

Teaching Scheme

Program: B.Tech. (Automobile Engineering)

Semester: 3rd

Sr. No.	Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Engineering Mathematics-3	AU410301	3	2	0	5	4
2	Manufacturing Processes	AU410315	4	0	0	4	4
3	Machine Design & Industrial Drafting	AU410316	3	2	0	5	4
4	Engineering Thermodynamics	AU410317	3	2	0	5	4
5	Measurement And Metrology	AU410319	3	0	0	3	3
6	Strength Of Materials	AU410318	3	2	0	5	4
7	Strength Of Material Lab	AU410320	0	0	2	2	1
8	Measurement And Metrology Lab	AU410330	0	0	2	2	1
9	Manufacturing Laboratory	AU410331	0	0	2	2	1
10	Aptitude/NC-1		0	2	0	2	0
TOTAL			19	10	6	35	26

Program: B.Tech. (Automobile Engineering)

Semester: 4th

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Engineering Mathematics-4	AU410401	3	2	0	5	4
2	Fluid Mechanics & Machinery	AU410412	3	2	0	5	4
3	Instrumentation for automobile engineers	AU410416	3	0	0	3	3
4	Automobile Engine	AU410414	3	0	0	3	3
5	Automobile Transmission	AU410415	3	0	0	3	3
6	Kinematics And Dynamics Of Machines	AU410413	4	2	0	6	5
7	Fluid Mechanics & Machinery Lab	AU410417	0	0	2	2	1
8	Automobile Engine Lab	AU410418	0	0	2	2	1
9	Computer Aided Part and Modeling Lab	AU410419	0	0	2	2	1
10	Kinematics And Dynamics Of Machines Lab	AU410420	0	0	2	2	1
10	Principles of management/NC-2		2	0	0	2	0
TOTAL			21	6	8	35	26

Program: B.Tech. (Automobile Engineering)

Semester: 5th

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Automobile Chassis	AU410508	4	0	0	4	4
2	Alternate fuels and pollution control	AU410509	3	0	0	3	3
3	Automobile Heat Transfer	AU410503	4	2	0	6	5
4	Special Purpose Vehicle	AU410510	3	0	0	3	3
5	Auto engine systems	AU410511	3	0	0	3	3
6	Elective-1		3	0	0	3	3
7	Presentation on Industrial Training	AU410516	0	3	0	3	0
8	Alternate fuels and pollution LAB	AU410512	0	0	2	2	1
9	Automobile Heat Transfer Lab	AU410513	0	0	2	2	1
10	FEA LAB	AU410514	0	0	2	2	1
11	Automobile Chassis Lab	AU410515	0	0	2	2	1
12	NC-3	AU410517	0	2	0	2	0
TOTAL:			20	7	8	35	25

Institute Elective-1

1	Safety And Ergonomics	AU410527	3	0	0	3	3
2	Advance Machining Processes	AU410522	3	0	0	3	3
3	Automotive Aerodynamics	AU410528	3	0	0	3	3

Program: B.Tech. (Automobile Engineering)

Semester: 6th

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Automobile Component Design	AU410601	4	2	0	6	5
2	Total Quality Management	AU410602	3	2	0	5	4
3	Two And Three Wheelers	AU410609	3	0	0	3	3
4	Vehicle Maintenance And Garage Practice	AU410610	3	0	0	3	3
5	Elective-2		3	0	0	3	3
6	Automobile Hydraulics and Pneumatics systems	AU410608	4	0	0	4	4
7	Vehicle Maintenance And Garage Practice Lab	AU410611	0	0	4	4	2
8	Automobile Hydraulics and Pneumatics systems Lab	AU410612	0	0	2	2	1
9	Two And Three Wheelers Lab	AU410613	0	0	2	2	1
9	NC-4	AU410614	2	0	0	2	0
10	Library/Sports/Expert Lecture	AU410615	0	0	1	1	0
TOTAL			20	6	9	35	26

Department Elective-1

1	Finite Element Analysis	AU410627	3	0	0	3	3
2	Modern Manufacturing Processes	AU410628	3	0	0	3	3
3	Modern Vehicle Technology	AU410629	3	0	0	3	3

Program: B.Tech. (Automobile Engineering)

Semester: 7th

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Automobile Electricals and electronics Systems	AU410705	3	0	0	3	3
2	Vehicle Dynamics	AU410702	3	2	0	5	4
3	Transport Management And Laws	AU410710	3	0	0	3	3
4	Automobile System Design	AU410708	3	2	0	5	4
5	Vehicle Body Engineering	AU410709	4	0	0	4	4
6	Elective-3		3	0	0	3	3
7	Automobile Electricals and electronics Systems Lab	AU410712	0	0	2	2	1
8	Vehicle Dynamics lab	AU410713	0	0	2	2	1
9	Minor Project	AU410711	0	0	8	8	4
TOTAL			19	4	12	35	27

Department Elective-2

1	Vehicle Design Data Characteristics *	AU410727	3	0	0	3	3
2	Computer Integrated Manufacturing	AU410722	3	0	0	3	3
3	Hybrid Vehicle Technology	AU410723	3	0	0	3	3

Program: B.Tech. (Automobile Engineering)

Semester: 8th

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Major Project	AU410803	0	0	35	35	20
TOTAL			0	0	35	35	20

3rd SEMESTER

INDUS University, Ahmadabad (Gujarat)

Sr. No.	Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Engineering Mathematics-3	AU410301	3	2	0	5	4
2	Manufacturing Processes	AU410315	4	0	0	4	4
3	Machine Design & Industrial Drafting	AU410316	3	2	0	5	4
4	Engineering Thermodynamics	AU410317	3	2	0	5	4
5	Measurement And Metrology	AU410319	3	0	0	3	3
6	Strength Of Materials	AU410318	3	2	0	5	4
7	Strength Of Material Lab	AU410320	0	0	2	2	1
8	Measurement And Metrology Lab	AU410330	0	0	2	2	1
9	Manufacturing Laboratory	AU410331	0	0	2	2	1
10	Aptitude/NC-1		0	2	0	2	0
TOTAL			19	10	6	35	26

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Subject: **Engineering Mathematics III**

Total Theory Periods: 45

Class Tests: **Two (Minimum)**

MSE Duration- **1 Hour**

ESE Duration: **Two and Half Hours**

CIE Marks: **Maximum Marks- 10**

Semester: **III**

Code: **AU410301**

Total Tutorial Periods: 30

Assignments: **Two (Minimum)**

Maximum Marks- **30**

MaximumMarks: **60**

Minimum Marks: **24**

Total Marks: **100**

Course Objectives:

- To provide an ability to see differential equations as a rigorous way of modeling physical phenomena.
- To provide an ability to derive major differential equations from physical principles.
- To provide an ability to understand the role of initial and boundary conditions in determining the solutions of equations.
- To provide an ability to choose and apply appropriate methods for solving differential equations.
- To provide an ability to undertake problem identification, formulation and solution.
- To provide an ability to calculate Laplace transforms and inverse Laplace transforms and uses them to solve differential equations (Initial value problems, Boundary value problems).
- To provide an ability to understand various concepts of Control System -Theory using Laplace Transform.
- To provide an ability to obtain Fourier series for simple periodic functions
- To provide an ability to understand Oscillation and Vibration related problems using Fourier Series and transform
- To provide an ability to obtain solution of the differential equations in form of the series using power series method.
- To provide an ability to communicate effectively with professionals within applied and engineering mathematics as well as with persons working with different scientific-technological applications in an interdisciplinary context.
- To provide an ability to develop abstract, logical and critical thinking and the ability to reflect critically upon their work and work of others.

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- To provide an ability to insight their strengths and weakness as learners and to appreciate the value of errors or mistakes as powerful motivators to enhance learning and understanding.
 - To provide an ability to interlink various engineering fields with Mathematics.
 - To provide mathematical knowledge and skills needed to support their concurrent and subsequent engineering studies.

UNIT-1

Differential equations and their applications-II: Solution of Linear differential equations of higher order with constant coefficients, complimentary function and particular integral, Method of variation of parameters, Method of Undetermined coefficients for solving higher order linear differential equations, Linear differential equations with variable coefficients (Cauchy's and Legendre forms), Simultaneous linear differential equations, application of Linear differential equation (Application of Deflection of Beams, Application of Electric circuits)

UNIT-2

Series solution, Special functions and Partial differential equations with applications: Series Solution of Ordinary Differential Equations, Definition and properties of Bessel's and Legendre's functions.

Formation of partial differential equations, Directly integrable equations, Lagrange's equation, Solutions of special type of non-linear partial differential equations of the first order, Method of separation of variables, solution of one dimensional wave equation, heat equation and Laplace equation.

UNIT-3

Laplace transforms: Definition, Linearity property, Laplace transforms of elementary functions, shifting theorem, Inverse Laplace transforms, Laplace transforms of derivatives and integrals, Convolution theorem, Application of Laplace transform in solving ordinary differential equations, Laplace transforms of periodic, Unit step and impulse functions, Introduction to Z-transforms: Definition and Standard Z-transforms, Linearity Property, dumping Rule and some standard results, Some useful Z-transforms.

UNIT-4

Fourier series, Fourier Integrals and Fourier Transforms: Fourier series, Drichlet's conditions, Euler's formula. Fourier expansion of periodic functions, Fourier series of even and odd functions, half range Fourier series.

Fourier integral theorem (only statement), Fourier sine and cosine integrals, Complex form of Fourier integral, Fourier transforms, Fourier sine and cosine transforms.

Text books:

1. Erwin Kreyszig “Advanced Engineering Mathematics (8th Ed.)” , Wiley Eastern Ltd., New Delhi.

Reference Books:

1. B. V. Ramana: **Higher Engineering Mathematics**, Mc Graw Hill, New Delhi.
2. Dr. B.S. Grewal: **Higher Engineering Mathematics**, Khanna Publishers, New Delhi.
3. R K Jain, S R K Iyengar: **Advanced Engineering Mathematics**. Third Edition, Narosa Publishing House
4. Murray Spiegel: **Advanced Mathematics for Engineering & Science: (Schaum’s Outline Series)**, McGraw Hill Publication
5. Merel C Potter, J L Goldberg: **Advanced Engineering Mathematics** (3rd Ed.), Oxford India Publication.

