NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Syllabus for

Final Year Automobile Engineering

Faculty of Engineering and Technology

Teachers, Paper Setters and Examiners Guidelines Manual

SEMESTER – VII and VIII

W.E.F 2015 – 2016

North Maharashtra University, Jalgaon
Syllabus Structure for Final Year Automobile engineering w.e.f year 2015-16
Semester –VII
ISE: Internal Sessional Examination ESE: End Semester Examination ICA:

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
		Theory		PR	Total	Theory			PR/OR	Total	
		TH Hr/W	Tut Hr/W	PR Hr/W	Total	ISE	ESE	ICA	ESE		
Automobile Service & Repair	D	3	---	---	3	20	80	---	---	100	3
Automobile System Design	D	3	---	---	3	20	80	---	---	100	3
Interdisciplinary Elective	E	3	---	---	3	20	80	---	---	100	3
Elective-I	E	3	---	---	3	20	80	---	---	100	3
Vehicle Testing & Evaluation	D	3	---	---	3	20	80	---	---	100	3
ASR	D	---	---	2	2	---	---	25	25 (PR)	50	1
ASD	D	---	---	2	2	---	---	25	25 (OR)	50	1
Elective-I	E	---	---	2	2	---	---	25	25 (OR)	50	1
Project–I	D	---	---	2	2	---	---	25	25 (OR)	50	2
Seminar-II	D	---	---	2	2	---	---	25	---	25	2
Industrial Visit	D	---	---	---	---	---	---	25	---	25	1
Total		**15**	**---**	**10**	**25**	**100**	**400**	**150**	**100**	**750**	**23**

Internal Continuous Assessment

- Interdisciplinary Elective shall be offered by the department to the students of other departments. Students from one department cannot register for Interdisciplinary Elective of the same department.
- At least 15 students should register for offering any elective.

	Interdisciplinary Elective		**Elective – I**
1	Transport Management and Motor Industry	1	Vehicle Body Engineering
2	Automobile Systems	2	Tribology
		3	Numerical Analysis and Computational Method
		4	Advanced Engine Technology

North Maharashtra University, Jalgaon

Syllabus Structure for Final Year Automobile Engineering w.e.f year 2015-16

Semester –VIII

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
		Theory		PR	Total	Theory			PR/OR	Total	
		TH Hr/W	Tut Hr/W	PR Hr/W	Total	ISE	ESE	ICA	ESE		
Automobile Dynamics	D	3	---	---	3	20	80	---	---	100	3
Special Purpose Vehicles	D	3	---	---	3	20	80	---	---	100	3
Elective-II	E	3	---	---	3	20	80	---	---	100	3
Elective-III	E	3	---	---	3	20	80	---	---	100	3
Auto Dynamics	D	---	---	2	2	---	---	25	25	50	1
SPV	D	---	---	2	2	---	---	25	25 PR	50	1
Elective-II	E	---	---	2	2	---	---	25	25	50	1
Industrial Lecture*	C	---	---	1*	1	---	---	50	---	50	2
Project–II	D	---	---	4	4	---	---	75	75	150	6
Total		**12**	**---**	**11**	**23**	**80**	**320**	**200**	**150**	**750**	**23**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

	Elective-II		**Elective – III**
1	Computer Aided Design and Computer Aided Manufacturing	1	Computational Fluid Dynamics
2	Analysis and Synthesis of Mechanism	2	Advanced Welding Technology
3	Automobile Painting and Collision Repairs	3	Noise Vibration and Harshness in Automobiles
		4	Automotive Materials

- Minimum 6 lectures to be delivered by experts from the industry in alternate weeks. Next week group discussion on the lecture delivered.
- At least 15 students should register for offering any elective

Course Outline

Automobile Service & Repair **ASR**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to Automobile Service & Repair. The background requires sound knowledge of Automobile engineering & various automobile systems of third year level. The course imparting the knowledge of repairing & maintenance of automotive vehicles.

Teaching Scheme:

	Hours per week	**No. of Weeks**	**Total hours**	**Semester Credits**
Lectures	03	14	42	03
Practical's	02	14	28	01

Examination Scheme

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**

Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: Automobile Engineering, Internal Combustion Engine & Automobile System at Third Year Level

Outline of the content: This course contains:

UNIT- I

1.		**Engine Repair & Maintains** **No of Lectures 09, Marks : 16**
	a	Introduction, Engine removal, Engine head, Removing cylinder head, Cleaning & inspection
	b	Refitting the cylinder head. Valve & valve mechanism, Piston connecting rod assembly, Cylinder block
	c	Reinstalling the assembly in the cylinder, Crank shaft & main bearing
	d	Engine reassembly, Precautions

UNIT- II

2.		**Tuning** **No of Lectures 09, Marks : 16**
	a	Tuning procedure, Crankshaft thumping, Connecting rod noise, Piston noise, Piston pin noise, Valve & tappet noise
	b	Abnormal oil consumption, Ignition timing
	c	Servicing of propeller shaft & differential assembly
	d	Assembling & dissembling of steering assembly

UNIT- III

3.		**Chassis Drive Line Components Service** **No of Lectures 08, Marks : 16**
	a	Introduction, Suspension systems & springs of rigid & independent types
	b	Dissembling of leaf spring, coil spring & its service
	c	Dissembling of clutch system (mechanical & hydraulic types) repair, maintenance & trouble shooting
	d	Removal of gear-box assembly, Procedure of gearbox dismantling, trouble shooting & refitting.

UNIT- IV

4.		**Brakes & It's Types** **No of Lectures 08, Marks : 16**
	a	Brake Testing, Brake Service, Bleeding Of Brakes, Brake Padel Adjustment, Brake Adjustment, Relining Wheel Brake, Reconditioning Master & Wheel Cylinder Fast Braking By Means Of Accelerated Speed
	b	Servicing Of Parking Brake, Wheel & Tyre Servicing Causes Of Tyre Wear & Its Remedies, Tyre Maintenance
	c	Wheel Balance, Static Balancing Of Front Wheel, Dynamic Balancing Of Front & Rear Wheel, Trouble Shooting.

UNIT- V

5.		**Servicing of Motor Vehicle** **No of Lectures 08, Marks : 16**
	a	Servicing & Its Necessity, Types Of Servicing, Cleaning Of Motor Vehicle & Its Part
	b	Steam Cleaning, Engine De-Coking, Precaution To Minimize Carbon, Method of De-Carburizing, Greasing Of Motor Vehicle.
	c	Garage & Fleet Management, Introduction, Specimen Of Job Card, Work Charge, Procedure & Records, Garage, Tools & Equipments

Text Book and References Books

1. Crouse & Anglin “Automotive Mechanics”, Tata McGraw Hill Publications.
2. Dr.Kirpal Singh “Automobile Engineering”(VOL –I & II) , Standard Publishers Distributors
3. Dr.V.M.Domkundwar “Automobile Engineering”, Dhanpat Rai & Company, Reprint 2014.
4. G.B.S Narang “Automobile Engineering”, Khanna Publishers.

Course Outline

Automobile System Design **ASD**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to Automobile System Design. The background requires sound knowledge of Design of machine element & Drawing of Automotive Components of third year level. The course imparting knowledge of Designing & optimization techniques.

Teaching Scheme:

	Hours per week	**No. of Weeks**	**Total hours**	**Semester Credits**
Lectures	03	14	42	03
Practical's	02	14	28	01

Examination Scheme

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**

Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: Design of Machine Elements, Automobile Engineering & Automobile System.

Outline of the content: This course contains:

UNIT- I

1.		**Design of Piston and Connecting Rod No of Lectures 09, Marks : 16**
	a	Material Selection, Construction Of Piston, Types Of Piston Manufacturing Process
	b	Design Of Piston, Design Of Piston Pin, Design Of Piston Rings
	c	Material Selection And Construction Of Connecting Rod, Types Of Connecting Rod, Manufacturing Process
	d	Design Calculation Of Split Type Connecting Rod And Its Drawing

UNIT- II

2.		**Design of Crank Shaft and Flywheel No of Lectures 09, Marks : 16**
	a	Material Selection, Construction Of Crank Shaft, Types Of Crank Shaft, Manufacturing Process ,Design Calculation And Drawing
	b	Material Selection and Construction Of Flywheel, Types of Flywheel, Manufacturing Process, Design Calculation And Drawing.

UNIT- III

3.		**Design of Cam Shaft, Valve operating Mechanism No of Lectures 08, Marks : 16**
	a	Material Selection & Construction Of Cam Shaft, Types Of Cam Profile,
	b	Manufacturing Processes Design For-1. Tangent Cam 2.Generated Cam Design Calculation & Drawing
	c	Calculation & Drawing Of Valve Operating Mechanism Like Rocker Arm, Valves & Springs.

UNIT- IV

4.		**Design of Drive Line No of Lectures 08, Marks : 16**
	a	Design Of Propeller Shaft & Universal Joint & Material Selection
	b	Design Of Differential,
	c	Numerical Problems On Steering Systems
	d	Design Of Front & Rear Axles.

UNIT- V

5.		**Statistical Consideration in Design No of Lectures 08, Marks : 16**
	a	Statistics Consideration In Design, Statistics In Design
	b	Design For Natural Tolerance, Statistical Analysis, Mechanical Reliability.
	c	Optimum Design Introduction To Optimum Design To Mechanical Element, Adequate & Optimum Design
	d	Johnsons Method Of Optimum Design, Simple Problems In Optimum Design

Text Books and References Books:

1. Joseph E Shigley & Larry D. Mitchell, “Mechanical Engg. Design” (IV Edition), Mc-Graw Hill International Book Company.
2. M.F.Spotts & T.E.Shout, “Design of machine element” (7th Edition), Tata Mc Graw Hill, New Delhi.
3. V.B.Bhandari, “Design of machine element”, Tata Mc Graw Hill, New Delhi.
4. R.C.Johnson, “Optimum design of mechanical element”, John Willey & Sons.
5. J.S.Arora, “Introduction to optimum design”, Mc Graw Hill Book Company.
6. R.B.Gupta, “Auto Design”, Satya prakashan, Delhi.

Interdisciplinary Elective
Course Outline

Automobile System **AS**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to Automobile Engineering.

Teaching Scheme:

	Hours per week	**No. of Weeks**	**Total hours**	**Semester Credits**
Lectures	03	14	42	03

Examination Scheme

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**

Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: - Degree Requirement

Prerequisite Course(S):- Fundamental knowledge of IC Engine, Theory of Machine

Outline of Content: - This course contents

UNIT- I

1.		**Vehicle Layouts And Specification** **No of Lectures 09, Marks : 16**
	a	Vehicle Specification, Vehicle Layouts, Types Of Vehicles And Their Applications
	b	Two And Four Wheelers, Cars, Light Commercial Vehicles, Trucks, Buses,
	c	Earth Moving Machinery, High Way Vehicles, Agricultural Tractors,
	d	Construction Of Automobile And Various Systems Of Automobiles Chassis And Frames
	e	Frame, Sub Frame, Integral Construction, Frame Alignment
	f	Body Bumpers, Doors, Hood, Articulated Vehicles, Trailers And Safety Consideration.

