Woung, *Theory of Ground Vehicles*, John Willey & Sons, NY ISBN- 978-0-471-35461-1.
2. J. G. Giles, *Steering, Suspension & Tyres*, Illefe Books Ltd. London ISBN- 978-0-592-00620-8.
3. W. Steed, *Mechanics of Road Vehicles*, Illefe Books Ltd. London
4. P. M. Heldt, *Automotive Chassis*, Chilton Co. NK

Course Content:

Unit-1 Suspension System **12 hours**
Suspension system - requirements, types, air suspension, rubber suspension, Shock absorbers, design of leaf spring, coil spring and torsion bar, types of drives-Hotchkiss and torque tube, wheel alignments, wheel wobble, wheel shimmy, pitching, bouncing and rolling, roll centre and roll axis, anti-roll bar, road holding.
Unit-2 Handling Characteristics **14 hours**
Handling Characteristics: Steering geometry, Fundamental condition for true Rolling, Ackerman's Steering Gear, Davis Steering gear, Steady state Handling - Neutral steer, Under steer and over steer, Steady state response, Yaw velocity, Lateral Acceleration, Curvature response & Directional stability, jack-knifing in articulated vehicle, loading of automobile chassis due to road irregularities, comfort criteria, load transferred while braking and cornering, equivalent weight of vehicle.
Unit-3 Ride Characteristics **14 hours**
Ride Characteristics: Human response to vibrations, Single degree & Two degree freedom, Free & Forced vibrations, Vehicle Ride Model, Two degree freedom model for sprung & un-sprung mass, Two degree freedom model for pitch & bounce, Vibrations due to road roughness and engine unbalance, Transmissibility of engine mounting, Motion of vehicle on undulating road & Compensated suspension systems. Identify the vibration characteristics of automobile system.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	Finite Element Methods				
Course Code	MCDM5006				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
	L	T	P	C	
	3	0	0	3	

Course Objectives:

1. To enable the students understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and thermal analysis
2. To understand the characteristics of various finite elements.
3. To develop finite element equations for simple and complex domains.

Course Outcomes

CO1	Apply the knowledge of mathematics and engineering to solve problems in structural and thermal engineering by approximate and numerical methods.
CO2	Design a new component or improve the existing components using FEA.
CO3	Solve the problems in solid mechanics and heat transfer using FEM.
CO4	Analyze the vibration problems and transient state problems dynamically.
CO5	Use commercial FEA packages like ANSYS and modern CAD/CAE tools for solving real life problems.

Text Book (s)

1. Seshu, P.(2010), *Textbook of Finite Element Analysis*, Prentice-Hall of India Pvt. Ltd. ISBN- 978-8-120-32315-5.
2. Tirupathi R. Chandrapatla, Ashok D. Belegundu, *Introduction to Finite Element in Engineering Prentice-Hall of India Private limited*, New Delhi – 110 001. ISBN-978-0-130-61591-6.

Reference Book (s)

1. Bathe, K.J, (1996), *Finite Element Procedures*, Prentice-Hall of India Pvt. Ltd., third Edition. ISBN-978-0-979-00490-2.
2. Zienkiewicz O.C. (1989), *The Finite Element Method*, McGraw-Hill. ISBN- 978-0-070-84072-0.
3. Reddy J.N. (1993), *The Finite Element Method*, McGraw-Hill, Third Edition, 1993. ISBN- 978-0-072-46685-0.
4. C.S. Krishnamoorthy, (1994), *Finite Element Analysis Theory and Programming*, Tata McGraw-Hill, ISBN- 978-0-074-62210-0.
5. Robert cook, R.D. et. Al., (2004), *Concepts and Applications of Finite Element Analysis*, John Wiley & sons, ISBN- 978-0-471-35605-9.

Course Content:

Unit-1 Fundamental Concepts **6 hours**
Matrix Algebra, Gaussian Elimination, Definition of Tensors and indicial notations, Plane strain- Plane stress hypothesis. Physical problems, Mathematical models, and Finite Element Solutions, Finite Element Analysis as Integral part of Computer Aided Design, Stresses and Equilibrium; Boundary Conditions; Strain-Displacement Relations; Stress –strain relations, Temperature Effects.
Unit-2 Finite Element Formulation from Governing Differential Equations and on Stationary of a Functional **6 hours**

Weighted Residual Method for Single Continuous Trail Function and General Weighted Residual Statement, Weak Variational Form of Weighted Residual statement, Comparison of Differential Equation, Weighted Residual and Weak forms, Piece-wise Continuous Trail function solution of weak form, One dimensional bar finite element and one dimensional heat transfer element, Functional of a differential equation forms, Rayleigh-Ritz Method, Piece-wise Continuous trail functions, Finite Element Method and Meaning of Finite Element Equations.
Unit-3 One-Dimensional Finite Element Analysis 9 hours
General form for Total Potential for 1-D, Generic form of finite element equations, Linear Bar Finite element, Quadratic Bar Element- Shape function and Element matrices, Beam element- selection of nodal d.o.f., Determination of Shape functions and Element matrices, 1-D Heat transfer problem.
Unit-4 Unit IV: Two-Dimensional Finite Element Analysis 9 hours
Approximation of Geometry and Field variable: Three-noded triangular element, Four-noded rectangular element, six-noded triangular elements, natural coordinates and coordinate transformation, 2-D elements for structural mechanics, Numerical integration, Incorporation of Boundary Conditions and Solution.
Unit-5 Dynamic Analysis using Finite Elements 9 hours
Introduction to vibration problems, Consistent and Lumped mass matrices, Form of finite element equations for vibration problems, Eigenvalue Problems, Transient vibration analysis and unsteady heat transfer problem.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Combustion Engineering**				
Course Code	**MAUE5007**				
Prerequisite	**Thermodynamics, IC Engines, Fuels and Combustion**				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

The aim of teaching this subject is to make students understand the details of different types of combustion concerned to the automobiles.