Digital resources

- 1 <http://freevidelectures.com/blog/2010/11/130-nptel-iit-online-courses/>
- 2 <http://nptel.ac.in/video.php?subjectId=122107036>
- 3 <http://ocw.mit.edu/index.htm>
- 4 <https://www.khanacademy.org/>

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **III**

Subject: **Manufacturing Processes**

Code: **AU410315**

Total Theory Periods: 60

Total Tutorial Periods: 0

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

MSE Duration- **1 Hour**

Maximum Marks- **30**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60**

Minimum Marks: **24**

CIE Marks: **Maximum Marks- 10**

Total Marks: **100**

Course objectives:

1. The objective of the subject is to study the Different manufacturing processes and their importance
2. Students will be able to perform the Machining operations while keeping different parameter in mind for ideal machine.

Course Content

UNIT 1

TRADITIONAL MACHINING PROCESSES PART 1

Types of metal cutting, cutting tool materials, chip formation, thermal aspects, tool wear and tool life, cutting fluids, classification of machine tools and motions in machine tools: working and auxiliary. Classification of lathes, construction and principal units of engine lathes, type and size range of engine lathes, Operations carried on engine lathe , lathe accessories and attachments, cutting speed, feed, depth of cut and machining time calculation for lathe, Planers, Shapers and Slotters (Classification: Attachments extending the processing capacities of each)

TRADITIONAL MACHINING PROCESSES PART 2

Drilling Machines- radial drilling machines, Boring Machine-Horizontal boring machines, Vertical boring machines, Milling Machines- Purpose and types of milling machines, general purpose milling machines, different types of milling operations, milling cutters, gear hobbingSawing and broaching, Machines- Metal sawing classification: reciprocating sawing machines, Grinding Machines and Abrasives: Classification of grinding machines, cylindrical grinders, internal grinders, Surface grinders, tool and cutter grinders, grinding wheels.

UNIT 2

METAL CASTING PROCESSES:

Types of patterns, pattern materials and pattern allowances. Molding Materials - sand molding, metal molding, investment molding, shell molding. Composition of molding sand, additives, Binders, Properties of moulding sand and sand testing, Fundamental of metal casting, Sand casting, Shell-Mould casting, Mold casting (plaster and ceramic), Investment casting, Vacuum casting, Permanent mould casting, Slush casting, Pressure casting, Die casting, Centrifugal casting, Continuous casting, Squeeze casting, Casting alloys, Solidification of castings, design of risers and runners, chills and chaplets, Gating system design.

UNIT 3

METAL FORMING PROCESSES

Metal working, Elastic and plastic deformation, Concept of strain hardening, Hot and cold working, Rolling, Principle and operations, Roll pass sequence, Forging, Forging operations, extrusion, Wire and tube drawing processes. Forging: Method of forging, Forging hammers and presses, Principle of forging tool design, Cold working processes: Shearing, Drawing Squeezing, Blanking, Piercing, deep drawing, Coining and embossing, Metal working defects, cold heading and Riveting.

UNIT 4

METAL JOINING PROCESSES

Principle of welding, soldering, Brazing and adhesive bonding. Classification of welding and allied processes. Gas welding and gas cutting, Arc welding, Power sources and consumables, Resistance welding: Spot, Projection and seam welding process, ultrasonic, Plasma and laser beam welding, Electron beam welding, and special welding processes e.g. TIG, MIG, friction and explosive welding. Defects of welding and remedial actions

PLASTIC MATERIAL PROCESSES

Injection – Blow and rotational moulding – Thermoforming Process - Reinforced plastics and Composite materials – Manufacturing of honey comb structure – shaping of ceramics – Transfer moulding – MMC – CMC.

TEXT BOOKS:

- SeropeKalpakjian, Steven R. Schmid :**Manufacturing Engineering and Technology**., Addison Wesley, 2001

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- P.C. Sharma, :**A Text Book of Production Technology**., S.Chand and Co. Ltd., New Delhi, 1996.
 - P.N. Rao :**Manufacturing Technology Vol-I (foundry Forging and Welding)**, McGraw Hill Publication.
 - Prof. P N Ra., **Manufacturing Technology** vol - 2(Metal cutting & Machine tools) McGraw Hill Publication. New Delhi.

REFERENCES:

- B.H.Amstead, “Manufacturing Processes”, Phillip F.Ostwald, L.Begemon, John Wiley and Sons, 8th Edition, 1998.
- De Garmo, “Materials and Processes in Manufacturing”, Prentice Hall of India, 8th Edition, 1998.
- T.R. Banga, R.L. Agarwal and T.Manghrani, “Foundry Engineering”, Khanna Publishers, New Delhi – 1995.

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **III**

Subject: **Machine Design & Industrial Drafting**

Code: **AU410316**

Total Theory Periods: 45

Total Tutorial Periods: 30

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

MSE Duration- **1 Hour**

Maximum Marks- **30**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60**

Minimum Marks: **24**

CIE Marks: **Maximum Marks- 10**

Total Marks: **100**

OBJECTIVE:

1. Student to be made aware of computer aided drafting of the component and system.
2. Basic knowledge of design techniques and fundamentals of design procedure.

UNIT 1

Design consideration of Machine Parts: Definition and understanding of various types of design, Morphology of design, Design procedure, , Selection of materials, Properties and I.S. coding of various materials, factors of safety, Stress Concentration and methods of relieving stresses, Types of stresses-tensile, compressive, shear, bending, bearing, crushing, Eccentric axial stresses, principle stress, Residual stresses, Limits, fits, tolerances.

Design of Fasteners:

A) Design of Riveted Joints:

Types of riveted joints, design of double and triple riveted butt joints with equal and unequal cover plates, Design of Circumferential joint, Longitudinal Butt Joint, Eccentric loading.

B) Welded Joints

Types of welded joints, stresses in welded joints, Design for various loading conditions in torsion, shear, or direct load, eccentrically loaded welded joints, welding symbols.

C) Cotter & Knuckle Joints:

Design of Gibb and cotter, and knuckle joint, Design of Spigot and socket Joint, Design of Turn buckle.

UNIT 2

Design of Shaft:

Design of solid and hollow shaft for transmission of torque, bending Moment and axial forces, Design of shaft for critical speed, design of shaft for rigidity and stiffness, flexible shafts.

Keys and Couplings:

Design of different types of keys, design of a muff and clamp coupling, Rigid coupling, Flange Coupling, Flexible coupling- Oldham, universal coupling.

UNIT 3

Power Screws:

Types of power screw threads, design of screw with different types of threads used in practice, Design of nuts, Design of C clamp, Screw jack, toggle jack, design of coupler.

Levers:

General Procedure for design of levers, designs of lever for safety valve, design of bell crank lever, design of rocker arm for exhaust valves.

UNIT 4

Introduction to CAD:

Introduction to AutoCad, Commands, Methods For 2D & 3D Drafting.

Assembly Drawings:

Drawings of assembled view for the part drawings of the following using Propionate dimensions.

a) Cotter joint, Coupling, Knuckle joint Sheet

Text Books:

1. P.C Sharma and D. K. Aggarwal “**Machine Design**”, S.K. Kataria & Sons 2009
2. V. B. Bhandari “**Design of Machine Elements**”, McGraw Hill Publication Publishing Co.

Reference book

1. S. G. Kulkarni, :**Machine Design - Solved Problems**, McGraw Hill Publication Publishing Company Ltd., New Delhi
1. William Orthein, :**Machine Component Design (Vol. I & II)**, M/s. Jaico Publishing
2. N.D. Bhatt, :**Machine Drawing**–Charator Publication

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3. P.S. Gill, **Machine Drawing** -S.K. Kataria & Sons New Delhi
 4. Joseph Edward Shigley and Charles R. Mischke, :**Mechanical Engineering Design**, McGraw Hill International Edition,

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **III**

Subject: **Engineering Thermodynamics**

Code: **AU410317**

Total Theory Periods: 45

Total Tutorial Periods: 30

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

MSE Duration- **1 Hour**

Maximum Marks- **30**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60**

Minimum Marks: **24**

CIE Marks: **Maximum Marks- 10**

Total Marks: **100**

Course Outcomes:

This course provides the basic knowledge about thermodynamic laws and relations. On completion of this course, the students are exposed to understand the concept and working of various automotive systems and their thermal relationship.

UNIT-1

Basic Concepts & Properties of pure substance:

Basic terminologies, pure substance, vapor liquid- solid phase in a pure substance, p-v, p-T, T-S diagram of pure substance, p-v-t surface, critical and triple point of pure substance, Molier chart, sensible heat and latent heat.

First law of Thermodynamics:

First law for a closed system undergoing a cycle and change of state, Energy-A property of the system, Perpetual motion machine of the first kind, steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump, heatexchanger, throttling process, comparison of S.F.E.E. with Euler and Bernouli Equation and unsteady flow process like filling and emptying process.

UNIT-2

Second law of thermodynamics & Entropy:

Limitations of first law of thermodynamics, Kelvin-Planck and Clausius statements and their equivalence, Perpetual motion machine of the second kind, Carnot cycle, Carnot's theorem,

corollary of Carnot theorem, thermodynamic temperature scale. Clausius theorem, the property of entropy, entropy change in a open system, reversible and irreversible process, entropy principle and applications, entropy generation in a open and closed system, Third law of thermodynamics, Entropy and disorder, concept of exergy..

Availability & Irreversibility:

Available and unavailable energy, available energy referred to a cycle, quality of energy, availability in non-flow and steady flow systems, Exergy balance, Second law efficiency.

UNIT-3

Thermodynamic Relations:

Maxwell's equation, T-ds equations, difference in heat capacities, ratio of heat capacities, Helmholtz and Gibbs function, Internal energy relations, Clausius- Claperyon equation, Joule-Thomson coefficient.

Vapor & Gas Power cycles:

Carnot cycle, Rankine cycle, comparison of carnot and rankine cycle, regenerative cycle, reheat cycle, Exergy analysis of vapor power cycles, calculation of cycle efficiencies, variables affecting efficiency of rankine cycle. Carnot, Sterling, Otto, diesel, dual, Atkinson and Brayton cycle. Comparison of otto, diesel and dual cycles, comparison between brayton and otto cycle, calculation of air standard efficiencies, mean effective pressure, Brayton Rankine combined cycle.

UNIT-4

Combustion of fuels:

Combustion of air, combustion equations, minimum air requirement, excess air and air fuel ratio, wet and dry analysis of products of combustion, conversion of volumetric analysis by mass, Determination of calorific value of fuel by Bomb calorimeter and Junkers gas calorimeter, Enthalpy of formation, Enthalpy of reaction, Adiabatic flame temperature.