UNIT- II

2.		**Transmission System** **No of Lectures 09, Marks : 16**
	a	Clutches:- Introduction, Operations, Types Of Clutches, Requirement Of Clutch, Trouble Shooting
	b	Gear Box :- Function, Types Of Gear Box, Torque Convertor, Trouble Shooting
	c	Drive Line :- Propeller Shaft, Differential, Rear Axles, Universal Joint

UNIT- III

3.		**Steering System & Brakes** **No of Lectures 08, Marks : 16**
	a	General Arrangement Of Steering System, Steering Gears, Steering Linkages, Wheel Alignment
	b	Brakes:- Function, Types Of Brakes, Master Cylinder, Wheel Cylinder, Trouble Shooting, Brake Bleeding

UNIT- IV

4.		**Suspension System** **No of Lectures 08, Marks : 16**
	a	Function & Objective, Different Components Of Suspension System
	b	Types Of Suspension Methods
	c	Front Axle Suspension System, Rear Axle Suspension System, Air Suspension System, Trouble Shooting

UNIT- V

5.		**Air Conditioning System** **No of Lectures 08, Marks : 16**
	a	Introduction, Car Air Conditioning System & It's Principle, Different Components Of Air Conditioning System
	b	Control Systems, Air Distribution System For Passenger Compartment
	c	Refrigeration Cycle:- Vapour Compression Cycle, Vapour Absorption Cycle

Text Book and Reference Books:

1. Dr. V. M. Domkundwar," Automobile Engineering" Dhanpat Rai & Company, Reprint 2014.
2. Dr. Kirpal Singh "Automobile Engineering" (VOL –I & II), Standard Publishers Distributors
3. G.B.S Narang "Automobile Engineering", Khanna Publishers
4. R.B.Gupta "Automobile Engineering" Satya Prakashan.

Interdisciplinary Elective

Course Outline

Transport Management **TM**
Course Title: Short Title Course Code

Branch - Automobile Engineering **Year - Fourth Year**

Course Description: This course introduces undergraduate students to Automobile Engineering..

Teaching Scheme:

	Hours per week	**No. of Weeks**	**Total hours**	**Semester Credits**
Lectures	03	14	42	03

Examination Scheme

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**

Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Course: - Fundamental knowledge about Transport Management and Motor Industry.

Outline of Content: - this course contents

Unit I

1.	**Motor vehicle Act**	**No. of Lectures – 09, Marks : 16**
	a	Vehicle Layouts And Specification, Short Titles And Definitions Laws Governing Use Of Motor Vehicle & Vehicle Licensing Of Drivers And Conductor, Registration Of Vehicle, State And Interstate Permits.
	b	Taxation Structure And Methods Of Laving Taxation, Insurance Type And Significance., Furnishing Particulars Of Vehicles Involved In Accident, Award Of Claim
	c	Tribunal, Duty Of Driver & Conductor In Case Of Accident, Traffic Rules, Signals And Liabilities And Preventive Measures, Design Of Road Complex ,
	d	Responsibility Of Driver, Public Authorities, Offences, Penalties And Procedures. Different Types Of Forms, Government Administration Structure, Personnel, Authorities And Duties

Unit II

2.		**Introduction to Transportation** **No of Lectures 09, Marks : 16**
	a	Transport Terminology - Important Terms Used In Road Transport Organization Like HMV, LMV, Fleet, Utilization , Breakdown Rate, Accident Rate, Route, Seat Km Etc.
	b	Cost Of Services- Capital Cost & Operating Cost, Fixed Cost & Variable Cost, Direct & Indirect Cost, Excess Capacity And Effect On Route
	c	Operational Productivity And Efficiency, Productivity In Road Transportation organization, The Environment Of Road Transport System, Optimizing Fleet And Vehicle Utilization, Conservation Of Fuel And Economy, Control Of Breakdown, Effective Traffic Operation

Unit III

3.		**Transport Vehicle Maintenance and Management** **No of Lectures 08, Marks : 16**
	a	Infrastructure In Road Transportation Organization, Garages, Essential Requirements Of Garages, Fleet Maintenance Record, Bus Station ,Bus Shelter, Bus Stop, Essential Requirement, Staffing, Management Of Transport Organization And Its Of Objectives, Typical Depot Layout
	b	Structure Of Passages And Goods Transport Organization
	c	Motor Industry Manufacturing Techniques And Quality Control Of Automobile Components Such As Piston, Cylinder, Valves, Crankshaft, Camshaft, And Bearing

Unit IV

4.		**Transportation Policy** **No of Lectures 08, Marks : 16**
	a	Significance Of Road Transportations Road Transportation As An Agent Of Change And Development ,National Scene, Transport Policy And Co-Ordination, Operating Characteristic S In Transportation Engineering Flexibility ,Speed And Acceleration, Dependability And Safety
	b	Performance Criteria, Transport Planning, Strategic Planning, Management Control, Operational Control Types Of Suspension, Methods

Unit-V

5.		**Road Safety** **No of Lectures 08, Marks : 16**
	a	Road Safety And Health Driving Comfort, Avoiding Fatigue, The Road To Exhaustation, Poisonous Car, Fumes, Car Sickness, Drugs & Driving First Aid, For Motorist, First Aid Kits, Braking & Stopping Interpreting The Signs, Rain, Floods, Hot, Mistcare & Precaution, Ice Snow Skidding, Emergencies & Road Observations.

	b	Accidents Definition Of Accident, Legal Obligation, Causes Of Accident, Insurance, Documentation, Analysis & Preventions Of Accidents, Road Safety & Drivers Role, A Defensive Driver, Driver Selection Test, Drivers Training.
	c	Security Devices Dog Restraint, Rear Fog Lamp, Guard Lamp, Reversing Light, Bonnet, Brakes Locks, Vibrator Alarm, Fog Lamp, Toe Bar, Roof Racks, And Luggage Containers.

Text Book and Reference Books:

1. Government Publication, The Motor vehicle Act, 1989.
2. Kadiyali. L.R., Traffic engineering and Transport Planning.
3. P.G. Patankar, "Road passenger Transport in India", C.I.T.T. Publication
4. Santosh Sharma, "Productivity In Road Transportation" A.S.R.T.V. Publication
5. Compendum of Transport Terms- C.I.R.T .Pune

Course Outline
Elective-I

Vehicle Body Engineering **VBE**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to Automobile Engineering.

Teaching Scheme:

	Hours per week	**No. of Weeks**	**Total hours**	**Semester Credits**
Lectures	03	14	42	03
Practical's	02	14	28	01

Examination Scheme

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**

Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: - Fundamental knowledge of Strength of Materials, Drawing of Automobile components

Outline of the content: This course contains:

UNIT- I

1.		**Vehicle Bodies & Materials** **No of Lectures 09, Marks : 16**
	Introduction	
	a	Classification, nomenclature of car body, different types of car body
	b	Basic Requirements & Structures Of Different Vehicle Bodies Regulations & Standards
	c	Constructional Trends & Styling Forms.
	Materials	
	d	Timber, Reinforced Plastic Molding, Sandwich Construction, Light Alloys, Expanded Metals, Fasteners, Adhesives, Glass, Steel Sheets, Insulating Materials
	e	Use Of Aluminum Structure For Bus Body Building.

UNIT- II

2.		**Private Car Body Work** **No of Lectures 09, Marks : 16**
	a	Sheet Metal Construction, Body Work Aerodynamics (Drag & Lift, Pitching, Yawing & Rolling) Forces & Moments, Sideways Forces, Hull Sealing
	b	Commercial Vehicle Body Design - Bus & Truck Body Weight Analysis, Pay Load, Methods Employed In Loading & Discharge
	c	Body Builders Drawing, Body Mounting, Wood Working Joints, Roof Construction Floor Construction

UNIT- III

3.		**Body Mechanism** **No of Lectures 08, Marks : 16**
	a	Design Of Windows, Door Construction, Design Of Pluggage Carrier, Design Of Spare Wheel Carrier, Design Of Passenger Seats
	b	Driver Seats, Comfort Factors, Circle Of Riding Comfort, Effect Of Discomfort, Safety Consideration
	c	Body Work Drafting :- Full Size Layout On Draft, Proportional Developments, Timber Framing For Composite Body Work , Body Draughtsman Curves

UNIT- IV

4.		**Auto Body Repairs & Testing** **No of Lectures 08, Marks : 16**
	a	Broad Review Of Manufacturing Processes & Equipments, Manufacture Of Prototype, Static & Dynamic Testing
	b	Sources Of Body Noises, Testing & Elimination, Leakage Testing, Testing For Safety & Road Testing
	c	Sheet Metal Working Tools, Timber Body Repairs, Light Alloy & Steel Body Repair
	d	Repairs To Reinforced Plastics Body Work, Corrosion Repairs

UNIT- V

5.		**Painting & Anti-Corrosion Finishes** **No of Lectures 08, Marks : 16**
	a	Introduction, Cleaning, Pretreatment, Priming, Finish Coating, Stoving, Internal Corrosion & Sealing, Materials Of Construction
	b	Painting Processes, Protection Of A Finished Cars, Water Leaks, Water Drainage, System, Windscreens, Apron Panel & Heating/Ventilation, Rear Drip, Tail Gate

Text Book and Reference Books:

1. G.Y Wong "Theory of Ground Vehicle'; John Willey & Sons.
2. Raza N Jazzar, "Vehicle Dynamics"; Springler.
3. Hans-Joachim Streitberger "Automobile Paints & Coatings, Wiley _ VCH Verlay GmbH & Co. KGaA
4. Hans-B Pacejka, Tyre & Vehicle Dynamics.
5. Jason c.Brown, A.John Robertson, "Motor Vehicle Structure "; Butterworth Heinemann.

Course Outline

Elective-I

Tribology **TRIBO**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to Automobile Engineering.

Teaching Scheme:

	Hours per week	**No. of Weeks**	**Total hours**	**Semester Credits**
Lectures	03	14	42	03
Practical's	02	14	28	01

Examination Scheme

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**

Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses:- Fundamental Knowledge of Physics, Chemistry, Engg. Maths, Fluid Mechanics, Machine Design, and Engineering materials.