Course Outcomes

CO1	Summarize the basic mechanism of combustion process (K3)
CO2	Demonstrate the Combustion of gaseous and vaporized fuels (K3)
CO3	Compare the flames using boundary conditions (K6)
CO4	Demonstrate the various types of combustion of liquid fuels (K3)

Text Book (s) and Reference Book (s)

1. Gary L. Borman& Kenneth W. Ragland, *Combustion Engineering*, McGraw Hill. ISBN- 978-0-070-06567-3.
2. Kenneth K. Kuo, *Principles of Combustion*, John Wiley & Sons. ISBN- 978-0-471-04689-9.
3. S. P. Sharma &Chander Mohan, *Fuels & Combustion*, Tata McGraw Hill ISBN-978-0-070-96627-7.
4. Samir Sarkar, *Fuels & Combustion*, ISBN-978-1-439-82541-9.

Course Content:

Unit-1 Introduction to Combustion process **6 hours**
Scope and history of combustion, Fuels, Thermodynamics of combustion, Chemical kinetics of combustion, rate of reactions, chain reactions, opposing reactions, consecutive reactions, competitive reactions, Conservation equation for multi component reacting systems.
Unit-2 Combustion of gaseous and vaporized fuels **6 hours**
Combustion of gaseous & vaporized fuels, gas –fired furnace combustion, Premixed charge engine combustion, Detonation of gaseous mixture
Unit-3 Diffusion of flames and boundary conditions **9 hours**
Premixed laminar flames, Gaseous diffusion flames & combustion of a single liquid fuel droplet, turbulent flames, combustion in two – phase flame systems, Chemically reacting boundary layer flows, Ignition
Unit-4 Combustion of liquid fuels **9 hours**
Combustion of liquid fuels, spray formation & droplet behaviour, Oil – fired furnace combustion, gas turbine spray combustion, direct injection engine combustion, detonation of liquid – gaseous mixture, combustion of solid fuels.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Computational Fluid Dynamics**				
Course Code	**MAUE5008**				
Prerequisite	**Fluid mechanics**				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the computational techniques useful in the analysis of fluid flow and heat transfer
2. To expose and train in using commercial CFD software and in writing codes for specific CFD applications.

Course Outcomes

CO1	Understand the governing equations of fluid flow and heat transfer (K2)
CO2	Apply finite difference methods and perform stability analysis (K3)
CO3	Solve steady and transient heat conduction equations (K3)
CO4	Solve the Navier-stokes equations for incompressible flows (K3)

Text Book (s)

1. S.V. Patankar (1994), *Numerical Heat Transfer and Fluid Flow, Hemisphere Series*, CRC Press, New York. ISBN-978-0-891-16522-4.
2. Y. Jaluria and K.E. Torrance (1986*), Computational Heat Transfer*, Hemisphere Publishing Corp.
3. J.D. Anderson, Jr. (1995), *Computational Fluid Dynamics – The Basic with Applications*, McGraw-Hill. ISBN- 978-0-070-01685-9.

Reference Book (s)

1. K.A. Hoffman (1989), *Computational Fluid Dynamics for Engineering*, Engineering Education System, Austin, Texas. ISBN- 978-0-962-37317-6.
2. K. Muralidhar and T. Sundarajan (1995), *Computatioanl Fluid Flow and Heat Transfer*, Narosa Publishing House, New Delhi. ISBN-978-8-173-19522-8.
3. Fluent 6.1 Manual (2001), Fluent Inc.

Course Content:

Unit-1 Review of the equations governing fluid flow and heat transfer	**6 hours**
Introduction to equations governing fluid flow and heat transfer - Conservation of mass, conservation of energy - expanded and special forms of Navier-Stokes equations - Potential theory - Boundary layer theory - Compressible flows - Turbulent flows.	
Unit-2 Finite Difference Method	**6 hours**
Introduction to finite differences, difference equations and discretization – Finite difference Methods: Explicit, implicit and Crank-Nicholson – Convergence and stability conditions - ADI – Boundary conditions - Applications to steady and transient heat conduction equations.	
Unit-3 Heat conduction, convection and diffusion	**12 hours**
One- and two- dimensional steady & transient conduction - Steady one-dimensional convection and diffusion - Solution methodology: upwind scheme, exponential scheme, hybrid scheme, power law scheme – Explicit, Implicit, Crank-Nicolson schemes – Stability criterion.	
Unit-4 Solution of Navier-Stokes equations for incompressible flows	**10 hours**
Sources of ray X-ray production-properties of d and x rays – film characteristics – exposure charts – contrasts – operational characteristics of x ray equipment – applications.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Transmission system design lab**				
Course Code	**MAUE5009**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		0	0	2	1

Course Objectives:

To orient the students with various aspects of transmission system design and engines through experiments

Course Outcomes

CO1	Assess the transmission systems used in vehicles
CO2	Visualize the suspension and steering systems of vehicles
CO3	Integrate the components of brakes and clutches

Text Book (s)

Ganesan.V.(2003), *Internal Combustion Engines*, 2nd edition, Tata McGraw Hill Co., ISBN-978-0-070-49457-2

Reference Book (s)

Giles. J.G. (1989), *Vehicle Operation and performance*, IIIiffe Books Ltd., London.