Properties of gases and Mixtures:

Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart. Gibbs-Dalton law, volumetric analysis of gas mixture, apparent molecular weight and gas constant, specific heat of a gas mixture, adiabatic mixing of perfect gases, gas and vapour mixtures, Gibbs function of a mixture of inert ideal gases

Text Book

1. P.K. Nag :**Engineering Thermodynamics**, McGraw-Hill , New Delhi

Reference Books:

1. R.Yadav, **Fundamentals of Engineering Thermodynamics** Central Publishing House, Allahabad
2. Yunus Cengel & Boles: **Thermodynamics – An Engineering Approach** by, McGraw Hill Publication, New Delhi
3. J.P. Holman :**Thermodynamics** , McGraw Hill Publication.
4. YVC Rao ,An **introduction to Thermodynamics** by, New Age publishers, New Delhi.
5. Robert Balmer, **Thermodynamics – Theory & Application** by, Jaico publication
Fundamentals of Thermodynamics by Sonntag, Borgnakke & Van wylen, John Wiley & sons (ASIA) PVT. LTD

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Subject: **Measurement and Metrology**

Total Theory Periods: 45

Class Tests: **Two (Minimum)**

MSE Duration- **1 Hour**

ESE Duration: **Two and Half Hours**

CIE Marks: **Maximum Marks- 10**

Semester: **III**

Code: **AU410319**

Total Tutorial Periods: 0

Assignments: **Two (Minimum)**

Maximum Marks- **30**

Maximum Marks: **60**

Minimum Marks: **24**

Total Marks: **100**

Unit 1

Concept of Measurement

General concept – Generalized measurement system-Units and standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration -Introduction to Dimensional and Geometric Tolerancing -interchangeability,

Linear and Angular Measurement

Definition of metrology-Linear measuring instruments: Vernier, micrometer, Slip gauges and classification, Tool Makers Microscope - interferometry, optical flats, - Comparators: limit gauges Mechanical, pneumatic and electrical comparators, applications. Angular measurements: - Sine bar, Sine center, bevel protractor and angle Decker..

Unit 2

Angular and Taper Measurements

Introduction; Working principle & construction of Angular Measuring instruments like Protractors, Sine bars, Sine centre, Angle gauges, Spirit level, Clinometers, angle dekkor; Applications, Advantages & limitations of commonly used angular measuring instruments; Taper Measuring instruments: Measurement of taper shafts & holes.

Screw Thread Measurements

Introduction & classification of Threads; Elements, Specification & forms of Screw Threads; Various Methods for measuring elements of External & Internal Screw Thread; Screw Thread Gauges; Errors in Threads.

Unit 3

Gear Measurements

Introduction & Classification of gears; Forms of gear teeth; Gear tooth terminology; Measurement and testing of spur gear: Various methods of measuring tooth thickness, tooth profile & pitch; Gear Errors.

Measurement of Surface Finish

Introduction; Surface Texture; Methods of Measuring Surface finish- Comparison Methods & Direct Instrument Measurement; Sample Length; Numerical Evaluation of Surface Texture; Indication of Surface roughness Symbols used; Adverse effects of poor surface finish.

Straightness, Flatness, Square ness, Parallelism and Machine Tool Tests

Introduction; Measurement of Straightness, Flatness, Square ness and Parallelism; run out and concentricity; tool makers microscope; Interferometry & its use in checking flatness, surface contour, parallelism etc.; Interferometers & optical flats; Introduction to Machine tool testing; Various Alignment test on lathe, Milling Machine, Drilling Machine etc.

Unit 4

Temperature Measurement

Introduction; Temperature and Temperature Scales; Methods of temperature Measurement; Expansion thermometers; Filled System thermometers; Electrical temperature measuring instrument; Pyrometers; Calibration of temperature measuring instruments.

Pressure Measurement

Introduction; Pressure standards and methods of pressure measurement; Manometers; Elastic pressure transducers; Measurement of Vacuum; Force balance pressure gauges; Electrical pressure transducers; pressure switches; Calibration of pressure measuring instruments, Maintenance and repair of pressure measuring instrument; Trouble shooting.

Laser and Advances in Metrology

Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications.- computer aided inspection.

TEXT BOOKS:

1. Doebelin, "Measurement System Application & Design" McGraw Hill, New Delhi, 2004.
2. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005
3. Donald Deckman, "Industrial Instrumentation", Wiley Eastern, 1985.

REFERENCES:

1. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2005
2. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000

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3. Beckwith, Marangoni, Lienhard, “**Mechanical Measurements**”, Pearson Education, 2006.

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Subject: **Strength of Materials**

Total Theory Periods: 45

Class Tests: **Two (Minimum)**

MSE Duration- **1 Hour**

ESE Duration: **Two and Half Hours**

CIE Marks: **Maximum Marks- 10**

Semester: **III**

Code: **AU410318**

Total Tutorial Periods: 30

Assignments: **Two (Minimum)**

Maximum Marks- **30**

Maximum Marks: **60**

Minimum Marks: **24**

Total Marks: **100**

Course Objectives:

- To Know the concepts of stress and strain
- To Analyze the beam of different cross sections for shear force, bending moment, slope and deflection
- To Understand the concepts necessary to design the structural elements and pressure vessels

UNIT- 1

Simple Stress and Strain: Introduction, Stress and Strains for axial force system, Hooke's law, Analysis of stress in bars, Thermal Stress and Strains, state of simple shear, relationship between elastic constants. Numerical problems.

Mechanical Properties of Materials: Stress-strain Diagrams, Obtaining yield stress by the offset method, proof stress, working stress, factor of safety, tangent modulus, secant modulus, stress concentration, residual stresses, fatigue.

Compound Stresses: Introduction, General 2-D state of stress, Principle stresses and Principle strains, graphical analysis of plane stress and plain strain problem –Mohr's circle Numerical Problems.

UNIT -2

Shear Force and Bending Moment Diagrams: Introduction, bending moment and shear force diagrams for statically determinate systems, relationship between load intensity, SF and BM, numerical problems involving different statically determinate beams, frames, and support conditions.

Stress in Beams:

1) Direct stresses due to Bending: Introduction, theory of pure bending, section modulus, beam of uniform

Strength, analysis and design for strength and stiffness criteria, numerical problems.

2) Shear Stresses due to Bending: Introduction, shear stress in beams, shear stress distribution, economical section, numerical problems.

UNIT- 3

TORSION OF CIRCULAR SHAFTS: Introduction, pure torsion formula, analysis of strength and stiffness criteria of solid and hollow circular shaft. Torsion combined with bending. Numerical problems.

COLUMN AND STRUTS: Introduction, short and long columns, Euler's theory on columns (Assumptions and standard cases), effective length and slenderness ratio, Rankine's formula, Numerical problems.

UNIT- 4

Deflection of Beams: Introduction, Equation of elastic curve and sign convention, Macaulay's method (UDL, Triangular load, couple load acting between the supports) for determination of deflection, Numerical problems.

Stresses in thin and thick cylinders. : Introduction, lame's equation. Numerical problems on thin cylindrical and spherical shells, thick cylinder and compound cylinders

TEXT BOOKS:

1. S.S.Rattan, **Strength of Materials**, McGraw Education (India) Private Limited, New Delhi.
2. William Nash, **Strength of Materials**, Schaum's Out Lines, McGraw Hill Publication, 2004
3. Ramamurtham S., **Strength of material**

REFERENCES:

1. Gere & Timoshenko, '**Mechanics of Materials**', McGraw Hill, 1993
2. V D Kodgire, **Material science and metallurgy**, Everest Publishers, Pune Delhi.
3. Dym, C.L., and Shames, I.H., '**Solid Mechanics**', McGraw Hill, Kogakusha, Tokyo, 1973.
4. Stephen Timoshenko, '**Strength of Materials**', Vol I & II, CBS Publishers and Distributors, Third Edition.
5. Timoshenko's. And Young, D.H., **Elements of Strength of Materials**, T.Van Nostrand Co. Inc., Princeton, N.J.

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **III**

Subject: **Strength of Materials Lab**

Code: **AU410320**

Total Practical Hours/Week: 02

Total Practical Hours/Sem: 30

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

Total Marks: 100

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

PURPOSE

To familiarize the students with the use of stress, strain measuring instruments.

INSTRUCTIONAL OBJECTIVES

1. The students will be able to understand procedures for conducting tensile, torsion tests on mild steel specimens.
2. Determine the Young's modulus using deflection test on beams and tensile test on rods, tension and compression test on springs, bricks, concrete, and impact tests on steel.

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To study the Universal Testing Machine.
2. To perform the Tensile Test of Mild Steel on U.T.M and To Draw Stress–Strain Curve.
3. To determine strength of wood on U.T.M (i) Along the Grain (ii) Across the Grain.
4. To determine shear strength of Mild Steel on U.T.M.
5. To observe Flexural Behavior of Timber specimen and to determine it's strength under transverse loading on U.T.M.
6. To study the Impact Testing Machine and test specimen of Izod and Charpy.
7. To determine Izod and Charpy Value of the given mild steel specimen.
8. To study the Fatigue Testing Machine and to discuss the procedure to find out endurance limit of given material.
9. To study the Spring Testing Machine.

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10. To determine modulus of rigidity for the material of open and closed Coiled Helical Spring Subjected to Axial Load by spring testing machine.
 11. To study the Torsion Testing Machine
 12. To determine ultimate shear stress and modulus of rigidity under Torsion.
 13. To study the Cupping Test Machine and to determine Erichsen value of Mild Steel sheet.
 14. To study the Rockwell Hardness Testing Machine and to determine the Rockwell Hardness of the given material.
 15. To study the Brinell Hardness Machine and to determine the Brinell hardness of the given material.
 16. To study the Vickers Hardness Machine and to conduct a hardness test on the machine.
 17. To study Column testing machine and to conduct Buckling Test of column.

Equipment/Machines/Instruments/Tools/Software Required:

1. Universal Testing Machine
2. Impact Testing Machine
3. Fatigue Testing Machine
4. Spring Testing Machine
5. Torsion Testing Machine
6. Cupping Testing Machine
7. Rockwell Hardness Testing Machine
8. Brinell Hardness Machine
9. Vickers Hardness Machine
10. Column Testing Machine

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **III**

Subject: **Manufacturing Laboratory**

Code: **AU410330**

Total Practical Hours/Week: 02

Total Practical Hours/Sem: 30

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

Total Marks: 100

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

PURPOSE

To expose hands- on training to the students on various machines like lathe, Shaper, Slotter, Milling, grinding machines. Welding and casting.