Outline of the content: This course contains:

UNIT- I

1.		**Tribology** **No of Lectures 09, Marks : 16**
	a	Introduction, Applications, Tribology In Industry Tribology In Design, Economic Considerations
	b	Friction: - Introduction, Kinds Of Friction Laws Of Friction, Causes Of Friction, Friction Measurement, Stick Slip Oscillations & Its Elimination.
	c	Wear: -Introduction, Types Of Wear, Various Factors Affecting Wear Theory Of Wear, Measurement Of Wear, Wear Between Solids And Flowing Liquids, Theory Of Wear

UNIT- II

2.		**No of Lectures 09, Marks : 16**
	a	Lubricants: - Lubricant Properties - Physical And Chemical.
	b	Lubrication - Introduction, Basic Modes Of Lubrication. Flow Of Viscous Fluid Through Rectangular Slot. Seals-Mechanical And Dynamic Seals
	c	Hydrostatic Bearings: Basic Concept, Operations, Advantages And Limitations. Hydrostatic Conical And Spherical Bearings, Load Carrying Capacity And Flow Of Lubricants. Bearing Power And Film Thickness, Bearing Temperature And Power. Compensators And Their Action. Optimum Design Step Bearing.

UNIT-III

3.		**Hydrodynamic Bearing** **No of Lectures 08, Marks : 16**
	a	Theory Of Hydrodynamic Lubrication, Mechanism Of Pressure Development In Oil Film
	b	Two Dimensional Reynolds Equation, Infinite Tapered Shoe Slider Bearings And Infinite Long Journal Bearing. Short Bearing Theory Applied To Journal Bearing

UNIT-IV

4.		**Hydrodynamic Thrust Bearing** **No of Lectures 08, Marks : 16**
	a	Introduction, Flat Plate Thrust Bearing, Step Thrust Bearing, Tapered Land Thrust Bearing, Tilting Pad Thrust Bearing, Spring Mounted Thrust Bearing, Hydrodynamic Pocket Thrust Bearing
	b	Friction And Power Losses In Journal Bearings: Ratio Of Heat Conducted, Evaluation Of Friction Loss In Concentric & Eccentric Journal Bearing & Quantity Of Oil Flow With Circumferential Groove And Hole.

UNIT-V

5.		**No of Lectures 08, Marks : 16**
	a	Hydrostatic Squeeze Film, Circular & Rectangular Plates, Impact Conditions Between Lubricated Solids, Applications To Journal Bearing
	b	Air Lubricated Bearings: -Tilting Pad Bearings, Electromagnetic Bearing,

		Hydrodynamic Thrust Bearing With Air Lubrications. Lubrication Practice, Quality Control & Management -Characteristics Of Lubricating Methods, Lubricating Devices & Systems, Organizing Application Charts

Text Book and Reference Books:

1. B. C. Majumdar "Introduction Tribology and Bearings", H. Wheeler and Company Pvt. Ltd.
2. Cameron A. "Basic Lubrication Theory, Wiley Eastern Ltd.
3. Fuller D. D., "Theory and Practice of Lubrication for Engineers". John Wiley and Sons.
4. Halling J. "Principles of Tribology", McMillan Press Ltd.
5. Hrassan & Powel, "Gas Bearing".

Course Outline

Elective-I

Numerical Analysis and Computational Methods NACM

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to Automobile Engineering.

Teaching Scheme:

	Hours per week	**No. of Weeks**	**Total hours**	**Semester Credits**
Lectures	03	14	42	03
Practical's	02	14	28	01

Examination Scheme

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**

Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: Fundamental knowledge of Engg. Mathematics.

Outline of the content: This course contains:

UNIT- I

1.		**Software Development Principles** **No of Lectures 09, Marks : 16**
	a	Software Development Principles Mathematical Modeling Problem Solving
	b	Transcendental Equation: Bisection Method, False Position, Successive Approximation Method, Newton Rap Son Method, Horner's Method, Rate Of Convergence.

UNIT- II

2.		**Integration & Differential Equation** **No of Lectures 09, Marks : 16**
	a	Numerical Integration Methods: Trapezoidal Rule Simpsons 1/3rd Rule, Simpson's 3/8 Rule, Gauss Quadrature Technique
	b	Ordinary Differential Equation :Taylor's Series Method, Euler's Method, Improved & Modified Euler's Method, Fourth Order Range - Kutta Method

UNIT- III

3.		**Interpolation & Curve Fitting** **No of Lectures 08, Marks : 16**
	a	Interpolation: - Linear And Quadratic Interpolation, Lagrange's Interpolation, Newton's Forward Interpolation, Newton's Backward Interpolation, Newton's Divided Difference Interpolation, Striling Interpolation
	b	Curve Fitting: - Linear & Quadratic Regression, Logarithmic Curve Fitting, Exponential Curve Fitting.

UNIT- IV

4.		**Linear Algebraic & Iterative Method** **No of Lectures 08, Marks : 16**
	a	Linear Algebraic Equation:- Gauss Elimination Method, Gauss Jordan Method LU - Decomposition Method
	b	Jacobi Iteration Method, Gauss Seidel Interactive Method, Cholesky Method Convergence Analysis, Choice Of Method.

UNIT- V

5.		**Finite Difference Method** **No of Lectures 08, Marks : 16**
	a	Finite Difference Method :- Solution Of Ordinary Differential, Solution Of Elliptical Equation For Various Boundary Condition, Solution Of Parabolic Equation By Explicit, Implicit And Crank-Nicolson Method
	b	Finite Element Method :-Finite Element Method Introduction, Comparison With Finite Difference Method, General Approach, Interpolation Function, Finite Element Application On One Dimensions.

Text Book and Reference Books:

1. Chapra Canale, “Numerical Method for Engineer”, McGraw Hill Co.
2. Joh H. Mathews, “Numerical Methods”, Pearson Education
3. P. Kandaswamy, “Numerical Methods”, S. Chand & Co. New Delhi.
4. J.N. Reddy, “Finite Element Method”, McGraw Hill Co.
5. Jain, Jain & Iyangar, “Numerical Method for Scientist & Engineering Computation”, New Age Interpolation Pvt., Ltd.
6. S.S.Shashri, “Introductory Method of Numerical Analysis”, Prentice Hill India.
7. Belegundupala, “Introduction to Finite Element Method”, Prentice Hill India.
8. P.K. Dey, Programming in “C “, Oxford, New Delhi.
9. Y. Kanitkar, “Let us C”, BPB Publications
10. Balgurusamy, “Programming in C”, TMH
11. Kaye, “An Introduction to Quantum Computing”, OUP.
12. Reddy, “An Introduction to Nonlinear Finite Element Analysis”, Oxford, Delhi

Course Outline

Vehicle Testing & Evaluation **VTE**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to Vehicle Testing & Evaluation.

Teaching Scheme:

	Hours per week	**No. of Weeks**	**Total hours**	**Semester Credits**
Lectures	03	14	42	03

Examination Scheme

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**

Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: - Fundamental knowledge of IC Engine, Applied thermodynamic.

Outline of the content: This course contains:

UNIT- I

1.		**Testing Of Vehicles** **No of Lectures 09, Marks : 16**
	a	Scope, Test Procedure, Vehicle Performance Trials, Instrumentation Calibration, Performance Evaluation Tests For Maximum Speed
	b	Brake Tests, Steering Torque Measurement, Engine Test, Use Of Chassis Dynamometer For Vehicle Test

UNIT- II

2.		**No of Lectures 09, Marks : 16**
	a	National Proving Ground, Various Testing Tracks :- High Speed Track, Belgian Pave Track, Corrugated Track, Deep Wading Through, Shallow Water Trough, Mud Track, Steering Pad, Serpentine Courses, Gradient Track.
	b	Evaluation & Measurement. :- Evaluation And Measurement Of Various Parameters Speed, Distance And Acceleration, Fuel Consumption, Vibration, Noise And Sound, Radio Interference, Exhaust Emission And Miscellaneous

UNIT- III

3.		**Component Testing** **No of Lectures 08, Marks : 16**
	a	Material Selection & Construction Of Cam Shaft, Types Of Cam Profile, Importance Of Component Testing Methods Of Testing And Correlation To Field Failure, Feedback, Failure Pattern
	b	Performance Evaluation And Endurance, Testing Of Aggregates Such As – Engine And Its Aggregates / Components. Gear Box
	c	Clutch, Axles, Shock Absorber, Springs, Rubber Components, Auto Transmission, Various Filters, Head lamps, Spark Plug, Tyres, Radiators, Injectors, Pumps, Electrical Item Brakes.

UNIT- IV

4.		**Vehicle Safety in Design / Manufacture** **No of Lectures 08, Marks : 16**
	a	Vehicle Configuration Requirements And Function Safety. Performance And Safety Suspension System, Steering System, Crach Worthiness.
	b	Morphology Of Vehicles General Layout Of Passenger Cars And Commercial Vehicles. Effects Of Shocks And Vibrations On Human Being, Comfort Criteria
	c	Safety Regulation Of EEC And Central Motor Vehicles Rules

UNIT- V

5.		**Visibility & Lighting** **No of Lectures 08, Marks : 16**
	a	Illumination And Glare Front Rear And Side Visibility, Safety Glasses, Warning And Signaling Devices. Antitheft Devices, Child Protection Devices
	b	Study Of Various Kinds Of Collisions And Impacts Such As Frontal Side And Rear. Crush Zone, Bumpers, Roll Over. Stability & Safety, Seat Belts And Passenger Restraint Systems

	c	Methods Of Measurement Of CO, HC & (NO) X By Infrared, FID - Flame ionization Detector And Chemiluminescence's Methods

Text Book and Reference Books:

1. Birch, "Automotive Chassis system"
2. CIRT & VRDE manuals
3. Giles, "Vehicle operation and performance"
4. Giles , "Motor Vehicle inspection"

Lab Course

Automobile Service & Repair **ASR Lab**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: - This lab includes different practical of Automobile Service & Repair. The course aims at imparting knowledge of Automobile Service & Repair and its modes.

Teaching Scheme:

	Hrs per week	No. of weeks	Total hour	Semester Credits
Laboratory	02	14	28	01

Evaluation Scheme:

Internal Continuous Assessment (ICA)	**25 marks**	**50 Marks**
End Semester Exam (ESE) (PR)	**25 marks**	

Prerequisite Course(S):- Automobile Engineering, Internal Combustion Engine & Automobile System.