List of Experimments	**40 hours**
1. Testing of Internal combustion engine according to Indian and International standards. 2. Performance analysis of two stroke Petrol Engine. 3. Performance analysis of four stroke Petrol Engine. 4. Performance analysis of four stroke Diesel Engine. 5. To Study various engine components, material and design aspects. 6. Performance test on variable compression ratio multi fuel diesel engine. 7. Study of ignition, cooling, lubrication systems 8. Assembling and dismantling of clutch and Transmission systems 9. Assembling and dismantling of automotive brakes, suspension and steering systems 10. Study of Recent developments in the field of I.C. Engine and Automobile	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
50	Nil	50	100

Name of The Course	**Engine testing and pollution measurement lab**				
Course Code	**MAUE5010**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives:

To orient the students with various aspects of engine testing and measurement through experiments.

Course Outcomes

CO1	Measure the performance of engine at different load conditions
CO2	Evaluate to determine the different parameters of engine
CO3	Test the engine performance of petrol and diesel engines
CO4	Assess the emission characteristics of internal combustion engines.

Text Book (s) and Reference Book (s)

1. Giles. J.G. (1989), *Vehicle Operation and performance*, IIIiffe Books Ltd., London.
2. Crouse.W.H. andAnglin.D.L.(1978), *Motor Vehicle Inspection*,McGraw Hill Book Co. ISBN-0070148139.
3. Ganesan.V.(2003), *Internal Combustion Engines*, 2nd edition, Tata McGraw Hill Co., ISBN-978-0-070-49457-2.

List of experiments
40 hours

1. Study of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers 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 Analyser and FID.
8. Study of ChemiluminescentNOxanalyzer.
9. Measurement of HC, CO, CO2, O2 using exhaust gas analyzer.
10. Diesel smoke measurement.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Vehicle testing lab**				
Course Code	**MAUE6001**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives:

To orient the students with the following through experiments:

1. Testing of vehicles using dynamometer
2. Wheel balancing.

Course Outcomes

CO1	Measure the wheel balancing and alignment of vehicles
CO2	Estimate correct ratios of engine parameters using different diagnostic systems
CO3	Test the two and four wheeler automobiles using dynamometers and on Road
CO4	Assess the exhaust gases of internal combustion engines.

Text Book (s) and Reference Book (s)

1. Manufacturer's Manual
2. Giles.J.G.(1989), *Vehicle Operation and performance*, lliffe Books Ltd., London.
3. Crouse.W.H. andAnglin.D.L.(1978), *Motor Vehicle Inspection*,McGraw Hill Book Co. ISBN-0070148139.
4. Ganesan.V (2003), *Internal Combustion Engines*, 2nd edition, Tata McGraw Hill Co. ISBN-978-0-070-49457-2.

List of experiments **40 hours**
1. Testing of 2 -wheeler using chassis dynamometer. 2. Testing of 4 -wheeler using chassis dynamometer. 3. Road Test of Vehicles for a. Brake b. Acceleration c. Fuel Consumption 4. Engine Analysis using Engine Diagnostic System for a. Petrol Engine. b. Diesel Engine. 5. Wheel Balancing and Wheel Alignment 6. Study of ChemiluminescentNOxanalyzer. 7. Measurement of HC, CO, CO2, O2 using exhaust gas analyzer. 8. Diesel smoke measurement.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Automotive engine and chassis component lab**				
Course Code	**MAUE6002**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

To orient the students with the following through experiments:

1. The design of chassis components
2. The assembly of the chassis.

Course Outcomes

CO1	Plan seat layout of various automobile
CO2	Design the frames of HMV, LMV, Car and Two Wheelers using CAD modelling
CO3	Tabulate different parts of automotive components

Text Book (s)

1. Manufacturer's Manual

List of experiments **40 hours**
1. Study of Frames used for HMV, LMV, Car and Two Wheelers. 2. Dismantling and assembling of different types of engines 3. Dismantling and assembling of a. Fuel Supply System b. Steering System, c. Suspension System, d. Braking System, e. Wheels and Tyres f. Propeller Shaft, Universal Joints and Differential 4. Study of Driver Seat 5. Brake adjustment and bleeding.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Dissertation-1**				
Course Code	**MAUE9998**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		0	**0**	**0**	**5**

Course Objectives:

1. To make literature survey for various recently emerging technologies.
2. To select any topic of interest and to review the related literature in detail.
3. To compare and analysis the various topologies for the selected topic of interest.
4. To give more emphasize to the one of best topology and to obtain a network model for it.
5. To analysis the simulation results of the particular topology obtained from various simulation tools.
6. To get realize the hardware implementation of the above topology for which we obtained simulations.