INSTRUCTIONAL OBJECTIVES:

To familiarize the students the with

1. Various types of lathe operations.
2. Production of flat surface and contour shapes on the given component.
3. Welding processes
4. Surface finishing process

LIST OF EXPERIMENTS:

1. Introduction- lathe machine, plain turning, step turning & grooving (including lathe mechanisms, simple problems).
2. Taper turning-compound rest/offset method & drilling using lathe (including drilling
3. Feed mechanism, twist drill nomenclature, and different types of taper turning operations).
4. External threading-single start (including thread cutting mechanism-simple problems).
5. Shaping v-block (including shaper quick return mechanism).
6. Grinding-cylindrical /surface/tool & cutter.
7. Slotting-keyways (including broaching tool nomenclature and slotter mechanism).
8. Milling-polygon /spur gear (including milling mechanism, simple problems).
9. Gear cutting and indexing methods
10. Study of casting processes
11. Drilling, reaming, counter boring.
12. Introduction to welding processes

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Subject: Measurement and Metrology Lab

Total Practical Hours/Week: 02

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

Semester: **III**

Code: **AU410331**

Total Practical Hours/ Sem: 30

Total Marks: **100**

List Of experiments:

1. Precision Measuring Instruments
2. Linear Measurement
3. Angular Measurement
4. Micrometer Calibration
5. Surface Roughness Measurement
6. Gear Tooth Thickness Measurement
7. Pressure Measurement
8. Temperature Measurement
9. Flow Measurement
10. Strain Gauge Transducer

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **III**

Subject: **Aptitude-1**

Code:

Total Theory Periods: 30

Total Tutorial Periods: 0

Course Objectives:

1. To make students aware and proficient for interpretations of the data and identification of process involving numbers.
2. To make students learn the application of number based data and performance inferences.

UNIT- 1

Introduction to DI

Definition, average, weighted average, mean, Cumulative Data, percentage caselets, fractions, Vedic mathematical techniques Mechanical Properties of Materials

UNIT -2

Types of charts

Charts: Types of charts A) Bar Charts (Numbers' sequences, Frequency Charts, Simple Bar charts (Informative) , Bar charts (cumulative)

UNIT -3

Types of charts

Charts: Types of charts B) Line charts and pie charts, tables and caselets.

UNIT-4

Verbal Aptitude (Analogy and Reading Skills)

Vocabulary and analogy solution, Summary and gist of a paragraph, Expressive reading.

Paragraph completion and logical reasoning (6hours)

Identification of the tone of the writing, inference inclusion and title identification techniques, Logical reasoning, Syllogisms.

4th SEMESTER

INDUS University, Ahmadabad (Gujarat)

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Engineering Mathematics-4	AU410401	3	2	0	5	4
2	Fluid Mechanics & Machinery	AU410412	3	2	0	5	4
3	Instrumentation for automobile engineers	AU410416	3	0	0	3	3
4	Automobile Engine	AU410414	3	0	0	3	3
5	Automobile Transmission	AU410415	3	0	0	3	3
6	Kinematics And Dynamics Of Machines	AU410413	4	2	0	6	5
7	Fluid Mechanics & Machinery Lab	AU410417	0	0	2	2	1
8	Automobile Engine Lab	AU410418	0	0	2	2	1
9	Computer Aided Part and Modeling Lab	AU410419	0	0	2	2	1
10	Kinematics And Dynamics Of Machines Lab	AU410420	0	0	2	2	1
10	Principles of management/NC-2		2	0	0	2	0
TOTAL			21	6	8	35	26

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Engineering Mathematics IV**

Code: **AU410401**

Total Theory Periods: 45

Total Tutorial Periods: 30

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

MSE Duration- **1 Hour**

Maximum Marks- **30**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60**

Minimum Marks: **24**

CIE Marks: **Maximum Marks- 10**

Total Marks: **100**

Learning Objectives:

- To provide an ability to understand, interpret and use the basic concepts: complex number, analytic function, harmonic function, Taylor and Laurent series, singularity, residue, conformal mapping, and meromorphic function.
- To provide an ability to prove certain fundamental theorems about analytic functions, e.g. Cauchy's integral formula
- To provide an ability to determine the images of curves under simple complex mappings.
- To provide an ability to determine the stability of certain dynamical systems using complex functions.
- To provide an ability to use conformal mapping to solve certain applied problems regarding heat conduction, electrical engineering and fluid mechanics.
- To provide an ability to use Taylor and Laurent expansions to derive properties of analytic and meromorphic functions.
- To provide an ability to compute integrals by means of residues.
- To examine common numerical methods such as finite element and finite difference techniques, including the strengths and weaknesses of particular applications.
- To discuss the concept of approximation in geometric and engineering applications.
- To provide an ability to utilize a systems approach to design and operational performance.
- To provide an ability to formulate mathematical models, choose suitable methods to investigate these models including the efficient use of computer tools.
- To provide an ability to analyze zeros and poles of meromorphic functions, classify singularities
- To provide an ability to identify various mathematical problems and reformulate these in a way suitable for numerical treatment.
- To provide an ability to select a suitable numerical method for the treatment of the given problem.

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- To provide an ability to solve various engineering problems including tabular data.
 - To provide an estimate of the accuracy of the results.
 - To provide an ability to communicate effectively with professionals within applied and engineering mathematics as well as with persons working with different scientific-technological applications in an interdisciplinary context.
 - To provide an ability to develop abstract, logical and critical thinking and the ability to reflect critically upon their work and work of others.
 - To provide an ability to interlink various engineering fields with Mathematics.
 - To provide mathematical knowledge and skills needed to support their concurrent and subsequent engineering studies
 - To provide an ability to insight their strengths and weakness as learners and to appreciate the value of errors or mistakes as powerful motivators to enhance learning and understanding.

Unit-1

Complex Analytic Functions: Complex planes, Curves in complex planes, Concept of neighborhood in the complex plane, Analytic function, Cauchy- Riemann equations (Cartesian and polar forms – without proof), Harmonic functions, conformal mappings, some standard conformal transformations.

Unit-2

Complex Integration: Complex integration, Cauchy's integral theorem and Cauchy's integral formula (without proof), Singularities, Taylor's and Laurent's series, Cauchy-Residue theorem, Residues & Contour integration. Applications of residue to evaluate real integrals.

Unit-3

Probability and Statistics: Introduction to Probability: Theorem of Total Probability, Bayes' Theorem,

Probability Distributions: Binomial Distribution, Poisson Distribution, Normal Distribution.

Numerical Methods: Basic Errors.

Solution of Algebraic and Transcendental Equations: Bisection method, Regula-Falsi method, Newton-Raphson method, Convergence condition for these methods.

Numerical methods in Linear Algebra: Gauss-Jacobi, Gauss-seidel method

Largest Eigen values and corresponding Eigen vectors : By power method

Unit-4

Finite differences and Interpolation: Finite differences Forward, Backward & Central difference operators and difference tables. Interpolation, Interpolation Formulae with equal intervals: Newton's forward, Newton's backward, Central difference interpolation by Stirling's formulae,

Interpolation Formulae with unequal intervals: Lagrange's & Newton's divided difference interpolation.

Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule.

Numerical differentiation: Using Newton's forward and backward interpolation formula,

Numerical Solutions of ordinary differential equations: Taylor's Method, Euler's Method, Improved Euler Method (Heun's Method), Runge-Kutta method of order four.

Text books:

1. Erwin Kreyszig: Advanced Engineering Mathematics (8th Edition) Wiley Eastern Ltd., New Delhi.

Reference Books:

1. R. V. Churchill and J. W. Brown : **Complex variables and applications** (7th Edition), McGraw-Hill (2003).
2. B. V. Ramana: **Higher Engineering Mathematics**, Mc Graw Hill, New Delhi.
3. Merel C Potter, J L Goldberg: Advanced Engineering Mathematics (3rd Edition) Oxford India Publication.
4. Dr. B.S. Grewal: **Higher Engineering Mathematics**, Khanna Publishers, New Delhi.
5. R K Jain, S R K Iyengar: **Advanced Engineering Mathematics**. Third Edition, Narosa Publishing House.
6. Murray Spiegel: **Advanced Mathematics for Engineering & Science:** (Schaum's Outline Series) , McGraw Hill Publication
7. M. K. Jain, S. R. K. Iyengar and R. K. Jain: **Numerical methods for scientific and Engineering computation**, New age Publication.

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Subject: **Fluid Mechanics**

Total Theory Periods: 45

Class Tests: **Two (Minimum)**

MSE Duration- **1 Hour**

ESE Duration: **Two and Half Hours**

CIE Marks: **Maximum Marks- 10**

Semester: **IV**

Code: **AU410412**

Total Tutorial Periods: 30

Assignments: **Two (Minimum)**

Maximum Marks- **30**

Maximum Marks: **60**

Minimum Marks: **24**

Total Marks: **100**

On completion of this course, the students will be familiar with the basic concepts of fluid flow phenomenon, conservation equations, their applications to the fluid flow problems and hydraulic machines

Unit – 1

PROPERTIES OF FLUID

Types of fluid, Ideal & Real Fluids, Fluid properties: Mass density, specific weight, specific volume, specific gravity, viscosity, vapour pressure, compressibility, surface tension, bulk modulus and capillarity, Newtonian and Non-Newtonian fluid

FLUID STATISTICS

Fluid statics: fluid pressure at a point, variation of pressure within a static fluid, hydrostatic law - Pressure head, Pascal's law. Buoyancy and Floatation. Measurement of pressure - Piezometric tube, manometry.

Unit –2

FLUID KINEMATICS

Description of fluid motion, Lagrangian and Eulerian approach, description of fluid flow - Velocity and acceleration of fluid particles - Different types of fluid flow. Description of flow pattern: Stream line, streak line, path line. Principle of conservation of mass - Continuity equation.

FLUID DYNAMICS

Euler's equation of motion along a stream line - Bernoulli's equation. Practical applications of Bernoulli's equation in flow measurement devices like venturimeter, nozzle, orificemeter and pitot tube. Impulse momentum equation, Momentum of momentum equation.