Outline of Content: This course contains:

1. Dismantle and assemble a four stroke multi cylinder engine.
2. Dismantle and assemble a two stroke petrol engine.
3. Aclcesmann steering geometry verification.
4. Brake system trouble shooting (Hydraulic brake, air brake and disc brake).
5. Study of servicing procedures of different types of rear axle assembly (Light duty and heavy duty vehicles)
6. Tran's axle assembly and servicing.
7. Servicing of clutches (single plate, multi plate).
8. Servicing of constant mesh, sliding mesh and synchromesh gear boxes.
9. Study of wheel alignment and balancing.
10. Observe and sketch figures of various garage tools used in automobile garage.

Note: Lab file should contain at least Eight experiments from above mentioned list.

ESE (Practical Examination)

The Practical Examination will comprise of performing the experiment and viva on the Practical's.

Instructions for Practical Exam:-

1. Eight experiments should be selected for practical examination.
2. The Number of Students for each practical set up should not be more than 5 students.
3. Oral will be based on the practical performed in the examination and the experiments included in the Journal.

Lab Course

Automobile System Design **ASD Lab**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Outline:-

This lab includes different assignments of Automobile System Design. The course aims at imparting knowledge of Automobile System Design and its modes.

Teaching Scheme:

	Hrs per week	No. of weeks	Total hour	Semester Credits
Laboratory	02	14	28	01

Evaluation Scheme:

Internal Continuous Assessment (ICA)	**25 marks**	**50 Marks**
End Semester Exam (ESE) (OR)	**25 marks**	

Prerequisite Course(S):- Automobile System Design, Internal Combustion Engine & automobile System.

Outline of Content: This course contains:

1) It shall consist of two A-2 size sheets based on design of any one system mentioned below: Piston connecting rod assembly, Propeller shaft & Universal joint, Front axle, Rear axle, Cam & valve actuating mechanism.
2) Components drawing of the above assembly in A-2 size sheet.
3) Three assignment based on curriculum of this course.

Lab Course

Vehicle Body Engineering **VBE Lab**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Outline:-

This lab includes different practical of Automobile Service & Repair. The course aims at imparting knowledge of Automobile Service & Repair and its modes.

Teaching Scheme:

	Hrs per week	No. of weeks	Total hour	Semester Credits
Laboratory	02	14	28	01

Evaluation Scheme:

Internal Continuous Assessment (ICA)	**25 marks**	**50 Marks**
End Semester Exam (ESE) (OR)	**25 marks**	

Prerequisite Course(S):- Fundamental knowledge of nomenclature of vehicle body, various body building methods & their designs.

Outline of Content: This course contains:

Term work shall consist of minimum eight assignments based on above syllabus.

Lab Course

Tribology **TRIBO Lab**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Outline:-

This lab includes different practical of Automobile Service & Repair. The course aims at imparting knowledge of Automobile Service & Repair and its modes.

Teaching Scheme:

	Hrs per week	No. of weeks	Total hour	Semester Credits
Laboratory	02	14	28	01

Evaluation Scheme:

Internal Continuous Assessment (ICA)	**25 marks**	**50 Marks**
End Semester Exam (ESE) (OR)	**25 marks**	

Prerequisite Course(s): Fundamental Knowledge of Physics, Chemistry, Engg. Math's, Fluid Mechanics, Machine Design, and Engineering materials.

Outline of Content: This course contains:

01 Practical on Journal Bearing apparatus.

02 Practical on Tilting pad thrust bearing apparatus

03 Friction in Journal Bearing

04 Practical on Brake line friction test rig.

05 Practical using Pin on disc test rig.

Note: Any 03 experiments should be performing from above list and 03 assignments include in the course based on curriculum of this course.

Guidelines for ICA: ICA will be based on Practical assignments submitted by the student in the form of journal.

Lab Course

Numerical Analysis and Computational Methods **NACM Lab**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Outline:-

This lab includes different practical of Automobile Service & Repair. The course aims at imparting knowledge of Automobile Service & Repair and its modes.

Teaching Scheme:

	Hrs per week	**No. of weeks**	**Total hour**	**Semester Credits**
Laboratory	02	14	28	01

Evaluation Scheme:

Internal Continuous Assessment (ICA)	**25 marks**	**50 Marks**
End Semester Exam (ESE) (OR)	**25 marks**	

Prerequisite Course(S):- Fundamental knowledge of Engg. Mathematics

Outline of Content: This course contains:

Term work shall consist of minimum eight assignments based on curriculum of this course.

The Oral Examination will comprise of performing viva on the term work

Course Title	Short Title	Course Code
Project-I	**P-I**	

Course Description:

The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	**No. Of Weeks**	**Total Hours**	**Semester Credits**
Laboratory	**2**	**14**	**28**	**2**

Prerequisite Course(s): Knowledge of science, mathematics, computer programming and core subject of engineering.

General Objectives: The objectives of project are to develop ability to work in group. The scope of work is design and conduct experiments, as well as to analyze and interpret data within realistic constrain such as economic, environmental, social, safety and manufacturability. The project work provides plate form for planning, material procurement, preparing specification and execution of work. The project also develop to work on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Apply knowledge of mathematics, science, and engineering.
2. Design and conduct experiments, as well as to analyze and interpret data.
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Function on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
5. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
6. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
7. Recognition of the need for, and an ability to engage in life-long learning.
8. Use the techniques, skills, modern engineering tools and software necessary for engineering practice.

Project-I

(Lab Course Contents)

Semester-VII **Examination Scheme:**
Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**
Practical: 2 Hrs/Week **(ESE) End Semester Examination (OR): 25Marks**

- It is expected that the broad area of Project-I shall be finalized by the student in the beginning of the VII semester / extension of Minor project undertaken may be Project-I.
- A group of Minimum 3 and Maximum 5 students shall be allotted for Project-I and same project group for Project-II.
- Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students. The **Synopsis/Abstract** on the selected topic, after detail literature survey should be submitted to the Project coordinator appointed by Head of the department.
- Project-I may involve literature survey, problem identification, work methodology preparing specification and material procurement, collection of data , conduction of experiments and analysis. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis.
- Approximately more than 50% work should be completed by the end of VII semester.
- Each student group is required to maintain log book for documenting various activities of Project-I and submit group project report in the form of thermal bound at the end of semester – VII. Submit the progress report in following format:
    a. *Title*
    b. *Abstract*
    c. *Introduction*
    d. *Problem identification and project objectives*
    e. *Literature survey*
    f. *Case study/Analysis/Design Methodology*
    g. *Work to be completed (Progress status)*
    h. *Expected result and conclusion*
    i. *References.*

- Evaluation Committee comprising of the Guide, Project Coordinator and Expert appointed by the Head of the department will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Guide lines for ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Assessment of the project-I for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-A.**

Guide lines for ESE: The End Semester Examination for Project shall consist of demonstration if any, presentation and oral examinations based on the project report**.**

Assessment of Project-I

Name of the Project: _____

Name of the Guide: _____

Table-A

SN	Name of Student	Problem Identification and project objectives	Literature Survey	Project Methodology/Design/PCB/ hardware/ simulation/ programming	Progress Status	Presentation	Total
		5	**5**	**5**	**5**	**5**	**25**

Course Title Short Title Course Code
Seminar-II

Course Description: The course explores the knowledge of presentation and effective communication. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	**No. Of Weeks**	**Total Hours**	**Semester Credits**
Practical	**2**	**14**	**28**	**2**

Prerequisite Course(s): Knowledge of science, mathematics, computer programming and core subject of engineering.

General Objectives: The objectives of Seminar –II are to develop ability express our view, presentation and effective communication. The scope of seminar-II is study various national and international journal for design, experiments conduct, as well as to analyze and interpret data within realistic constrain such as economic, environmental, social, safety and manufacturability.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand literature survey for selection of seminar topics.
2. Apply knowledge of mathematics, science, and engineering for effective presentation of selected topic.
3. Function on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
4. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
5. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
6. Practice the use of various resources to locate and extract information using offline & online tools, journals.
7. Practice the preparation and presentation of scientific papers and seminars in an exhaustive manner.

Seminar-II
(Course Contents)

Semester-VII **Examination Scheme:**
Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**
Practical: 2 Hrs/Week

1. Each Student shall select a topic for seminar which is not covered in curriculum. Seminar topic should not be repeated and registration of the same shall be done on first come first serve basis.
2. Topic of Seminar shall be registered within a three weeks from commencement of VII Semester and shall be approved by the committee.
3. The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of Seminar-II. Seminar shall be related state of the art topic of his choice approved by the committee.
4. Each student should deliver a seminar in scheduled period (Specified in time table or time framed by department) and submit the seminar report (paper bound copy/Thermal bound)in following format:
    a. *Title*
    b. *Abstract*
    c. *Introduction*
    d. *Literature survey*
    e. *Concept*
    f. *Functional and Technical Details*
    g. *Applications*
    h. Comparison with similar topics / methods
    i. *Future scope*
    j. *References*

Guide lines for ICA: ICA shall be based on topic selection, presentation and Seminar-II report submitted by the student in the form of thermal bound. Assessment of the Seminar-II for award of ICA marks shall be done jointly by the guide and a departmental committee, as per the guidelines given in **Table- B**

ASSESSMENT OF SEMINAR-II

Name of Guide: _____

Table-B

SN	Name of Student	Seminar Topic	Topic Selection	Literature survey	Report writing	Depth of under-standing	Presentation	Total
			5	5	5	5	5	25

Course Title	Short Title	Course Code
Industrial Visit	**IV**	

Course Description: The course explores the knowledge industry organization, new trends in manufacturing, maintenance and safety. The industrial visit provides the practical visualization of theoretical study of various engineering subject.

	Hours per Week	**No. Of Weeks**	**Total Hours**	**Semester Credits**
Practical	**-**	**-**	**-**	**1**

General Objectives: The main objective behind these visits is to explain the working of industrial equipments in running conditions to the students and tell them about the expectations of the industrialists from the fresh engineers.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand organizational set up of an industry.
2. Develop our self for expectations of the industrialists from the fresh engineers.
3. Understand manufacturing, material handling, maintenance, safety standard and environmental consideration in industry.
4. Function on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
5. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
6. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Industrial Visit
(Course Contents)

Semester-VII **Examination Scheme:**
Teaching Scheme: **(ICA) Internal Continuous Assessment: 25 Marks**

1. Industry visits to minimum two industries shall be carried out by each student preferably or college shall arrange the industrial visit during the vacation period otherwise during the regular VII semester.
2. The student should obtain appropriate certificates of visit from the concerned organizations just after the visits.
3. Every Student should submit Industrial Visit report individually at the end of Semester-VII(First Term of Final Year)
4. The report(Thermal Bound) should contain information about the following points:
   a. *The organization - activities of organization and administrative setup technical personnel and their main duties.*
   b. *The project / industry brief description with sketches and salient technical information.*
   c. *The work / processes observed with specification of materials, products, equipments etc. and role of engineers in that organization.*
   d. *Suggestions (if any) for improvement in the working of those organizations.*
5. The evaluation of the report of technical visits will be made by panel of three teachers appointed by Head of the department based on following points:

Guide lines for ICA: ICA shall be based on knowledge gain by student and Industrial Visit Report submitted by the student in the form of Thermal bound. Assessment of the Industrial Visit for award of ICA marks shall be done jointly by industrial visit coordinators departmental committee based on viva -voce as per the guidelines given in **Table- C**

Table-C

SN	Name of Student	Name of Industry	Report writing	Depth of Under-standing	Total
			15	**10**	**25**

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Fourth Year Engineering

(Automobile Engineering)

Faculty of Engineering and Technology

Course Outline

Semester- VIII

Course Outline

Automobile Dynamics **AD**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to imparting knowledge of Automobile dynamics. The background required a sound knowledge of Mathematics, Mechanics, Automobile layouts and automobile engineering.