Course Outcomes

CO1	Analyze the relevance of knowledge obtained from literature for the research work taken up
CO2	Evaluate the recently advanced techniques.
CO3	Extract detailed information about the topic of interest
CO4	Plan an innovative work in the area of interest
CO5	Apply the different simulation tools applicable to the area of research

Text Book (s)

Depending upon the area of interest student may choose any text book of relevant field.

Reference Book (s)

As per the chosen area of research.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
50	Nil	50	100

Name of The Course	**Dissertation-II**				
Course Code	**MAUE9999**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		0	**0**	**0**	**15**

Course Objectives:

1. To make literature survey for various recently emerging technologies.
2. To select any topic of interest and to review the related literature in detail.
3. To compare and analysis the various topologies for the selected topic of interest.
4. To give more emphasize to the one of best topology and to obtain a network model for it.
5. To analysis the simulation results of the particular topology obtained from various simulation tools.
6. To get realize the hardware implementation of the above topology for which we obtained simulations.

Course Outcomes

CO1	Design a project relevant to the field of study
CO2	Demonstrate expertise in the selected area of research
CO3	Conduct an innovative work in the selected area of research
CO4	Apply the different simulation tools applicable to the area of research
CO5	Demonstrate a thorough understanding of the chosen topic of dissertation

Text Book (s)

Depending upon the area of interest student may choose any text book of relevant field.

Reference Book (s)

As per the chosen area of research.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
50	Nil	50	100

Name of The Course	**Simulation of automobile system**				
Course Code	**MAUE5011**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

To provide knowledge about computer simulation of IC Engines Process.

Course Outcomes

CO1	Summarize the combustion using different thermodynamic process
CO2	Simulate SI engine with air as a working medium
CO3	Simulate the progressive combustion of SI engine
CO4	Simulate two stroke SI engine.

Text Book (s)

1. Ganesan.V.,*Computer Simulation of Spark - Ignition Engine Process*, Universities Press (I) Ltd, 1996. ISBN-978-8-173-71015-5.
2. Ganesan.V.,*Computer Simulation of Compression - Ignition Engine Process*, Universities Press (I) Ltd, 2000. ISBN- 978-8-173-71283-8.

Reference Book (s)

1. Ramoss.A.L. (1992), *Modeling of Internal Combustion Engines Processes*, McGraw Hill Publishing Co..
2. Ashley Campbel (1986), *Thermodynamic analysis of combustion engines*, John Wiley & Sons, New York. ISBN- 978-0-471-03751-4.
3. Benson.R.S.,Whitehouse.N.D.(1979), *Internal Combustion Engines*, Pergamon Press, Oxford. ISBN-978-0-080-22717-7.

Course Content:

Unit-1 Introduction	**6 hours**
Introduction - Heat of reaction - Measurement of URP - Measurement of HRP - Adiabatic flame temperature:Complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature - Isentropic changes of state.	
Unit-2 SI ENGINE SIMULATION WITH AIR AS WORKING MEDIUM	**6 hours**
SI Engine Simulation With Air As Working Medium Deviation between actual and ideal cycle - Problems, SI engine simulation with adiabatic combustion, temperature drop due to fuel vaporisation, full throttle operation - efficiency calculation, part-throttle operation, super charged operation.	
Unit-3 PROGRESSIVE COMBUSTION	**9 hours**
Progressive Combustion SI Engines simulation with progressive combustion with gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation,pressure crank angle diagram and other engine performance.	
Unit-4 SIMULATION OF 2-STROKE SI ENGINE	**9 hours**
Simulation Of 2-Stroke SI Engine Introduction – Air fuel mixture formation – Chemically correct mixture combustion – Scavenging – Exhaust and mixing processes in a two stroke engine. Diesel Engine Simulation	

Multi zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance and simulation for pollution estimation.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	Automobile Air Conditioning				
Course Code	MAUE5012				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	T	P	C
		3	0	0	3

Course Objectives:

The objective of Automobile Air Conditioning is to

1. make students familiar with the different refrigeration systems, air-conditioning systems, eco-friendly refrigerants used.
2. acquaint the students with the load analysis, air distribution and temperature control of an automobile.

Course Outcomes

CO1	Summarize the basic principles of refrigeration and air conditioning (K1)
CO2	Identify the characteristics required for selection of refrigerants (K2)
CO3	Demonstrate the basic layout and components of air conditioning system (K3)
CO4	Analyze the load and air distribution in refrigeration and air conditioning systems (K4)
CO5	Illustrate the techniques of temperature control, maintenance and servicing of air conditioning system (K3)

Text Book (s) and Reference Book (s)

1.Michel Information Services (1989), *Mitchell Automotive Heating and Air Conditioning Systems*, Prentice Hall. ISBN-978-0-135-86223-0.
2. Paul Lung, Automotive Air Conditioning, C.B.S. Publisher & Distributor, Delhi.
3. N.C. Harris (1974), *Modern Air Conditioning*, McGraw-Hill; 2nd edition, ISBN- 978-0-070-26811-1.
4. ASHRAE Handbook – 1985 Fundamentals
5. William H. Crouse & Donald L. Anglin (1990), *Automotive Air Conditioning*, McGraw Hill, Inc. ISBN-978-0-070-14591-7.
7. Paul Weisler (1990), *Automotive Air Conditioning*, Reston Publishing Co. Inc. ISBN- 978-0-835-90261-8.