Unit –3

DIMENSIONAL AND MODAL ANALYSIS

Dimensions, dimensional homogeneity, methods of dimensional analysis-Reyleigh Method, Buckingham Pi theorem. Model analysis - Advantages and applications of model testing. Similitude, derivations of important dimensionless numbers and its significance, model laws: Reynolod's model law, Fraude's model law, Euler's model law, Weber's model law, Mach's model law.

FLOW THROUGH PIPES

Laminar and turbulent flow characteristics, laminar flow through circular pipes - Hagen Poiseuille law, major and minor losses in pipes, pipe friction, Darcy - Weisbach equation, parallel, series and branched pipes.

Unit –4

BOUNDARY LAYER THEORY AND FLUID FLOW OVER BODIES

Boundary layer development on a flat plate and its characteristics – Boundary layer thickness, displacement thickness, momentum thickness, energy thickness. Momentum equation for boundary layer by Vonkarman, drag on flat plate, boundary layer separation and its control. Aerofoil theory, lift and drag
Coefficients, streamlined and bluff bodies.

HYDRAULIC MACHINES

Hydraulic turbine: Classification, difference between impulse and reaction turbine. Construction and working of Pelton turbine, Francis turbine and Kaplan turbine, velocity triangle, heads and efficiencies. Pumps: classification, difference between positive and non-positive displacement pumps. construction and working of reciprocating pump. Centrifugal pump-heads of a centrifugal pump, priming, velocity triangle, work done, efficiencies of centrifugal pump.

Text Books

1. S.K. Som and G. Biswas “**Introduction to Fluid Mechanics and Fluid Machines**” -- TMH ,Delhi.
2. Bansal R K “**Fluid Mechanics and Hydraulics Machines**”- , 5th edition, Laxmi publications (P) Ltd., New Delhi, Ninth Edition, 2006.

Reference Books

1. R.K.Bansal “**Fluid Mechanics & Hydraulics Machines**” -Laxmi Publications.,Delhi
2. K.L. Kumar “**Engineering Fluid Mechanics** “-, Eurasia Publication House, Delhi

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Instrumentation for Automobile Engineers**

Code: **AU410416**

Total Theory Periods: 45

Total Tutorial Periods: 0

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

MSE Duration- **1 Hour**

Maximum Marks- **30**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60**

Minimum Marks: **24**

CIE Marks: **Maximum Marks- 10**

Total Marks: **100**

Course Objectives:

- To study the Characteristics of Transistor..
- To study the application of Semiconductor Devices like JFET, MOSFET and UJT.
- To study the Basics of Measurement System for Electronic devices.
- To study the use of Primary sensing element and Signal Conditioning Unit.
- Automotive Sensors and Actuators.

UNIT: 1

TRANSISTOR & ITS BIASING

Transistor Symbols – Transistor as an Amplifier– Connections– CB, CE,&CC–Characteristics Comparison of Transistor Connection. Transistor biasing: Methods of transistor Biasing– Base resistor method–Biasing with feedback resistor– Voltage divider bias method.

UNIT -2

JFET, MOSFET, SCR & UJT

JFET – JFET as an Amplifier and its Output Characteristics –JFET Applications– MOSFET Working Principles, SCR – Equivalent Circuit and V-I Characteristics. SCR as a Half wave and full wave rectifier Application of SCR, UJT– Equivalent Circuit of a UJT and its Characteristics.

MEASUREMENT SYSTEM

Methods of Measurements, Classification of Instruments and application, Static and Dynamic Characteristics of an Instruments, Errors in Measurement Systems– Units, System, Dimension and standards.

UNIT-3

UNIT IV - PRIMARY SENSING ELEMENTS AND SIGNAL CONDITIONING

Transducers and inverse transducers. Characteristics and Choice of transducers, Input, Transfer and output Characteristics and its application. Operational Amplifier, Characteristics of Operational Amplifier, Attenuator, Amplitude Modulation and Demodulation, Basic Filters, A/D Converter.

UNIT-4

UNIT V - AUTOMOTIVE SENSORS AND ACTUATORS

Introduction, basic sensor arrangement, Types of sensors such as – oxygen sensors, Crank angle position sensors -Fuel metering, vehicle speed sensor and detonation sensor -Altitude sensor, flow sensor. Throttle position sensors, solenoids, stepper motors, relays.

TEXT BOOKS:

1. Sawhney A. K, “**A Course in Electrical and Electronic Measurement and Instrumentation**”, Dhanpat Rai & Sons, New Delhi, 2001.
2. Millman and Halkias, “**Electronic devices and Circuits**”, McGraw Hill Publication International Edition, 1994.
3. Mithal G. K, “**Electronic Devices and Circuits**”, Khanna Publishers, New Delhi, 2008.

REFERENCES:

1. “**BOSCH Automotive Handbook**”, 8th Edition, Bentley publishers, 2011.
2. Sze S. M, “**Semiconductor Devices – Physics and Technology**”, 2nd Edition, John Wiley & Sons, New York, 2002.
3. Ben G. “**Streetman and Sanjay Banerjee, Solid State Electronic Devices**”, 6th Edition, PHI Learning, 2009.

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Automobile Engine**

Code: **AU410414**

Total Theory Periods: **45**

Total Tutorial Periods: **0**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

MSE Duration- **1 Hour**

Maximum Marks- **30**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60**

Minimum Marks: **24**

CIE Marks: **Maximum Marks- 10**

Total Marks: **100**

Course Objectives:

1. To study about Construction and operation of IC Engine
2. To study about Fuels and Combustion in IC Engines
3. To study about Performance calculation.

UNIT 1

ENGINE CONSTRUCTION AND OPERATION

Four stroke SI and CI engines - Working principle - function, materials, constructional details of engine components - Valve and port timing diagram - Firing order and its significance - relative merits and demerits of SI and CI engines Two stroke engine construction and operation. Comparison of four- stroke and two-stroke engine operation.

FUELS AND COMBUSTION

Combustion equation, conversion of gravimetric to volumetric analysis -Determination of theoretical minimum quantity of air for complete combustion -Determination of air fuel ratio for a given fuel. Properties and rating of fuels (petrol and diesel), chemical energy of fuels, reaction equation, combustion temperature, combustion chart

UNIT 2

VARIABLE SPECIFIC HEAT

Reason for variation of specific heats, Effect of specific heat on air standard cycle of otto and diesel cycles

FUEL AIR CYCLE, ACTUAL CYCLE AND THEIR ANALYSIS

Factors comparison of air standard and fuel air cycles, effect of operating variables on cycle analysis, difference between actual cycle and fuel cycle for SI and CI engines

UNIT 3

COMBUSTION IN SI ENGINES

Combustion in premixed and diffusion flames - Combustion process in IC engines. Stages of combustion - Flame propagation - Flame velocity and area of flame front - Rate of pressure rise - Cycle to cycle variation – Abnormal combustion - Theories of detonation - Effect of engine operating variables on combustion. Combustion chambers - types, factors controlling combustion chamber design.

UNIT 4

COMBUSTION IN CI ENGINES

Importance of air motion - Swirl, squish and turbulence - Swirl ratio. Fuel air mixing - Stages of combustion - Delay period - Factors affecting delay period, Knock in CI engines - methods of controlling diesel knock. CI engine combustion chambers - Combustion chamber design objectives - open and divided. Induction swirl, turbulent combustion chambers. - Air cell chamber - M Combustion chamber.

ENGINE PERFORMANCE

Performance parameters - BP, FP, IP, Torque specific fuel consumption, Specific Energy consumption, volumetric efficiency, thermal efficiency, mechanical efficiency, Engine specific weight, and heat balance. Testing of engines – different methods. Numerical problems

TEXT BOOKS

1. Ganesan V, “**Internal combustion engines**”, 4th edition, McGraw Hill Publication Education, 2012.
2. Rajput R. K, “**A textbook of Internal Combustion Engines**”, 2nd edition, Laxmi Publications (P) Ltd, 2007.

REFERENCES

1. John. B, Heywood, “**Internal Combustion Engine Fundamentals**”, McGraw Hill Publishing Co., New York, 1990 .
2. Ramalingam K. K, “**Internal Combustion Engines**”, Second Edition, Scitech Publications.
3. Sharma S. P, Chandramohan, “**Fuels and Combustion**”, McGraw Hill Publication Publishing Co, 1987.
4. Mathur and Sharma, “**A course on Internal combustion Engines**”, Dhanpat Rai & Sons, 1998.
5. Edward F, Obert, “**Internal Combustion Engines and Air Pollution**”, Intext Education Publishers

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Automobile Transmission**

Code: **AU410415**

Total Theory Periods: **45**

Total Tutorial Periods: **0**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

MSE Duration- **1 Hour**

Maximum Marks- **30**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60**

Minimum Marks: **24**

CIE Marks: **Maximum Marks- 10**

Total Marks: **100**

OBJECTIVES

1. On completion of this course, the student will know about the clutch, gearbox, hydrodynamic drives, automatic transmission, hydrostatic drive and electric drive in automobiles, their principle of operation and Performance.
2. Problem solving on above aspects

UNIT 1

CLUTCH AND GEAR BOX

Role of Clutch in driving system - Requirements of transmission system – Design aspects - Construction and working principle of different types of clutches Designing the torque capacity, axial force of single plate clutch and typical problems involving the above principles. Objective of the Gear Box - Setting top, bottom and intermediate gear ratios. Problems involving these derivations - Performance characteristics at different speeds - Construction and operations of Sliding-mesh gear box - Constant-mesh gear box Synchro-mesh gear box - Planetary gear box - Problems on above aspects

UNIT 2

FLUID COUPLING, TORQUE CONVERTERS

Fluid coupling - Principle of operation - Construction details - Torque capacity –Performance characteristics - Problems on design - Reduction of drag torque. Torque converter - Principle of operation Constructional details – Performance characteristics. Converter coupling – Construction - Free wheel –Characteristic performance

UNIT 3

MODERN HYDRO-KINETIC TORQUE CONVERTERS

Multi-stage hydro-kinetic torque converter - Poly-phase hydro-kinetic torque converter - Construction, working and performance.