Teaching Scheme

	Hrs per week	No. of weeks	Total hour	Semester Credits
Lecture	03	14	42	03
Practical	02	14	28	01

Examination Scheme:

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**
Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: Fundamental knowledge about the vehicle dynamics, automobile system etc

Outline of the content: This course contains:

Unit- 1

1.	**Performance of Automobile**	**No of Lectures 09, Marks : 16**
	a	Power for Propulsion, Traction And Tractive effort, Relation between Engine Revolutions, N and Vehicle Speed, V.
	b	Road Performance curves: Acceleration, Gradiability and Drawbar Pull. Calculation of Equivalent Weight, *We.*
	c	Gear Ratio for Maximum Acceleration, Distribution of Weight, Stability of Vehicle on Slope, Calculation of maximum Acceleration, Maximum Tractive Effort and Reactions for Different Drive.
	d	Dynamic of Vehicle Running on a Banked Track, Stability of Vehicle Taking a Turn.

Unit- 2

2.	**Vehicle Vibration**	**No of Lectures 09, Marks : 16**
	a	Some Definitions, Vehicle Vibration and Human Comfort.
	b	Vehicle Vibration with Single Degree of Freedom, Vibration with two Degree of Freedom.

Unit- 3

3	Frame, Suspension, Springs and Wheel	No of Lectures 08, Marks : 16
	a	The Frame, Vehicle Dynamics and Suspension Requirement, Suspension System.
	b	Suspension Control Devices, Suspension Services, Chassis Springs.
	c	Theory of Chassis Springs, Mechanics of an Independent Suspension System, The Roll Axis and the Vehicle Under the Action of Side Forces, The Wheel.
	d	Tyre, Tyre Construction and Manufacturing, Tyre Design Consideration and Features, tyre Operation and Service.

Unit- 4

4.	Handling Characteristic	No of Lectures 08, Marks : 16
	a	Steering Geometry, Fundamental condition of true rolling, Ackerman steering gear, Davis steering gear.
	b	Steady state handling , neutral steering, oversteering, over steering, steady state response, yaw velocity, lateral acceleration, curvature response and directional stability

Unit- 5

5	Braking Performance	No of Lectures 08, Marks : 16
	a	Braking of vehicle – Braking applied to gear wheels, front wheels and all four wheels on straight and curved paths. Mass transfer & its effects, Braking Efficiency, Stopping distance reaction time.
	b	Brake Locking and antilock devices, Calculation of mean lining pressure and heat generation during braking, Braking of vehicle moving in a curved path.

Text Books and Reference Books:

1 Wong J. Y, “Theory of Ground Vehicles”, John Willey & Sons Inc. 3rd edition.
2 Giri N.K., “Problems in Automobile Dynamics”,
3 Gillespie, “Fundamentals of vehicle dynamics”
4 Grover, “Mechanical vibration”
5 Eills, “Vehicle dynamics”.

Course Outline

Special Purpose Vehicle **SPV**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to imparting knowledge of Special Purpose Vehicle. The background required a sound knowledge of Automobile, special purpose vehicles and automobile engineering.

Teaching Scheme

	Hrs per week	No. of weeks	Total hour	Semester Credits
Lecture	03	14	42	03
Practical	02	14	28	01

Examination Scheme:

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**
Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: Fundamental knowledge about the Automobiles engineering, automobile system.

Outline of the content: This course contains:

Unit- 1

1.	**Heavy Machinery**	**No. of Lectures 09, Marks : 16**
	a	Introduction: - General classification & application of earth moving machinery in open cast mining & other places. Operations involved in such application
	b	Constructional & working features of different types of earth moving machinery, such as drills, rippers, shovels, wheel loaders, lifts, tractors, brake vehicles, Excavators, Dampers, Dozers, Cranes, Crushers, Feeders & compressors.

Unit- 2

2.	**Automobile System**	**No. of Lectures 09, Marks : 16**
	a	Study of working principles & design considerations of different systems involved like power systems, Transmission, Final drive, Lubrication, electrical, braking, steering & pneumatic & hydraulic control circuits
	b	Study of instrumentation applied to such machines

Unit- 3

3	Intra-plant transporting & Equipment	No. of Lectures 08, Marks : 16
	a	Intra-plant transporting & handling equipment:- Types & principles groups of materials handling equipment, choice of hoisting equipments surface & overhead equipments.
	b	Components & theory of Hoisting equipments: - Chains & ropes, Pulleys suckcket drums, load handling attachments, arresting gear & brakes.

Unit- 4

4.	Vehicle Drives & Cranes	No. of Lectures 08, Marks : 16
	a	Drives: - Hand drive & operating levers, Power driver, Hoisting mechanisms traveling gear slowing, jib & lifting gears.
	b	Mobile Cranes: - Basic characteristic of truck cranes, stability & design features, control systems & safety devices.

Unit- 5

5	Elevators	No. of Lectures 08, Marks : 16
	a	Elevators: - Cage elevators, portable air operated hoist, portable hydraulic jacks, car lift, stackers, handling & safety.
	b	Battery operated electric vans: - principles of operation, special features.

Text Books and Reference Books:

1 N. Rudenko," Material Handling Equipments", M.R. Publishers
2 "Truck Cranes" , M.R. Publishers
3 Sheldon, R. "Shacket, Electric Vehicles" , Domus Book, New York
4 Y.Fokras & M. Tushnyakov, "Construction Equipments operation & maintenance", (MIR Mosco.)
5 A. Astskhov ,"Truck cranes ", (MIR)
6 E.G. Poninson ,Motor Grader , (MIR)

Course Outline
(Elective-II)

Computer Aided Design and Computer Aided Manufacturing CAD/CAM

Course Title: Short Title Course Code

Branch - Mechanical Engineering **Year – Fourth Year**

Course Description: The course presents the elements of solid modeling, creation of parts of increasing complexity and the assembly of parts to form a final design, along with mechanism simulation. The operation and programming of CNC machines is covered.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lectures	03	14	42	03
Practical	02	14	28	01

Examination scheme:

End semester exam (ESE) 80 Marks Duration: 03 hours

Internal Sessional exam (ISE) 20 Marks

Purpose of Course: Degree Requirement

Prerequisite Course(s): Fundamental knowledge about the Design and Automation of Manufacturing Process, Strength of Materials, Engg. Mechanics, etc

Outline of Content: This course contains:

UNIT-I

1.	**Introduction To CAD/CAM And Networking No. of Lectures – 9, Marks : 16**	
	a	Define CAD/CAM, Product Life Cycle & CAD/CAM, and Application of Computers for Design Process, Selection of a CAD system, Desirable relationship of CAD/CAM database, Benefits & Application of CAD.
	b	Hardware in CAD, Introduction, The Design Work Station, The graphics terminal, Operator input/output devices,
	c	Computer communication, Principle of networking, Classification of network, Transmission media & interface, LAN system.

UNIT-II

2.	Computer Aided Graphics	No. of Lectures – 9, Marks : 16
	a	Introduction, Graphic Primitives, Point plotting, Drawing of lines, Co ordinate system used in graphic element, Transformation in graphics,
	b	2D transformation, Homogeneous transformation, Concatenate co ordinate transformation, Translation, Rotation, Scaling, Mirror, Reflection, Inverse co ordinate transformation, clipping,
	c	3D transformation, View Port, Windowing, Standardization in graphics IGES files.

UNIT- III

3.	Computer Aided Modeling & Automation	No. of Lectures – 8, Marks : 16
	a	Requirement of Geometric Modeling, Geometric Model, Geometric Model Construction Method: Wire Frame Modeling, Surface Modeling, Solid Modeling, Representation of Curve & Surfaces, Design of curve shape, Cubic Spline, Bezier curve, B-spline curve
	b	AUTOMATION: Concept of Automation, Types of Automation, Advantages & limitations of Automation, Levels of Automation, Advanced Automation Function.

UNIT- IV

4.	Computer Aided Manufacturing	No. of Lectures – 8, Marks : 16
	a	INDUSTRIAL CONTROL SYSTEM Continuous control system, Discrete control system, Computer process control, Forms of CPC, Computer process Monitoring, Direct Digital Control, Numerical Control & Robotics, Programmable logic controller, Supervisory control, Distributed Control & Personnel Computers
	b	CNC PROGRAMMING Axis of CNC Machines, Manual Part Programming using G and M codes Adoptable to Fanuc Controller for Lathe.

UNIT-V

5.	Introduction to FMS, GT and Robotics	No. of Lectures - 8 Marks : 16
		FMS – Introduction, Components of FMS, Types of FMS, Application & Benefits, Planning & implementation issue, Typical FMS layout.

	b	GT – Part families, Part classification & coding, optic coding system, Multiclass coding system, Application of GT.
	c	Robotics – Robot Anatomy, Robot Control System, End effectors, Sensors, Industrial Robot, Application and its selection.