Course Content:

Unit-1 Refrigeration	**6 hours**
Refrigeration : Introduction, methods of refrigeration, vapour compression refrigeration system, vapour absorption refrigeration system, applications of refrigeration & air conditioning, Automobile air conditioning, air conditioning for passengers, isolated vehicles, transport vehicles, applications related with very low temperatures.	
Unit-2 Refrigerant	**6 hours**
Refrigerant: Classification, properties, selection criteria, commonly used refrigerants, alternative refrigerants, eco-friendly refrigerants, applications of refrigerants, refrigerants used in automobile air conditioning.	
Unit-3 Automobile emission and control	**9 hours**
Air Conditioning Systems: Classification, layouts, central / unitary air conditioning systems, components like compressors, evaporators, condensers, expansion devices, fan blowers, heating systems, Automotive heaters, Types, Heater Systems, Air conditioning protection, Engine protection.	

Unit-4 Load Analysis and air distribution systems	**9 hours**
Load Analysis: Outside & inside design consideration, factors forming the load on refrigeration & air conditioning systems, cooling & heating load calculations, load calculations for automobiles, effect of air conditioning load on engine performance, Air Distribution Systems : Distribution duct system, sizing, supply / return ducts, type of grills, diffusers, ventilation, air noise level, layout of duct systems for automobiles and their impact on load calculations.	
Unit-5 Temperature control and Air conditioning services	**9 hours**
Air Routine & Temperature Control : Objectives - evaporator care air glow, through the dash re-circulating unit, automatic temperature control, controlling flow, control of air handling systems. Air Conditioning Service : Air conditioner maintenance & service - servicing heater system, removing & replacing components, trouble shooting of air conditioning system, compressor service, methods of dehydration, charging & testing.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Transport Management**			
Course Code	**MAUE5013**			
Prerequisite	-			
Corequisite	-			
Antirequisite	-			
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

The objective of transport management subject is to make students familiar with the notion of transport management, vehicle maintenance, supply management, scheduling and motor laws.

Course Outcomes

CO1	Plan the manpower in different sections of transportation
CO2	Develop the schedule for maintenance of automobiles
CO3	Calculate the cost of inventory in transportation using software
CO4	Summarize fare structure, schedules and sections of motor vehicle act

Text Book (s) and Reference Book (s)

1. John Dolce, *Fleet Management*, McGraw-Hill Co. 1984 ISBN- 978-0-070-17410-8.
2. Goverment Publication, *The Motor vehicle Act*, 1989.
3. Rex W Faulks (1987), *Bus and Coach Operation*, Butterworth. ISBN-978-0-408-02810-3.
4. Kitchin.L.D.(1992), *Bus operation*, 3rd Edition, llliffe and Sons Ltd., London.
5. Kadiyali.L.R., *Traffic engineering and Transport Planning*, Khanna Publishers, ISBN- 978-8-174-09220-5

Course Content

Unit-1 Organisation and Management	**6 hours**
Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training –welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations	
Unit-2 Vehicle Maintenance	**6 hours**
Scheduled and unscheduled maintenance - Planning and scope - Evaluation of PMI programme – Work scheduling - Overtime - Breakdown analysis - Control of repair backlogs - Cost of options.	
Unit-3 Vehicle Parts, Supply Management and Budget	**9 hours**
Cost of inventory - Balancing inventory cost against downtime - Parts control - Bin tag systems – Time management - Time record keeping - Budget activity - Capital expenditures - Classification of vehicle expenses - Fleet management and data processing - Data processing systems - Software. Model - Computer controlling of fleet activity - Energy management. AE – 94 07-08 – SRM – E&T.	
Unit-4 Fare structure and motor vehicle Act	**9 hours**
Scheduling And Fare Structure Route planning - Scheduling of transport vehicles - Preparation of timetable – preparation of vehicle and crew schedule - Costs, fare structure – Fare concessions - Methods of fare collection - Preparation of fare table.Motor Vehicle ActSchedules and sections - Registration of motor vehicles - Licensing of drivers and conductors - Control of permits - Limits of speed - traffic signs - Constructional regulations - Description of goods carrier, delivery van, tanker, tipper, municipal, fire fighting and break down service vehicle.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Tractor and Farm Equipment**			
Course Code	**MAUE5015**			
Prerequisite	-			
Corequisite	-			
Antirequisite	-			
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

This subject acquaints students with the design and control of tractors, working of engines and farm equipments

Course Outcomes

CO1	Classify various types of tractors, their components and safety aspects
CO2	Summarize the engine design and operation of tractors
CO3	Demonstrate the working principle of cooling and lubrication systems of tractor
CO4	Classify different attachment of tractors used for farming purpose.

Text Book (s) and Reference Book (s)

1.Rodichev and G.Rodicheva(1987), *Tractor and Automobiles*, MIR Publishers. ISBN- 978-5-030-00855-4.
2. Kolchin. A., and V.Demidov (1972), *Design of Automotive engines for tractor*, MIR Publishers.