UNIT 4

AUTOMATIC TRANSMISSION AND APPLICATIONS OF AUTOMATIC TRANSMISSION

Principle of working of epi-cyclic gear train - Construction and working principle of Ford-T model gear box - Wilson gear box- construction, working and derivation of gear ratios - Cotal electromagnetic transmission - Automatic over-drive - Hydraulic control system for automatic transmission. Chevrolet automatic transmission - Turbo glide transmission - Power glide transmission - Toyota “ECT-i” [Automatic transmission with intelligent electronic control systems] - Mercedes Benz automatic transmission - Hydraulic clutch actuation system for automatic transmission. Hydrostatic drive – principle, types, advantages, limitations - Comparison of hydrostatic drive with hydrodynamic drive - Construction and working of typical Janny hydrostatic drive. Lay-out of elective drive - Principle of early and modified ward Leonard control systems – advantages, limitations, performance characteristics

TEXT BOOK

1. “**Automotive Transmissions: Fundamentals, Selection, Design and Application**”, 2nd Edition, Springer, 2011.

REFERENCES

1. Heldt P. M, “**Torque converters**”, Chilton Book Co., 1992.
2. Newton Steeds & Garrot, “**Motor Vehicles**”, **SAE International and Butterworth Heinemann**, 2001.
2. CDX Automotive, “**Fundamentals of Automotive Technology: Principles and Practice**”, Jones & Bartlett Publishers

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Kinematics and Dynamics Of Machines**

Code: **AU410413**

Total Theory Periods: **60**

Total Tutorial Periods: **30**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

MSE Duration- **1 Hour**

Maximum Marks- **30**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60**

Minimum Marks: **24**

CIE Marks: **Maximum Marks- 10**

Total Marks: **100**

Course Objectives:

- To understand the concept of different mechanisms.
- To analyze the mechanisms for velocity and acceleration.
- To Understand the concepts of different transmission systems
- To understand governing system and cam profile generation.

UNIT- 1

MECHANISMS: Link, Kinematic chains and their classification, mechanism and machine, Inversions of four-bar chain, single slider crank chain and Double slider crank chain mechanisms, various types of Quick return motions. Pantograph, straight line motion mechanisms.

VELOCITY & ACCELERATION ANALYSIS OF MECHANISM: Angular and linear velocities in link mechanism, velocity and acceleration Diagram for slider - crank chain and four-bar chain mechanism including coriolis component of acceleration. Graphical methods of Kinematic analysis, instantaneous center of rotation.

UNIT -2

BELT DRIVE & CHAIN DRIVE: Analysis of forces and power transmission. Effects of centrifugal force creep and initial tension, Chains, chain length, angular speed ratio, classification of chains.

TOOTHED GEARING & GEAR TRAINS: Classification of gears, types of motion, and law of gear tooth action, in involute and cycloid tooth profile - interference of gears - minimum number of teeth to avoid interference, contact ratio. Helical, spiral, worm and bevel gears, Introduction to gear train and types of gear trains.

UNIT- 3

CAMS: Types of cams and followers. Drawing a cam profiles for a given displacement - time diagram, SHM, Uniform velocity, Uniform Acceleration, Cycloidal motion, Uniform Acceleration & Retardation.

GOVERNORS: Introduction, Objectives, Types of Governors, Working of Porter Governor and Hartnell Governor

GYROSCOPE & ITS EFFECT: Angular Velocity, Angular acceleration, Gyroscopic Torque, gyroscopic effect on naval ships, stability of automobile, stability of two wheel and four wheel automobile

UNIT- 4

BALANCING OF ROTATING AND RECIPROCATING MASSES:

Forces due to revolving masses. Balancing of revolving masses in one plane and in different planes. Balancing of reciprocating mass, balancing of locomotives, partial balancing of locomotives, swaying couple, hammer blow, variation in tractive effort, secondary balancing, balancing of inline engines, balancing of V-engines, balancing of radial engines.

VIBRATIONS IN MECHANICAL SYSTEMS: Introduction, Basic features of vibration systems - single degree of freedom Systems and vibration isolation. Introduction to free vibration and Forced vibration.

TEXT BOOKS:

1. S.S.Rattan “**Theory of Machines**” by, Mc Graw Hill
2. R.S.Khurmi “**Theory of Machine**” by. S.chand Publication

REFERENCES:

1. Jagdish Lal “**Theory of Machines**” by Metropolitan Book Co.
2. Amitabha Ghosh & Mallik “**Theory of Mechanisms and Machines**” by A. K East West Press
3. Rao J. S. and Dukkipati R. V. “**Mechanism & Machine Theory**” by New Age International Pub.
4. Charles Wilson & J.Peter Sadler E. “**Kinematics and Dynamics of Machinery**” by Pearson Education publications

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Fluid Mechanics and Machinery Lab**

Code: **AU410417**

Total Practical Hours/Week: **02**

Total Practical Hours/Sem: **30**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

List of Experiments: (At least ten experiments are to be performed by each student)

1. To determine the meta-centric height of a ship model.
2. To verify Bernoulli's Theorem.
3. To verify Impulse Momentum Principle.
4. To calibrate a Venturi meter and study the variation of coefficient of discharge.
5. To calibrate an orifice-meter.
6. Experimental determination of critical velocity in pipe.
7. To determine of head loss in various pipe fittings.
8. Flow measurement using Pitot tube.
9. To study the transition from laminar to turbulent flow and to determine the lower critical Reynold's number.
10. To determine the hydraulic coefficients (C_c , C_d and C_v) of an orifice.
11. To determine the coefficient of discharge of a mouth piece.
12. To obtain the surface profile and the total head distribution of a forced vortex.
13. To study the velocity distribution in pipe and to compute the discharge by integrating velocity profile.
14. To study the variation of friction factor for pipe flow.
15. To determine the roughness coefficient of an open channel.

List of Equipment/Instruments/Machines/Software Required:

- Apparatus for determination of metacentric height
- Bernoulli's apparatus
- Impact of jet apparatus
- Venturimeter
- Orifice meter
- Pipe friction apparatus
- Orifice apparatus
- Mouth Piece apparatus with the provision for determination of hydraulic coefficient C_c , C_d & C_v
- Vortex flow apparatus
- Apparatus of head loss in various pipe fittings.

-
- Reynold's apparatus
 - Complete setup for flow measurement using Pitot tub

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Automobile Engines Lab**

Code: **AU410418**

Total Practical Hours/Week: **02**

Total Practical Hours/Sem: **30**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

OBJECTIVES

On completing this course, the students will get knowledge to test engines, lubricants and fuels used for IC engines. They will get the knowledge of using various dynamometers used for testing IC engines and testing of fuels.

LIST OF EXPERIMENTS

1. **a)** Valve timing diagram for four stroke Engine
b) Port timing diagram of a two stroke Engine
2. Performance test on constant speed diesel engine
3. Performance test of Petrol engine at full throttle and part throttle conditions
4. Performance test of Diesel engine at full load and part load conditions
5. Morse test on petrol engines
6. Test for optimum coolant flow rate in IC engines
7. Energy balance test on an Automotive Diesel engine
8. Determination of flash and fire point of fuels and lubricating oil by different methods

REFERENCE

Laboratory Manual

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Computer Aided Part and Modeling Lab**

Code: **AU410419**

Total Practical Hours/Week: **02**

Total Practical Hours/ Sem: **30**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

PURPOSE

Course Objectives:

1. Operate a CAD workstation
2. Understand and apply basic AutoCAD commands.
3. Organize and manage CAD related files for 2D drawings
4. Create 2D & 3D CAD Models.
5. Produce 2D drawings accurately scaled for plotting.
6. Use CAD technology, available to CAD professionals consistent with current methods of Drafting, design or engineering.
7. Use modification techniques to edit and modify drawings for presentation and accuracy
Assessment Strategy: Exam questions, quizzes and homework and lab evaluation.
8. Using plotters/printers to create CAD presentations.

List Of experiments:

1. Practice on Drafting software using Measuring Commands; Basic Draw Commands; Display Commands GRID, SNAP, CIRCLE, LINE, ARC, LIMITS, ZOOM, PAN
Practice on using Editing Commands; Creating Layers; CHANGE, ERASE, EXTEND, TRIM, GRIDS, LAYER. Construction Commands ARRAY, COPY, MIRROR, MOVE, OFFSET, FILLET, CHAMFER, AND OSNAP.
2. Placing lettering on a drawing; Crosshatching a drawing TEXT, BHATCH.
3. 2D and 3D drafting of automobile components like engine crank shaft, connecting rod etc.
4. 2D & 3D drafting of machine components.
5. Creating a Assembly.
6. Preparation of roll cage for BAJA/Go Kart vehicles.

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Kinematics And Dynamics Of Machines Lab**

Code: **AU410420**

Total Practical Hours/Week: **02**

Total Practical Hours/Sem: **30**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

Purpose:

To make aware about the fundamentals of kinematics of linkage mechanism, gyroscopic effects and governing of weights with the application of those in Automobile Engineering.

List Of Experiments:

1. Study of different types of mechanisms.
2. Study of belt and chain drive.
3. To perform cam analysis using cam apparatus
4. Study of different types of gears train.
5. To study and perform gyroscopic effect .
6. Study of simple pendulum
7. Sheet-1 velocity analysis.
8. Sheet-2 Acceleration analysis.
9. Sheet-3 cam analysis.
10. Study of working of different types of governors.
11. Study of balancing and its application in automobile.
12. To study about longitudinal vibration of a spring mass system.

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **IV**

Subject: **Aptitude 2**

Code:

Total Theory Periods: **00**

Total Laboratory Hours: **30**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

Course Objectives:

- To make students competitive exam ready.
- Verbal Ability Proficiency increment and understanding of language structure.
- Difference between colloquial and formal approach towards English language.

UNIT-1

Introduction to Quantitative Analysis

Permutation & Combination, Probability, Function, Set Theory

UNIT -2

Critical Reasoning, Grammar II and Vocabulary Empowerment

Critical Reasoning , Situation based , Reaction Based , Decision Making , Idioms and phrases, Roots and etymology of words.

UNIT -3

Video Profile and Social Media Professional Reach (Requires Laptop)

LinkedIn, Glassdoor profiles, application for Internships and jobs online, video Profile Creation

UNIT-4

Placement Preparation

Solution of written tests conducted by prominent corporate, Introduction to Group Discussion and Personal Interview.