Text Book and Reference Books

1. Ibrahim Zeid and R. Sivasubramanian - CAD/CAM – Theory and Practice Tata McGraw Hill Publishing Co. 2009
2. Ibrahim Zeid, "Mastering CAD/CAM" – Tata McGraw Hill Publishing Co. 2000
3. Chandrupatla T.R. And Belegunda A.D. -Introduction to Finite Elements in Engineering" -Prentice Hall India
4. Segerling L.J. - Applied Finite Elements Analysis" John Wiley and Sons.
5. Rao P.N., Introduction to CAD/CAM Tata McGraw Hill Publishing Co.
6. Grover M.P.-Automation, production systems and computer integrated manufacturing" -Prentice Hall of India
7. Yoram Koren - Robotics McGraw Hill Publishing Co.
8. James G. Keramas, Robot Technology Fundamentals, Delmar Publishers.
9. S.R.Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.
10. Lakshiminarayana H. V. Finite Element Analysis (Procedures in Engineering), University Press, 2004.
11. Chandrupatla T. R., Finite Element Analysis for Engineering and Technology, University Press, 2009.
12. Seshu P. Text book of Finite Element Analysis, PHI Learning Private Ltd. New Delhi, 2010.
13. P. Radhkrishnan, S. Subramanyam, V. Raju,"CAD/CAM/CIM", New Age Publication.
14. Mikell P. Grover, Emory W. Zimmer's,"Computer Aided Design and Manufacturing", P.H.I.
15. Zeid,"CAD/CAM" ,T.M.H.
16. B.S.Pabla, M.Adithan,"CNC Machine ", New Age International (P) Ltd.
17. Rao, Tiwari, Kundra,"Computer Aided Manufacturing", T.M.H.
18. CAD/CAM & AUTOMATION by Farazdak Haidri

Course Outline
(Elective-II)

Analysis and Synthesis of Mechanism **ASM**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to imparting knowledge of Mechanics. The background required a sound knowledge of Mathematics, Mechanics, TOM-I & II.

Teaching Scheme

	Hrs per week	**No. of weeks**	**Total hour**	**Semester Credits**
Lecture	03	14	42	03
Practical	02	14	28	01

Examination Scheme:

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**
Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: Fundamental knowledge about the mechanics and theory of machines.

Outline of the content: This course contains:

Unit- 1

1.	**Kinematics**	**No. of Lectures 09, Marks : 16**
	a	Kinematics element in pair mechanisms with lower & higher pairs,
	b	Geometry of motion type number of synthesis of mechanisms,
	c	Chebyshov- polynomials, spacing of accuracy points.

Unit- 2

2.	**Coupler Curve**	**No. of Lectures 09, Marks : 16**
	a	Four bar coupler point curves.

	B	Equation of coupler curves, robort chebyshov theorem.
	C	Doybke oiubts & symmetry- Euler savary equation & cubic of stationary curvature.

Unit- 3

3	**Synthesis of Planner of Mechanisms**	**No. of Lectures 08, Marks : 16**
	a	Geometry method of synthesis of planar mechanisms, two finitely separated link positions.
	b	Three finitely separate link positions- poles and relative poles.
	c	Synthesis with three accuracy points, four finitely separated link positions.
	d	Pole triangle, image poles- opposite poles, quadrilateral circle point and center point curves- synthesis with four accuracy points.

Unit- 4

4.	**Algebra method of synthesis of planar mechanisms**	**No. of Lectures 08, Marks : 16**
	a	Displacement equations of the four bar linkage- with four accuracy points-
	b	Synthesis with three accuracy points- synthesis with prescribed velocity & acceleration synthesis
	c	Compatibility synthesis with five accuracy points structural error curve respecting analysis of mechanical error in linkages.

Unit- 5

5.	**Spatial Mechanisms**	**No. of Lectures 08, Marks : 16**
	a	Synthesis of spatial linkages, displacement analysis matrix method of analysis function generators for symmetric function.
	b	Application of spatial mechanisms to robotics, kinematics analysis of as industrial robots manipulators, gripper theory.

Text Books and Reference Books:

1. Arthur G. Erdman and George. N. Sandor "Mechanisms Design Analysis and Synthesis Vol. I & II", Prentice hall of India.
2. J.E.Shigley "Kinematic analysis of Mechanisms", Mc Graw Hill, New York.
3. J.E.Shigley and J, J.Vicke - Theory of Machines & Mechanisms, International students' edition, Mc Graw Hill, New York.

Course Outline
(Elective-II)

Automobile Painting & Collision Repairs **APCR**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to imparting knowledge of Automobile Painting & Collision Repair. The background required a sound knowledge of Chemistry, Automobile Engineering, Automobile Service and Repair.

Teaching Scheme

	Hrs per week	No. of weeks	Total hour	Semester Credits
Lecture	03	14	42	03
Practical	02	14	28	01

Examination Scheme:

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**
Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: Fundamental knowledge about the Automobile Engineering & Auto Service and Repair.

Outline of the content: This course contains:

Unit- 1

1.	**Painting techniques**	**No. of Lectures 09, Marks : 16**
	a	Painting techniques & Topcoat refinishing, definition & objectives of painting, elements of paint, pigments, resin, solvent, paint drying, paint drying characteristics, drying forms & film mesh works.
	b	Automobile paints, topcoat paints, special paint, painting method, spraying, immersion, painting new vehicles, body components, new vehicle painting process, global refinish system.
	c	HVLP recommendations, sanding recommendations, wet sanding, dustless dry sanding, vehicle protective coating, unpainted surfaces, filling dented or irregular surfaces.

Unit- 2

2.	**Painting Equipments**	**No. of Lectures 09, Marks : 16**
	a	Refinishing facilities, equipments & tools & repainting process, refinish & OE paint, types, individual characteristics, painting & drying facilities, drying equipments, colour matching scales, air spray gun, and electrostatic painting equipments.
	b	Accessories, repainting, types of paints & repainting process, spray gun, surface treatment, primer surface & sanding, fundamental of colour, match masking, top coat process.
	c	Whole body & block repainting, spot repainting, waxing, repainting of bumpers, metallic colour appearance charger due to painting conditions.

Unit- 3

3	**Paint Defects & Causes**	**No. of Lectures 08, Marks : 16**
	a	Paint defects, causes & correction, small body paint repair, correction for paint finish defects.
	b	Defects occurring during painting, seeds fish eyes, orange peels, runs, blushing, shrinkage, bleeding, line holes, pretty traces, abrasion mane, blisters, peeling, spotting discoloration, chalking, yellowing, nibs, and loss of gloss.
	c	Repairing a hole small dert, cout truck bed, defects occurring with time, fale (absorption).

Unit- 4

4.	**Health Effects & Safety**	**No. of Lectures 08, Marks : 16**
	a	Safety & cleanliness minor body repair, paint & solvent toxicity & its prevention, paint & solvent toxicity, toxicity prevention, five hazards, fire extinguishing, health & safety, organic solvents, heavy metals.
	B	Acute chronic effects, respiratory sensitization, skin & eye effects, stability of isocyanates, storage, incompatibility, hazardous decomposition, body filters, door dig repairs, scratch repair, drip repair.

Unit- 5

5	**Paint Selection**	**No. of Lectures 08, Marks : 16**
	a	Paint mixing systems, OEM color selection process, paint codes, tints, mixing, paint mixing, single stage paint, and three stage paint, two tone paint, troubleshooting, and painting plastic parts.
	b	Flexible paint additives, painting new plastic parts, repairing plastic parts, compressed air supply equipments, air & fluid control equipment, hose & connections, air systems maintenance.

Text Books and Reference Books:

1 Anil Chikara, "Automobile Paint Techniques" , (satya prakashan, New Delhi).

2 Micheal Crandell, "Painting For Collision Repair"

3 Jim Richardson," Pro paint and Body", HP Trade, Ist edition.

4 Deninis Parki," How to paint your cae", Motorbooks.

Course Outline
(Elective-III)

Computational Fluid Dynamics CFD

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to imparting knowledge of fluid dynamics. The background required a sound knowledge of Mathematics, Mechanics,

Teaching Scheme

	Hrs per week	No. of weeks	Total hour	Semester Credits
Lecture	03	14	42	03

Examination Scheme:

End semester scheme(ESE) **80 marks** **Duration : 03 Hrs.**
Internal Sessional Examination (ISE) **20 marks**

Purpose of Course: Degree Requirement

Prerequisite Courses: Fundamental knowledge about the fluid mechanics, automobile dynamics.

Outline of the content: This course contains:

Unit- 1

1.	**Introduction**	**No. of Lectures 09, Marks : 16**
	a	Conservation Equation, Derivation of Mass Momentum & Energy Equation in differential & integral form
	b	General scalar transport equation, Application to simple control volumes
	c	Mathematical classification of PDEs, elliptical, parabolic, hyperbolic

Unit- 2

2.	**Numerical Methods**	**No. of Lectures 09, Marks : 16**
	a	Overview, Discretization Methods overview FDM, FVM, FVM, Solution of discretization equation
	b	Direct Methods, Iterative Methods. Accuracy, consistency, stability and convergence

Unit- 3

3	**Finite Difference Method**	**No. of Lectures 08, Marks : 16**
	a	Taylor Series expansion, finite approximation of first order derivatives using FDS, BDS, CDS, Transient conduction, 2D diffusion equation discretization
	b	Boundary conditions: Drichlet, Neumann and mixed. Implicit, Explicit and Crank-Nicholsan scheme

Unit- 4

4.	**Solution of linear system of equations**	**No. of Lectures 08, Marks : 16**
	a	Direct and iterative methods, Jacobi, Gauss-Siedel
	b	Tri Diagonal Matrix Algorithm, Alternating Direction Implicit methods

Unit- 5

5	**Finite Volume Method & Essentials of CFD analysis**	**No. of Lectures 08, Marks : 16**
	a	2D Convection diffusion equation, Lax-Wendroff and Maccormak methods
	b	Central and Upwind differencing. Pressure Correction- SIMPLE algorithm
	c	Practical guidelines for CFD simulation processes, Grid Generation types, problem setup
	d	types of boundary conditions, solution process, post-processing

Text Books and Reference Books:

1 Suhas V Patankar, "Numerical Heat Transfer and Fluid Flow", Taylor & Francis
2 J. D. Anderson, "Computational Fluid Dynamics - The Basics With Appications", McGraw Hill
3 C T Shaw, "Using Computational Fluid Dynamics"
4 H K Versteeg, W Malalasekera ,"An introduction to Computational Fluid Dynamics"
5 P S Ghoshdastidar, "Computer simulation of flow and heat transfer"
6 Jiyuan Tu, Guan Heng Yeah, C Liu, "Computational Fluid dynamics", Elsevier
7 T. J. Chung, "Computational Fluid dynamics", Cambridge University Pres
8 Charles Hirsch, "Numerical Computation of Internal and External Flows", Vols I and II, Wiley
9 Sengupta Tapan K., Fundamentals of Computational Fluid Mechanics, University Press, 2005

Course Outline
(Elective-III)

Advanced Welding Technology **AWT**

Course Title: Short Title Course Code

Branch - Mechanical Engineering **Year – Fourth Year**

Course Description: This course is aimed to provide deeper knowledge of materials technology of welding**,** quality techniques at production by welding**,** Knowledge of current computer systems and cost for welding operations**.**

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lectures	3	14	42	3

Examination scheme:

End semester exam (ESE) 80 Marks Duration: 03 hours

Internal Sessional exam (ISE) 20 Marks

Purpose of Course: Degree Requirement

Prerequisite Course(s): Fundamental knowledge of workshop technology, manufacturing process, material science.