Unit-1 General Introduction	**10 hours**
General Design of Tractors : Classification of Tractors-Main components of Tractor-Safety Rules.	
Unit-2 Tractor control	**10 hours**
Control of the Tractor and Fundamentals of Engine Operation: Tractor controls and the starting of the tractor engines-Basic notions and definition-Engine cycles-Operation of multi cylinder engines-General engine design - Basic engine performance characteristics.	
Unit-3 Working of Automobile Engines	**9 hours**
Engine Frame Work and Valve Mechanism of Tractor: Cylinder and pistons-Connecting rods and crankshafts Engine balancing – Construction and operation of the valve mechanism-Valve mechanism components – Valve mechanism troubles. Cooling system, Lubrication System and Fuel System of a Tractor: Cooling system – Classification, Liquid cooling system – Components, Lubricating system servicing and troubles – Air cleaner and turbo charger – Fuel tanks and filters –Fuel pumps.	
Unit-4 Farm Equipments	**9 hours**
Working attachment of tractors-Farm equipment – Classification – Auxiliaryequipment – Trailers and body tipping mechanism.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	Alternative Fuels and Power Systems			
Course Code	**MAUE5017**			
Prerequisite	-			
Corequisite	-			
Antirequisite	-			
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

1. To introduce the students to different kinds of alternative fuels.
2. To understand the properties and applications of alternative fuels.

Course Outcomes

CO1	Identify the need for alternative fuels and their sources.
CO2	Demonstrate the performance characteristics of alcohol fuels in SI and CI engines.
CO3	Investigate the properties, engine performance and emission characterstics of hydrogen, biogas and vegetable oil fuels.
CO4	Demonstrate the layout of electric, solar powered and hybrid vehicles.

Text Book (s) and Reference Book (s)

1. Osamu Hirao and Richard K. Pefley (1988), *Present and Future Automotive Fuels*, John Wiley and Sons. ISBN-978-0-471-80259-4.
2. Keith Owen and Trevor Eoley (1990), *Automotive Fuels Handbook*, SAE Publications.
3. Richard L.Bechtold (1997), *Automotive Fuels Guide Book*, SAE Publications. ISBN- 978-0-7680-0052-8.

Course Content:

Unit-1 Introduction	**10 hours**
Estimation of petroleum reserves - Need for alternative fuels - Availability and Suitability to Piston Engines, Concept of conventional fuels, potential alternative fuels - Ethanol, Methanol, DEE/DME - Hydrogen, LPG, Natural gas, producer gas, Bio gas and Vegetable oils - Use in I.C. Engines-Merits and Demerits of various fuels.	
Unit-2 ALCOHOL FUELS	**10 hours**
Properties as engine fuels - Performance in S.I.Engines - Alcohol & Gasoline blends - Flexible Fuel Vehicle -Reformed alcohols - Use in C.I. Engines - Emulsions - Dual fuel systems -Spark assisted diesel engines – AE – 60 07-08 – SRM – E&T Surface ignition engines - Ignition accelerators - Combustion and emission characteristics in engines – emissioncharacteristics.	
Unit-3 GASEOUS FUELS and VEGETABLE OILS	**9 hours**
Hydrogen - Properties - Use in CI Engines - Use in SI Engines - Storage methods - Safety precautions. Producer gas and biogas - Raw materials - Gasification - Properties - Cleaning up the gas - Use in SI and CI engines, LPG & Natural gas - Properties - Use in SI and CI Engines. Various vegetable oils for engines – Properties - Esterification - Performance in engines - Performance and emission Characteristics.	
Unit-4 ELECTRIC AND SOLAR POWERED VEHICLES	**9 hours**
Layout of an electric vehicle - Advantage and limitations - Specifications - System component. Electronic control system - High energy and power density batteries - Hybrid vehicle - Solar powered vehicles.	

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	**30**	**50**	**100**

Name of The Course	**Special Purpose Vehicles**			
Course Code	**MAUE5018**			
Prerequisite	-			
Corequisite	-			
Antirequisite	-			
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

The objective of teaching special purpose vehicles is to make students familiar with the classification of special purpose vehicles based on their applications, wheel tyres and truck type.

Course Outcomes

CO1	Classify the special purpose vehicles based on listed parameters
CO2	Explain working principles and design consideration of different earth moving machines.
CO3	Summarize the elements and working of a farm tractor.
CO4	Summarize elements and design parameters of mobile cranes.

Text Book (s) and Reference Book (s)

1. Y. Pokras and M. Tushnyakov, *Construction Equipment Operation & Maintenance*, MIR, Moscow.
2. A. Astskhov, *Truck Cranes*, MIR, Moscow.
3. E.G. Poninson, *Motor Graders*, MIR, Moscow.
4. N. Rudenko, *Material Handling Equipment*, MIR. Publishers. ISBN-978-0-714-70285-8.
5. Sheldon, R.Shacket, Domus Books, *Electric Vehicles*, New York. ISBN- 978-0-891-96085-0.