REFERENCE BOOKS:

- 1) Norman Lewis "Word Power Made Easy"
- 2) R S. Agarwal "Quantitative Aptitude"
- 3) Wrenn and Martin "English Grammar and composition"
- 4)"www.catgurus.in"

5th Semester

INDUS University, Ahmadabad (Gujarat)

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Automobile Chassis	AU410508	4	0	0	4	4
2	Alternate fuels and pollution control	AU410509	3	0	0	3	3
3	Automobile Heat Transfer	AU410503	4	2	0	6	5
4	Special Purpose Vehicle	AU410510	3	0	0	3	3
5	Auto engine systems	AU410511	3	0	0	3	3
6	Elective-1		3	0	0	3	3
7	Presentation on Industrial Training	AU410516	0	3	0	3	0
8	Alternate fuels and pollution LAB	AU410512	0	0	2	2	1
9	Automobile Heat Transfer Lab	AU410513	0	0	2	2	1
10	FEA LAB	AU410514	0	0	2	2	1
11	Automobile Chassis Lab	AU410515	0	0	2	2	1
12	NC-3	AU410517	0	2	0	2	0
TOTAL:			20	7	8	35	25

Institute Elective-1

1	Safety And Ergonomics	AU410527	3	0	0	3	3
2	Advance Machining Processes	AU410522	3	0	0	3	3
3	Automotive Aerodynamics	AU410528	3	0	0	3	3

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Cred
Automobile chassis	AU410508	4	0	0	4	4

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Subject: **Automobile chassis**

Code: AU410508

Total Theory Periods: **60hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Objectives:

After completion of this course, the students are expected to select proper automobile Chassis for a vehicle, identify and solve problems related to automobile system.

Course content:

Unit – I

Vehicle Classification and Layouts

Study various vehicle layouts as front engine and front wheel drive, front engine & rear wheel drive, rear engine & rear wheel drive, Components of transmission system, four wheel drives, and classification of chassis, Different Criteria and Design parameters for chassis selection.

Drive line

Propellers shaft, Types of drive as torque tube and hotch-kiss drive, Final drive types, Bevel, Hypoid, Worm and worm wheel, Type of drive axles & differential, Fully or semi-floating and three quarter floating, Dead axle.

Unit –II

Front axle and steering system

Types of front axle. Constructions details. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe-in. Conditions for true rolling motion of wheels during steering. Steering geometry. Ackerman and Davis steering system. Constructional details of steering linkages. Different types of steering gear boxes. Steering linkages and layouts. Power and Power assisted steering.

Braking system

Function, Internal expanding brakes, Brake lining material, Properties, Calculation of braking force and shoe geometry, Hydraulic braking system, Brake oil, Bleeding of brakes, Pneumatic braking system, Vacuum brakes, Exhaust brakes. Anti lock braking systems. Regenerative braking system.

Unit –III

Suspension system

Purpose, Types of suspension system, Front and rear suspension, Coil spring, Leaf spring, Torsion bars, Shock absorbers, Air and rubber suspension, Plastic suspensions, Hydro-pneumatic suspension, Independent suspension.

Wheels and tyres

Types of wheels - construction. Function of tires - Solid and pneumatic Tires. Constructional details of pneumatic tires, Specifications of tires.

Unit –IV

Performance of vehicle

Vehicle motion, resistances during motion, accelerated and constant velocity motions, tractive force, gradeability, power required and engine characteristics, gear ratio requirement.

Advancement in Systems used in Automobiles.

Advancements in Drive line, Brakes, Steering, Suspension, Wheels and Tyres, and Effects of these advancements on the Automobile Sector and Society.

Text Books

1. Automobile Engineering by Kirpal Singh, Standard Publishers Distributors Delhi
2. Automobile Engineering" by R.B. Gupta, Satya Parkashan, New Delhi

Reference Books

1. Automotive Engineering by James D Halderman, Pearson
2. Automobile Engineering Vol-I & II by Dr. K.M. Gupta.

Digital Resorces

<http://www.carbibles.com>

<http://www.scribd.com>

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Alternate fuels and pollution control	AU410509	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Subject: **Automobile Fuels and Pollution Control** Code: AU410509

Total Theory Periods: **45hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Objectives:

1. The course introduces different types of fuels and various pollution control techniques that are used in automotive and which can be used for future purpose.
2. There will be enhancement of knowledge of different fuels in the field of automobile.,

UNIT 1

INTRODUCTION

Working process of I.C. Engine. Study of various parameters related to properties of different types of fuel (Rating of fuel, Ignition quality, volatility, calculations of Air / Fuel ratio, Calorific Value) as input and output in terms of results (Fuel efficiency, Fuel requirement, Engine efficiency and Engine life). Sources of fossil fuel, scope of availability of fossil fuel in future

NEED FOR ALTERNATIVE FUELS AND POLLUTION CONTROL

Effects of constituents of Exhaust gas emission on environmental condition of earth (N₂, CO₂, CO, NO_x, SO₂, O₂) Pollution created by Exhaust gas emission in atmosphere. Green house effect, Factors affecting green house effect. Study of Global Carbon Budget, Carbon foot print and Carbon credit calculations. Emission norms as per Bharat Standard up to BS – IV and procedures for confirmation on production, various techniques and methods for pollution control, future sources of energy other than alternate fuels

UNIT 2

ALCOHOL

Sources of Methanol and Ethanol, methods of its production. Properties of methanol & ethanol as engine fuels, Use of alcohols in S.I. and C.I. engines, performance of blending methanol with gasoline. Emulsification of alcohol and diesel. Dual fuel systems. Improvement / Change in emission characteristics with respect to % blending of Alcohol.

BIO DIESELS

Base materials used for production of Bio Diesel (Karanja oil, Neem oil, Sunflower oil, Soya bean oil, Mustard oil, Palm oil, Jatropha seeds). Process of separation of Bio Diesel. Properties Diesel blended with vegetable oil, and difference in performance of Engine.

UNIT 3

HYDROGEN:

Hydrogen as a substitute fuel. Study Properties, Sources and methods of Production of Hydrogen, Storage and Transportation of hydrogen. Also, the economics of Application and Advantages of hydrogen (Liquid hydrogen) as fuel for IC engine/ hydrogen car. Layout of hydrogen car

FUEL CELLS :Concept of fuel cells based on usage of Hydrogen and Methanol. Power rating, and performance. Heat dissipation, Layout of fuel cell vehicle.

BIOGAS: Introduction to Biogas system, Process during gas formation, Factors affecting biogas formation. Usage of Biogas in SI engine & CI engine.

LPG & CNG: Properties of LPG & CNG as engine fuels, fuel metering systems, combustion characteristics, effect on performance, emission, cost and safety.

UNIT 4

SOLAR POWER

Solar cells for energy collection. Storage batteries, layout of solar powered automobiles. Advantages and limitations.

ELECTRIC & HYBRID VEHICLES

Layout of an electric vehicles, advantages & limitations. Systems components, electronic controlled systems, high energy and power density batteries. Types of hybrid vehicles.

VEGETABLE OILS

Various Vegetable oils for Engines – Esterification – Performance and emission characteristics

SYNTHETIC ALTERNATIVE FUELS: Di-Methyl Ether (DME), P-Series, Eco Friendly Plastic fuels (EPF)

Text books:

1. Alternate Fuels by Dr. S. Thipse - Jaico Publications
2. Internal Combustion Engines by Ganeshan - Tata McGraw Hill

Reference books:

1. Automotive Emission Control by Crouse, AND Anglin - McGraw Hill
2. Alternative Fuels Guidebook Bechtold R
3. The properties and performance of modern alternative fuels SAE Paper no. 841210.
Internal Combustion Engines by Heywood Joh

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Automobile Heat Transfer	AU410503	4	2	0	6	5

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Subject: **Automobile heat transfer**

Code: AU410503

Total Theory Periods: **60 hrs**

Total Tutorial Periods: **30**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Objectives:

1. To understand basic heat transfer modes.
2. Heat transfer by different modes in automobile systems
3. To understand principle and working of heat exchanger.

Course content

UNIT 1

Principles of Heat Transfer:

Modes of heat transfer, Fourier's law, Newton's law of cooling, thermal radiation, Electrical analogy concept of overall heat transfer coefficient

Heat Transfer by Conduction:

General heat conduction equation in Cartesian coordinates and its transformation to cylindrical One-dimensional steady-state heat conduction from plane wall, cylindrical wall and composite wall. Critical thickness of insulation for cylinder and sphere. Heat flow through plane wall with variable thermal conductivity, Critical thickness of Insulation. One dimensional steady state heat conduction with uniform heat generation through plane wall; hollow cylinder and solid cylinder. Heat transfer from extended surfaces. Efficiency and effectiveness in various configuration; Thermal diffusivity, unsteady state heat conduction with negligible internal resistance

UNIT 2

Heat Transfer by Convection:

Fundamentals of convection. Mechanism of forced convective heat transfer with laminar and turbulent boundary layer, Hydrodynamic boundary layer, Thermal boundary layer. Dimensional and analytical analysis of the process; significance of non dimensional numbers empirical and theoretical co-relations for flat plate, pipe and bank of tubes. Heat transfer by free convection. Momentum and energy equations, Effect of surface configuration; mechanism of process and heat transfer correlations.

Heat Transfer with change of phase:

Phenomenon of boiling, nucleation, regimes of boiling, phenomenon of condensation, film wise and drop wise condensation on vertical plate, heat pipe.

UNIT 3

Heat Transfer by Radiation:

Physical mechanism. Surface emission properties, surface irradiation properties, concept of black body. Kirchhoff's law of radiation. Intensity of radiation and its relation, radiosity, Lambert's cosine law, Stefan Boltzmann law, Planck's distribution law, Wien's displacement law, Emissivity, real surface behavior, gray surface behaviors, radiation heat exchange between gray bodies, electrical network method for radiant heat exchange between gray and black surfaces, radiation shields.

Heat Exchangers:

Classification of heat exchanger. Analysis including LMTD, Effectiveness, NTU, fouling mechanism, growth and design to minimize fouling. Small types of heat exchangers. Plate-Fin heat exchangers, construction and configuration, advantages and Disadvantages. Air cooled heat exchanger, construction and configuration, advantages and Disadvantages.

UNIT 4

Automobile cooling system:

Radiator construction, Engine Cooling system construction, types of engine cooling system, coolant properties. Design parameters for radiator, Thermostat Valve, Radiators Cap, Radiator fan, Radiator Fan shroud, Surge Tank. Design parameters and Synchronization of vehicular Engine cooling system for dissipation of heat generated in Engine. Cooling system trouble diagnosis.