Outline of Content: This course contains:

UNIT-I

1.		**Conventional welding Technology No. of Lectures – 9, Marks : 16**
	a	Introduction: Importance and application of welding, classification of welding process. Selection of welding process

	b	Brief review of conventional welding process: Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of MS.CI, Al, and Stainless steel & Maurer/Schaefflar Diagram. Soldering & Brazing.

UNIT-II

2.		**Advanced welding Techniques No. of Lectures – 9, Marks : 16**
	a	Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc.

UNIT- III

3.		**Advanced welding Techniques No. of Lectures – 8, Marks : 16**
	a	Advanced welding Techniques (continued) : Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spray-welding / Metalizing, Hard facing.

UNIT- IV

4.		**Metallurgy and Weld Life No. of Lectures – 8, Marks : 16**
	a	Weld Design: Welding machines/equipments and its characteristics and arc-stability, Weld defects and distortion and its remedies, Inspection/testing of welds, Weld Design, Welding of pipe-lines and pressure vessels.
	b	Life predication. 4 51 Thermal and Metallurgical consideration: Thermal considerations for welding, temperature distribution, Analytical/Empirical analysis/formulae, heating & cooling curves.
	c	Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties.

UNIT-V

5.		**Advance welding** **No. of Lectures – 8, Marks : 16**
	a	Welding Under The Influence Of External Magnetic Field: Parallel Field, Transverse Magnetic Field, Longitudinal Magnetic Field, Improvement Of Weld Characteristics By The Application Of Magnetic Field, Magnetic Impelled Arc Welding.
	b	Fundamentals Of Underwater Welding- Art And Science: Comparison Of Underwater And Normal Air Welding, Welding Procedure, Types Of Underwater Welding, Underwater Wet Welding Process Development.

Text Book and Reference Books

1. Little R.L., "Welding Technology", Tata McGraw Hill, New Delhi, 1994.

2. Ghosh A. and Mallik A.K., "Manufacturing Science", East West Press, 1985.

3. Davies A.C., "The Science and Practice of Welding", Cambridge University, New York, 1989.

4. Balchin N.C., "Health and Safety in Welding and Allied Processes", Jaico Publishing House, Mumbai, 1989.

5. Rao P. N., "Manufacturing Technology", Tata McGraw Hill, 1990.

6. Mukharjee P. C., "Fundamental of Metal Casting Technology", Tata McGrew Hill, 1970.

7. Jeffus Larry “Welding Principles and Applications” Delmar Publishers, 1999.

Course Outline
(Elective-III)

Noise, Vibration & Harshness in Automobile NVHA

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to imparting knowledge of Automotive NVH. The background required a sound knowledge of noise & vibration.

Teaching Scheme

	Hrs per week	No. of weeks	Total hour	Semester Credits
Lecture	03	14	42	03

Examination Scheme:

End semester scheme(ESE) 80 marks Duration : 03 Hrs.
Internal Sessional Examination (ISE) 20 marks

Purpose of Course: Degree Requirement

Prerequisite Courses: Fundamental knowledge about the automotive engineering, mechanical vibration.

Outline of the content: This course contains:

Unit- 1

1.	**Introduction to NVH & Vibration Analysis**	**No of Lectures 09, Marks : 16**
	a	Noise, Vibration and Harshness (NVH) and its role in automotive design and development
	b	Physiological effects of noise and vibration, sources of vibration and noise in automobiles
	c	Basics of Vibration Analysis - Basic concepts, mathematical models, formulating the equations of motion - linear and torsional system characteristics and response
	d	damped and undamped single & two degree of freedom systems under harmonic force, coordinate coupling, generalized coordinates and modal analysis

Unit- 2

2.	**Vibration Control Techniques**	**No of Lectures 09, Marks : 16**
	a	Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments

	b	Applications: isolation of the engine from vehicle structure and control of torsional oscillation amplitudes in engine crankshaft

Unit- 3

3	**Noise Fundamentals**	**No of Lectures 08, Marks : 16**
	a	Fundamentals of acoustics – general sound propagation – structure borne sound & air borne sound, Plane wave propagation - wave equation
	b	specific acoustic impedance, acoustic intensity, Spherical wave propagation – acoustic near and far fields, Reference quantities
	c	The decibel scale, relationship among sound power, sound intensity and sound pressure level, summation of pure tones
	d	Decibel addition, subtraction and averaging, Effects of reflecting surfaces on sound propagation, octave band analysis
	e	Anatomy of Human Ear, Mechanism of hearing, loudness, weighting networks, equivalent sound level.

Unit- 4

4.	**NVH Measurements**	**No of Lectures 08, Marks : 16**
	a	Vibration and Noise Standards – Pass/Drive by noise, noise from stationary vehicles, interior noise in vehicles
	b	NVH measurement tools and techniques, Modal parameter (natural frequency, mode shape and damping) estimation techniques, signal and system analysis

Unit- 5

5	**Automotive Noise Sources and Control Techniques**	**No of Lectures 08, Marks : 16**
	a	Methods for control of engine noise, Transmission Noise, Intake and Exhaust Noise
	b	Aerodynamic Noise, Tyre Noise, Brake noise
	c	Noise control strategy, noise control at source – along the path isolation, damping, balancing, resonators, absorption, barriers and enclosures.

Text Books and Reference Books:

1. Bell, L. H. and Bell, D. H., "Industrial Noise Control – Fundamentals and Applications", Marcel Dekker Inc, New York, 1994
2. Ambekar, A. G., "Mechanical Vibrations and Noise Engineering", Prentice Hall of India, New Delhi, 2006.
3. Beranek, L. L. and Ver, I, L., "Noise and Vibration Control Engineering – Principles and Application", John Wiley & Sons, Inc, 1992
4. Wilson, C. E., "Noise Control – Measurement , Analysis, and Control of Sound and Vibration", Harper & Row Publishers, New York, 1989
5. Thomson, W. T., " Theory of Vibrations with Applications", CBS Publishers Delhi
6. Norton, M.P., "Fundamentals of Noise and Vibration Analysis for Engineers", Cambridge University Press, Cambridge, 2003.
7. Irwin, J. D. and Graf, E. R., "Industrial Noise and Vibration Control", Prentice Hall, Englewood Cliffs, New Jersey
8. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992
9. Moser, M., "Engineering Acoustics – An Introduction to Noise Control", Springer, Indian Edition, 2009
10. Matthew Harrison, "Vehicle Refinement – Controlling Noise and Vibration in Road Vehicle", Butterworth-Heinemann, Indian Edition,2011
11. Smith, J. H., "An Introduction to Modern Vehicle Design", Butterworth Heinemarm, 2002

Course Outline
(Elective-III)

Automotive Materials AMTS

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Description: This course introduces undergraduate students to imparting knowledge of Automotive Materials. The background required a sound knowledge of materials.

Teaching Scheme

	Hrs per week	No. of weeks	Total hour	Semester Credits
Lecture	03	14	42	03

Examination Scheme:

End semester scheme(ESE) 80 marks Duration : 03 Hrs.
Internal Sessional Examination (ISE) 20 marks

Purpose of Course: Degree Requirement

Prerequisite Courses: Fundamental knowledge about the automobile engineering, manufacturing engineering.

Outline of the content: This course contains:

Unit- 1

1.	**Elasticity & Heat treatment Technique**	**No. of Lectures 09, Marks : 16**
	a	Elasticity-forms - Stress and strain relationship in engineering materials - Deformation mechanism - Strengthening material - Strain hardening, alloying, polyphase mixture, martensitic precipitation,
	b	Dispersion, fiber and texture strengthening - iron carbon diagram, Strength and stiffness – failure modes – analysis of laminated composites – stress-strain variation in a laminate
	c	Heat treatment of steel - Annealing - Types, normalizing, Types, hardening and tempering with specific relevance to automotive components, surface hardening techniques
	d	Induction, flame and chemical hardening, coating of wear and corrosion resistance, Electroplating. Phosphating, Anodizing, hot dipping, thermal spraying, hard facing and thin film coatings

Unit- 2

2.	**Selection of materials**	**No. of Lectures 09, Marks : 16**
	a	Criteria of selecting materials for automotive components viz Cylinder block, Cylinder head, Piston, Piston ring, Gudgeon pin, Connecting rod, Crank shaft, Crank case, Cam, Cam shaft, Engine valve
	b	Gear wheel, Clutch plate, Axle, Bearings, Chassis, Spring, body panel - Radiator, Brake lining etc. Application of non-metallic materials such as composite, ceramic and polymers in automobile

Unit- 3

3	**Material and Its Characteristics**	**No. of Lectures 08, Marks : 16**
	a	Definition –Need – General Characteristics, Applications. Fibers, flake and particulate composites – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive
	b	Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness
	c	Manufacturing: Bag Moulding – Compression Moulding – Pultrusion – Filament Winding

Unit- 4

4.	**Manufacturing & testing methods**	**No. of Lectures 08, Marks : 16**
	a	Manufacturing methods: Production of various fibers – matrix materials and surface treatments – fabrication of composites – fabrication of thermosetting resin matrix Composites – fabrication of thermoplastic resin matrix composites – short fiber Composites – fabrication of metal matrix and ceramic matrix composites
	b	Testing aspects of composites: Experimental characterization of composites – uniaxial tension, compression and shear tests – determination of interlaminar fracture toughness damage identification through non-destructive evaluation techniques – ultrasonic, acoustic emission and X-radiography

Unit- 5

5	**Special laminates**	**No. of Lectures 08, Marks : 16**
	a	Symmetric laminates, uni-directional, cross-ply and angle-ply laminates, quasi-isotropic laminates. Recent trends in composite materials – carbon composites
	b	Bucky Papee. Application of composite materials in aerospace, automotive, defense and industry.
	c	Mechanical behavior of UD composites: Longitudinal strength and stiffness – transverse strength and stiffness – failure modes – analysis of laminated composites – stress-strain Variation in a laminate.