Course Content:

Unit-1 Classification of Special Purpose Vehicles	**8 hours**
Classification of Special Purpose Vehicles: based on applications, wheel types & Truck type.	
Unit-2 Construction working principle and working	**10 hours**
Study of working principles & design considerations: of different systems involved like power system, transmission, final drive, lubrication, electrical, braking, steering, pneumatic & hydraulic control circuits. Constructional & working features: of different types of earth moving machinery such as Tippers, shovels, loaders, Excavators, Dumpers, Dozers, Fork Lift truck, Road rollers.	
Unit-3 Farm Tractor	**9 hours**
Farm Tractor: Layout, Load distribution, Engine, Transmission & Drive line, Steering, Braking system, Wheels & Tyres, Hydraulic system, Auxiliary Systems, Draw bar, PTO Shaft. Different types of Implements, accessories and attachments. Tractor trolley.	
Unit-4 Mobile Cranes	**10 hours**
Mobile Cranes : Basic characteristics of truck cranes, stability & design features, control systems & safety devices. Tracked Vehicles, Articulated Vehicles, Multi-axle Vehicles, fifth wheelmechanism. Semi trailer & Prime mover brakes & electrical systems. Dead Axles. SpecialPurpose Electric Vehicles, Solar Vehicles and Hybrid Vehicles. Types, architecture and parameters of design considerations.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Safety, Health and Enviornment**				
Course Code	**MAUE5019**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

The course is intended to
1. Introduce the basics of Air pollution.
2. Understand the measures and technologies required to control the air pollution.

Course Outcomes

CO1	List the Different type of hazards and Vulnerability models
CO2	Identify fire and explosion model for Automotive safety Analysis
CO3	Examine different Air Pollutants
CO4	Investigate wind circulation stability conditions and Maximum Mixing Depths
CO5	Summarize air pollution control technologies

Text Book (s) and Reference Book (s)

1. M N Rao & H V N Rao (2000), *Air pollution*, Tata McGraw Hill Publishing Ltd. ISBN- 978-0-074-51871-7.

Course Content:

Unit-1 Safety **8 hours**
Concepts of safety – Hazard classification chemical, physical, mechanical, ergonomics, biological and noise hazards – Hazards from utilities like air, water, steam. Hazard identification - Safety Audits - Checklists - What if Analysis – HAZAN – HAZOP - Vulnerability models - Event tree and Fault tree Analysis - Past accident analysis - Flixborough - Mexico - Bhopal - Madras - Vizag accident analysis.
Unit-2 Automotive safety Analysis **8 hours**
Introduction to Consequence Analysis - Fire and Explosion models: Radiation - Tank on fire - Flame length – Risk analysis - Radiation intensity calculation and its effect to plant, people & Property - UCVCE - Explosion due to - Deflatration - Detonation - TNT, TNO & DSM model - Over pressure - Methods for determining consequences effects - Effect of fire- Effects of explosion - Risk contour - Flash fire - Jet fire - Pool fire - BLEVE - Fire ball.
Unit-3 Air Pollution Monitoring **9 hours**
Collection of Gaseous Air Pollutants, Collection of Particulate Pollutants, Measurement of SO_2, Nox, CO, Oxidants and Ozone
Unit-4 Meteorology & Dispersion of pollutants **9 hours**
Wind Circulation, Lapse Rate, Stability Conditions, Maximum Mixing Depths, Plume Rise & dispersion
Unit-5 Emission Control Systems **9 hours**
Air pollution control technologies for particulates and gaseous contaminants, Gravity settlers, Electrostatic precipitators, Bag Filters, Scrubbers, Cyclone, control for moving sources.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Hydraulics and Pneumatics**				
Course Code	**MAUE5020**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

This subject deals with the hydraulic and pneumatic aspects which helps students to understand their applications in automobile engineering.

Course Outcomes

CO1	Explain the fluid power in hydraulic and pneumatic systems
CO2	Summarize the different elements of hydraulic systems and their working
CO3	Summarize the different elements of Pneumatic systems and their working
CO4	Apply Hydraulic and Pneumatic principle in different automotive application

Text Book (s) and Reference Book (s)

1.AnthonyEspisito (2003), *Fluid Power with Application*, Pearson Education (Singapore) Pte.Ltd, Delhi, India, Fifth Edition, First Indian Reprint, ISBN- 978-8-177-58580-3.

2. Werner Deppert and Kurt Stoll (1975), *Pneumatic Controls : An introduction to principles*, Vogel-Druck Wurzburg, Germany. ISBN-978-3-802-30102-5.

3. Pippenger, J.J (2002), *Industrial Hydraulic & Pneumatics*, McGraw Hill.

4. Anderson B W, *The analysis and design of pneumatic systems*, John Wiley.

5. A. B. Goodwin, *Fluid Power Systems*, Mc Millan Pub. Co. ISBN- 978-0-333-19368-6.

Course Content:

Unit-1 Introduction to fluid power	**10 hours**
Introduction to fluid power – Classification, application in various fluids of engineering, various hydraulic and pneumatic ISO/JIC Symbols, transmission of power at static and dynamic states, Types of hydraulic fluids and their properties, effect of temperature on fluids.	
Unit-2 Elements and working of hydraulic systems	**10 hours**
Different elements of hydraulic system, constructional and working details of each component; Pumps and motors, characteristics, Maintenance of hydraulic system, control valves, actuators and mountings, filter, regulator and lubricator. Selection criteria for cylinders, valves, pipes etc.	
Unit-3 Pneumatic Systems	**9 hours**
Pneumatic Systems : Application of pneumatics, physical principles, basic requirement of pneumatic system. Comparison with hydraulic systems. Elements of Pneumatics, Air compressors, Pneumatic control valves, Pneumatic actuators - types and the mountings, Air motors – types, Pneumatic circuits – Basic pneumatic circuit, impulse operation, speed control, pneumatic motor circuit, sequencing of motion, time delay circuits and their applications.Pneumatic servo-system for linear and rotary motion.	
Unit-4 Automotive Applications of pneumatic systems	**9 hours**
Typical Automotive Applications: Hydraulic tipping mechanism, power steering, fork lift hydraulic gear, hydro-pneumatic suspension Maintenance and trouble shooting of hydraulic & pneumatic circuits. Introduction to fluidics-study of simple logic gates, turbulence, amplifiers, pneumatic sensors and applications.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	Vehicle Aerodynamics			
Course Code	**MAUE5021**			
Prerequisite	-			
Corequisite	-			
Antirequisite	-			
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

1. To analyze the stability, safety and comfort of the vehicles
2. To understand wind tunnels and testing techniques
3. To apply CFD for aerodynamic design of vehicle

Course Outcomes

CO1	Demonstrate aerodynamic drag and forces in a car body
CO2	Identify the parameters of vehicle body related to car stability, safety and comfort.
CO3	Summarize the wind tunnels and testing methodology.
CO4	Model fluid flow equations around a vehicle body
CO5	Construct the aerodynamic models for cars, buses and trucks.

Text Book (s)

1. DaleH. Beterfield et al (2001), *Total Quality Management*, Pearson Education Asia. ISBN- 978-8-131-76496-1.

Reference Book (s)

1. John Bank J.E. (1993), *Total Quality Management*, Prentice Hall, India, ISBN- 978-0-132-84902-9.
2. Samuel K.Ho (2002), *TQM- AN Integrated approach*, Kogan Page India Pvt. Ltd, ISBN- 978-0-749-41561-7.
3. Jill A.Swift, Joel E. Ross and Vincent K. Omachonn (1998) *Principles of Total Quality*, St.Lucie Press, US, 1998. ISBN-978-1-574-44094-2.

Course Content:

Unit-1 Fundamentals of Aerodynamics	**6 hours**
Scope – Development trends – Flow phenomena related to vehicles – External and Internal flow problems – Performance of cars and light vans – Resistance to vehicle motion – Drag – Types of drag – Flow field around car – Aerodynamic development of cars – Optimization of car bodies for low drag.	
Unit-2 Stability, Safety and Comfort	**6 hours**
The origin of forces and moments – effects – vehicle dynamics under side wind – Force and Moment coefficients – Safety limit – dirt accumulation on vehicle - wind noise – Air flow around individual components – High performance vehicles – Very log drag cars – Design alternatives – High efficiency radiator arrangement – Development and simulation methods.	
Unit-3 Wind Tunnels and Test Techniques	**12 hours**
Principles of wind technology – Limitations of simulation – Scale models – Existing automobile wind tunnels – Climatic tunnels – Measuring equipment and transducers. Pressure measurement – velocity measurements – Flow visualization techniques – Road testing methods – Wind noise measurements.	
Unit-4 Introduction to CFD	**10 hours**
Methods to solve Navier–Stokes equation – Forces acting in a fluid element –	

Compressibility effects in a flow field – Inviscid flow – Governing equations – Irrotation flow field and consequences – Potential flows – Boundary layer methods – Numerical modelling of fluid flow around vehicle body.
Unit-5 Aerodynamic Design **6 hours**
Development and simulation methods –cars, buses, trucks studies.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Automotive Safety**				
Course Code	**MAUE5022**				
Prerequisite	-				
Corequisite	-				
Antirequisite	-				
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

The concept of introducing this subject is to make students familiar with the aspect of vehicle safety and to introduce them with the notion of bus body and commercial vehicle.

Course Outcomes

CO1	Classify different aspects of saftey in automobile
CO2	Categories different saftey parameteres in car
CO3	Illustrate layout of different bus body
CO4	Illustrate various bodies of Commercial Vehicle

Text Book (s) and Reference Book (s)

1. Hucho, W.H. (1997), *Aerodynamics of Road vehicles*, Butterworths Co. Ltd. ISBN- 978-0-750-61267-8.
2. J. Powloski (1969), *Vehicle Body Engineering,* Business books limited, London. ISBN- 978-0-220-68916-2.
3. Ronald. K. Jurgen (1999), *Automotive Electronics Handbook,* Second edition- McGraw-Hill Inc. ISBN- 978-0-070-34453-2.
4. ARAI Safety standards.

Course Content:

Unit-1 Introduction	**6 hours**
The concept of vehicle safety; Need of safety; active safety: driving safety; conditional safety; perceptibility safety; operating safety- passive safety: exterior safety, interior safety, deformation behaviour of vehicle body.	
Unit-2 Vehicle safety	**9 hours**
Regulations, automatic seat belt Tightener system; Collapsible steering column; Tiltable steering wheel; Electronic system for activating air bags; Bumper design for safety; antiskid brakingsystem; Speed control devices; Causes of rear end collision; Frontal object detection; Rear vehicle object detection system; Object detection system with braking system interactions	
Unit-3 Bus Body	**9 hours**
Types: Mini bus, single and double decker, two level, split level and articulated bus. Bus body layout – Floor height - Engine location - Entrance and exit location - Seating dimensions. Constructional details: Frame construction, Double skin construction -Types of metal section used - Regulations -Conventional and integral type construction.	
Unit-4 Commercial Vehicle	**8 hours**
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100