Text Books and Reference Books:

1. Khanna.O.P., “Material Science and Metallurgy ", Dhanapat Rai & Sons, 1992
2. B. D. Agarwal, L. J. Broutman, Analysis and Performance of Fibre Composites, John Wiley.
3. Kapoor, “Material Science and Processes ", New India Publishing House, 1987
4. Dieter.G.E. Mechanical Metallurgy, McGraw Hill, New York, 1972.
5. Avner.S.H. Introduction to physical metallurgy, McGraw Hill, New York., 1982
6. Raghavan.V. Physical Metallurgy, Principle and Practice, Prentice Hall, 1995
7. R. F. Gibson, Principle of Composite Material Mechanics, McGraw Hill
8. M. M. Schwartz, Composite Materials Handbook, McGraw Hill. Inc
9. R. M. Jones, Mechanics of Composite Materials, McGraw Hill. Inc

Lab Course

Automobile Dynamics **AD LAB**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Outline:- This course introduces undergraduate students to imparting knowledge of Automobile dynamics. The background required a sound knowledge of Mathematics, Mechanics, Automobile layouts and automobile engineering

Teaching Scheme:

	Hrs per week	No. of weeks	Total hour	Semester Credits
Laboratory	02	14	28	01

Evaluation Scheme:

Internal Continuous Assessment (ICA)	**25 marks**	**50 Marks**
End Semester Exam (ESE) (Practical)	**25 marks**	

Prerequisite Course(S):- Fundamental knowledge about the vehicle dynamics, automobile System etc

Outline of Content: This course contains:

1. To study kinematic characteristics of vehicle suspension system.
2. Vehicle performance test for ride comfort and Impact isolation.
3. To evaluate automobile damper system and its components
4. To measure torque magnitude, steering system inertia and stiffness in vehicle.
5. Tractive effort measurement.
6. Acceleration time test.
7. Brake efficiency test.
8. Measurements of turning circle radians.

Note: Lab file should consist of minimum five experiments.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

The Practical Examination will comprise of performing the experiment and viva on the Practical's.

Lab Course

Special Purpose Vehicle **SPV LAB**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Outline:- This course introduces undergraduate students to imparting knowledge of Special Purpose Vehicle. The background required a sound knowledge of Automobile, special purpose vehicles and automobile engineering

Teaching Scheme:

	Hrs per week	No. of weeks	Total hour	Semester Credits
Laboratory	02	14	28	01

Evaluation Scheme:

Internal Continuous Assessment (ICA) **25 marks** **50 Marks**
End Semester Exam (ESE) (OR) **25 marks**

Prerequisite Course(S):- Fundamental knowledge about the Automobiles engineering, Automobile system.

Outline of Content: This course contains:

1. Study of different types of earth moving machinery.
2. Study of different types of power system
3. Study of different types handling and hoisting equipments
4. Study of different types of drives & mobile cranes
5. Study of different types of elevators

Guide lines for ICA:
ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-
In ESE the student may be asked questions on the prescribed certified journal Evaluation will be based on oral examination.

Lab Course

Computer Aided Design & Computer Aided Manufacturing **CAD/CAM LAB**

Course Title: Short Title Course Code

Branch- Mechanical Engineering **Year – Fourth Year**

Course Description: The course presents the elements of solid modeling, creation of parts of increasing complexity and the assembly of parts to form a final design, along with mechanism simulation.

Teaching Scheme:

	Hours Per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	2	14	28	1

Evaluation scheme:

Internal Continuous Assessment (ICA) 25 Marks 50 Marks

End Semester exam (ESE) (OR) 25 Marks

Prerequisite Course(s): Basic knowledge about of Engg. Drawing, Computer Graphics, SOM, Design & Manufacturing.

Outline of Content: This course contains:

A. Introduction to Modeling (Using any CAD software).

1. 2D drawing using sketcher- 2 Drawings 2 Hrs.
2. 3D modeling using 3D features (Modeling of Screw jack, Brake Pedal, Clutch, Steering linkages, Carburetor, F.I.P., *any four components*)
3. Assembling and drafting (Any 2 above mentioned assemblies) with proper mating conditions and interference checking.
4. Surface Modeling (Any 2 of the above assemblies). 4 Hrs.

B. Computer Aided Manufacturing

1. Manual Part programming on CNC Lathe and CNC Milling to generate tool Path, NC Code and optimization of tool path (to reduce machining time) using any cam software. 4 Hrs.

Note: Oral will be based on the prescribed term-work presented in the form of certified journal.

Lab Course

Analysis and Synthesis of Mechanism **ASM Lab**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Outline:- This course introduces undergraduate students to imparting knowledge of Mechanics. The background required a sound knowledge of Mathematics, Mechanics, TOM-I & II.

Teaching Scheme:

	Hrs per week	**No. of weeks**	**Total hour**	**Semester Credits**
Laboratory	02	14	28	01

Evaluation Scheme:

Internal Continuous Assessment (ICA)	**25 marks**	**50 Marks**
End Semester Exam (ESE) (OR)	**25 marks**	

Prerequisite Course(S):- Fundamental knowledge about the mechanics and theory of machines.

Outline of Content: Teacher should facilitate any five assignments on curriculum of this course.

Guide lines for ICA:
ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-
In ESE the student may be asked questions on prescribe journal. Evaluation will be based on answers given by students in oral examination.

Lab Course

Automobile Painting & Collision Repairs **APCR Lab**

Course Title: Short Title Course Code

Branch - Automobile Engineering **Year – Fourth Year**

Course Outline:- This course introduces undergraduate students to imparting knowledge of Automobile Painting & Collision Repair. The background required a sound knowledge of Chemistry, Automobile Engineering, Automobile Service and Repair

Teaching Scheme:

	Hrs per week	No. of weeks	Total hour	Semester Credits
Laboratory	02	14	28	01

Evaluation Scheme:

Internal Continuous Assessment (ICA)	**25 marks**	**50 Marks**
End Semester Exam (ESE) (Practical)	**25 marks**	

Prerequisite Course(S):- Fundamental knowledge about the Automobile Engineering & Auto Service and Repair.

Outline of Content: Teacher should facilitate minimum Five Assignments based on above syllabus.

Guide lines for ICA:
ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-
In ESE the student may be asked questions on prescribe journal. Evaluation will be based on answers given by students in oral examination.

Course Title	Short Title	Course Code
Industrial Lecture	**IL**	

Course Description:

The gap between industry's needs and the academic community's aspirations appears to be considerably large. There exists a strong feeling, at least in the academic circles, that unless technology driven initiatives find a surer place in the industrial sector in this country, the academia-industry interaction is likely to remain confined to developmental activities with limited exploratory or research-based content As institutes committed primarily to creation and growth of technological knowledge, technical institutes have an important role to play in the industrial sector of the country's economy. This fact by way of encouraging mechanisms to foster interaction between the academia and industry. Typically, academic interest in the multidimensionality of a problem leads to a tendency to explore a variety of options to arrive at a solution. This industrial lecture develops ability of student for expectations of the industrialists from the fresh engineers.

	Total Hours	**Semester Credits**
Lecture	**06**	**2**

General Objectives: The domains in which interaction is possible are:

a. Placement and entrepreneurship development.
b. Industry participation in technology development involving some exploratory work.
c. Academic intervention in solving specific industry problems.
d. Laboratory utilization by industry.
e. Continuing education programme.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand need, requirement and expectation of industry from fresh engineers.
2. Understand importance of laboratory practices throughout carrier of engineer. Design and conduct experiments, as well as to analyze and interpret data.
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Function on multidisciplinary teams, communicate effectively.
5. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
6. Recognition of the need for, and an ability to engage in life-long learning.
7. Use the techniques, skills, modern engineering tools and software necessary for engineering practice.

Industrial Lecture

(Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 50Marks**

Lecture: 1 Hr

1. There is a need to create avenues for a close academia and industry interaction through all the phases of technology development, starting from conceptualization down to commercialization.
2. List of renowned persons from industry shall be prepared by the committee appointed by Head of the department. After approval from the Principal, Minimum five Industrial lectures in alternate week shall be arranged, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors / R&D Labs covering the various aspects?
3. Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.
4. Students shall submit the report based on minimum five lectures giving summary of the lecture delivered.
5. The summary should contain brief resume of the expert, brief information of his organization and brief summary of the lecture in bullet point form.

ASSESSMENT OF Industrial Lecture

Guide lines for ICA: Assessment of the Industrial Lecture for award of ICA marks shall be done jointly by departmental committee as per attendance in industrial lecture, report submitted by student and overall performance in semester as per the guidelines given in **Table- D**

Table-D

SN	Name of Student	Attendance (05 Marks per Lecture)	Dept of Understanding (03 Marks per Lecture)	Report Writing	Total
		25	**15**	**10**	**50**

Course Title Short Title Course Code

Project-II **P-II**

Course Description:

The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Laboratory	**4**	**14**	**56**	**6**

Prerequisite Course(s): Knowledge of science, mathematics, computer programming and core subject of engineering.

General Objectives: The objectives of project are to develop ability to work in group. The scope of work is design and conduct experiments, as well as to analyze and interpret data within realistic constrain such as economic, environmental, social, safety and manufacturability. The project work provides plate form for planning, material procurement, preparing specification and execution of work. The project also develop to work on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Apply knowledge of mathematics, science, and engineering.
2. Design and conduct experiments, as well as to analyze and interpret data.
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Function on multidisciplinary teams, communicate effectively and Knowledge of contemporary issues.
5. Identify, formulate, and solve engineering problems by understanding professional and ethical responsibility.
6. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
7. Recognition of the need for, and an ability to engage in life-long and self learning.
8. Use the techniques, skills, modern engineering tools and software necessary for engineering practice.

Project-II

(Lab Course Contents)

Semester-VIII **Examination Scheme:**

Teaching Scheme: **(ICA) Internal Continuous Assessment: 75Marks**

Practical: 2 Hrs/Week **(ESE) End Semester Examination OR: 75Marks**

1. Project-I work decided in VII semester shall be continued as Project-II
2. Students should complete implementation of ideas given in synopsis/Abstract, so that project work should be completed before end of semester.
3. Project-II may involve fabrication, design, experimentation, data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. The stage also includes testing , possible results and report writing
4. Each student's project group is required to maintain log book for documenting various activities of Project-II and submit group project report at the end of Semester-VIII in the form of Hard bound.
    a. *Title*
    b. *Abstract*
    c.Introduction
    d. *Problem identification and project objectives*
    e. *Literature survey*
    f. Case study/Analysis/Design Methodology
    g. *Project design and implementation details*
    h. *Result and conclusion*
    i. Future scope
    j. References.

Guide lines for ICA: ICA shall be based on continuous evaluation of students' performance throughout semester in project-II and report submitted by the students' project group in the form hard bound. Assessment of the project-II for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-E.**

Guide lines for ESE:-

In ESE the student may be asked for demonstration and questions on Project. Evaluation will be based on answers given by students in oral examination.

Assessment of Project - II

Name of the Project: _____

Name of the Guide: _____

Table-E

		Assessment by Guide (50 Marks)				Assessment by Committee (25 Marks)		
SN	**Name of Student**	**Attendance, Participation and team work**	**Material procurement/ assembling/ Designing/Programming**	**Case study/ Execution**	**Project Report**	**Dept of Understanding**	**Presentation**	**Total**
Marks		**10**	**15**	**15**	**10**	**10**	**15**	**75**