Ergonomic aspects of cooling

Cabin cooling, ergonomic aspects for vehicle cabin cooling, HVAC

Text Book:

1. Heat and mass transfer by D.S. Kumar, S.K. Kataria & Sons
2. Heat and Mass Transfer by R. Yadav "Central Publishing House"

Reference Books:

1. Heat Transfer by Sukhatme

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2. Heat transfer by Gield
 3. Heat transfer by kreith, TMH
 4. Heat and Mass Transfer by R.K. Rajput, S. Chand & Company Ltd., New Delhi.
 5. Heat Transfer – A Practical approach by – Yunus Cengel, Tata McGraw Hill
 6. Automobile Technology by N.K.Giri, Khanna Publication
 7. Heat and Mass Transfer by P.K.Nag, Tata McGraw Hill

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Special Purpose Vehicle	AU410510	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Subject: **Special Purpose Vehicle**

Code: AU410510

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course objectives:

1. After completion of this course, the students are expected to ,
2. Understand different types of special purpose vehicle for particular application.

Course Content:

Unit 1

Classification of special purpose vehicles: based on applications, wheel types & truck type, Vehicles for Differently abled persons

Study of working principles & design considerations: of different systems involved like power system, transmission, final drive, lubrication, electrical, braking, steering, pneumatic & hydraulic control circuits

Unit 2

Constructional & working features: of different types of earth moving machinery such as tippers, shovels, loaders, excavators, dumpers, dozers, fork lift truck, road rollers.

Unit 3

Farm tractor: layout, load distribution, engine, transmission & drive line, steering, braking system, wheels & tyres, hydraulic system, auxiliary systems, draw bar, PTO shaft. Different types of implements, accessories and attachments. Tractor trolley.

Mobile cranes: basic characteristics of truck cranes, stability & design features, control systems & safety devices.

Unit 4

Tracked vehicles, articulated vehicles, multi-axle vehicles, fifth wheel mechanism. Semi-trailer & prime mover brakes & electrical systems. Dead axles.

Special purpose electric vehicles, solar vehicles and hybrid vehicles. Types, architecture and parameters of design considerations.

Text books:

1. "electric vehicles" by Sheldon, r. shacket, domus books, new york.

Reference books:

1. Hand book of earth moving machinery - central water & power commission study of casting processes
2. Truck cranes a. Astskhovmir, moscow

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Auto engine systems	AU410511	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Subject: **Auto Engine System**

Code: AU410511

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course objectives:

1. The purpose of this course is to impart adequate knowledge on different systems of SI and CI Engines.
2. To understand the construction and working of different systems of automobile engines.

Course Content:

UNIT I

INTAKE AND EXHAUST SYSTEMS

Intake system components - Discharge coefficient, Pressure drop - Air filter, intake manifold, Connecting Pipe - Exhaust system components - Exhaust manifold and exhaust pipe, Exhaust mufflers, Types, operation

AIR POLLUTION

Emission norms, Exhaust gas emission constituents and analysis, Orsat apparatus, Modern methods and Gas chromatography

UNIT II

CARBURETION AND GASOLINE INJECTION

Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor Chokes - Effects of altitude on carburetion - Carburetor for

2-stroke and 4-stroke engines - carburetor systems for emission control. Petrol injection - Open loop and closed loop systems, mono point, multi point and direct injection systems - Principles and Features,.

UNIT III

DIESEL INJECTION

Requirements - Air and solid injection - Fuel supply system in CI engine Fuel injection pump, fuel feed pump, injectors, nozzles, cold starting devices (glow plugs), types of governors, Types of injection nozzle - Nozzle tests - Spray characteristics - Injection timing - Factors influencing fuel spray atomization, penetration and dispersion of diesel Common Rail Diesel Injection (CRDI) System.

UNIT IV

LUBRICATION AND COOLING

Need for cooling system - Types of cooling system - Liquid cooled system: Thermosyphon system, Forced circulation system, pressure cooling system properties of coolant, additives for coolants Need for lubrication system - Mist lubrication system, wet sump any dry sump lubrication - Properties of lubricants, consumption of oil.

SUPERCHARGING AND SCAVENGING

Objectives - Effects on engine performance - engine modification required Thermodynamics of supercharging and Turbocharging – Turbo lag-Windage losses- Turbo charging methods - Engine exhaust manifold arrangements. Classification of scavenging systems -Mixture control through Reed valve induction - Charging Processes in two-stroke cycle engine - Terminologies Shankey diagram - perfect displacement, perfect mixing.

TEXT BOOKS:

1. Ganesan V, “Internal combustion engines”, 4th edition, Tata McGraw Hill Education, 2012.
2. Rajput R. K, “A textbook of Internal Combustion Engines”, 2nd edition, Laxmi Publications (P) Ltd, 2007

REFERENCES:

1. IC Engine by Sharma & Mathur, TMH.
2. IC Engine by Elliot.
3. Vehicle Technology by Heinz Heizler.
4. IC Engine by Maleev.
5. IC Engine by Heldt.
6. Engine troubleshooting, Cummins Engine, Columbus.

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Safety And Ergonomics	AU410527	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Subject: **Safety and Ergonomics**

Code: AU410527

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Objectives :

To provide an understanding to the automotive safety and comforts systems and its future prospects

Course Contents:

UNIT – 1

DESIGN OF AUTOMOTIVE BODY AND SAFETY

Introduction to automotive safety systems - Design of the body for safety - engine location - concept of crumple zone - safety sandwich construction - deformation behaviour of vehicle body - speed and acceleration characteristics of passenger compartment on impact.

SAFETY SYSTEMS

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

UNIT –2

CRASH WORTHINESS

Definition – Requirements – Tests – component, sled and full-scale barrier impacts-Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety

UNIT –3

COLLISION WARNING AND AVOIDANCE

Collision warning system, causes of rear end collision, deformation of body due to cyclic loads and collision frontal object detection ,rear vehicle object detection system, object detection system with braking system, sensors assist,

UNIT –4

COMFORT SYSTEMS

Ergonomics, NVH (noise, vibration and harshness) of chassis, engines and power train, ride, Quality and sound quality; heating, ventilation and air conditioning systems. Steering and mirror adjustment, central locking system, Garage door opening System, tyre pressure control system, rain sensor system, environment information system

TEXT BOOK

1. Vivek D. “Ergonomics in the Automotive Design Process” Bhise publisher CRC press, Taylor and Francis group.\

REFERENCES

1. Ronald K Jurgen, “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., - 1999.
2. Bosch, “Automotive Handbook”, 5th edition - SAE Publication - 2000.
3. JullianHappian, “Smith An Introduction to Modern Vehicle Design”, SAE, 2002.
4. Johnson W and Mamalis A.G, “Crashworthiness of Vehicles”, MEP, London.
5. Richard Bishop, “Intelligent Vehicle Technology and Trends” – 2005.
6. George A. Peters , Barbara J. Peters, “Automotive Vehicle Safety” – 2002

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Advance Machining Processes	AU410522	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Subject: **Advance Machining Process**

Code: AU410522

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Objectives:

1. A Student Understands the basic techniques of mechanistic modeling with its application to manufacturing processes
2. Students are able to plan and diagnose machining processes used in practice via a qualitative understanding of their thermo-mechanical behavior.
3. Students understand the mechanical aspects of orthogonal cutting mechanics.
4. Students understand the thermal aspects of orthogonal cutting mechanics. Students understand the practical aspects of tool wear and tool life, and their influence on economics.

UNIT I

Introduction

why do we need advanced machining processes (amps)?advanced machining processes, conventional machining processes and unconventional machining processes

Mechanical Advanced Machining Processes

Abrasive Jet Machining (AJM) - introduction - abrasive jet machining setup – gas propulsion system - abrasive feeder - machining chamber - ajm nozzle - abrasives.

Parametric Analysis - stand-off-distance - abrasive flow rate - nozzle pressure – mixing Ratio.

UNIT II

Abrasive Flow Finishing: Abrasive Flow Finishing, Working Principle, Abrasive Flow Machining System - Machine - Tooling - Media, Process Variables, Process Performance, Applications - Aerospace - Dies and Molds

Magnetic Abrasive Finishing (MAF): working principle of maf, material removal (or stock removal) and surface finish - bonded and unbonded magnetic abrasives - machining fluid - magnetic flux density, analysis

Ultrasonic Machining (USM): Ultrasonic Machining System, Mechanics of Cutting, Parametric Analysis, Process Capabilities, Applications

UNIT III

Water Jet Cutting (WJC) : introduction, wjm machine, process characteristics, process performance, applications

Abrasive Water Jet Machining (AWJM): working principle, process characteristics, cutting parameters, process capabilities, applications

Thermoelectric Advanced Machining Processes

Electric Discharge Machining (EDM): introduction, working principle of edm, r-c pulse generator, edm machine, cnc-edm, process variables, process characteristics, applications

UNIT IV

Electric Discharge Grinding (EDG) And Electric Discharge Diamond Grinding (EDDG): electric discharge grinding, electrical discharge diamond grinding - working principle - capabilities and applications.

Wire Electric Discharge Machining: working principle, wire edm machine, advances in wire cut, stratified wire, process variables, process characteristics, applications
Laser Beam Machining, Plasma Arc Machining, Electron Beam Machining
Electrochemical And Chemical Advanced Machining Processes, Electrochemical Grinding, Electro stream Drilling, Electrochemical Deburring

TEXT BOOKS:

1. SeropeKalpakjian, Steven R. Schmid “Manufacturing Engineering and Technology”, Addison Wesley, 2001
2. P.C. Sharma, “A Text Book of Production Technology”, S.Chand and Co. Ltd., New Delhi, 1996.
3. Manufacturing Technology Vol-II, By P.N. Rao, Tata McGraw Hill.

REFERENCES:

1. B.H.Amstead, “Manufacturing Processes”, Phillip F.Ostwald, L.Begemon, John Wiley andSons, 8th Edition, 1998.
2. De Garmo, “Materials and Processes in Manufacturing”, Prentice Hall of India, 8th Edition,1998.
3. T.R. Banga, R.L. Agarwal and T.Manghrani, “Foundry Engineering”, Khanna Publishers,New Delhi – 1995.
4. P.N.Rao, “Manufacturing Technology – foundry Forging and Welding”, Tata McGraw HillPublishing Co., New Delhi – 1988

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Automobile Aerodynamics	AU410528	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Subject: **Automotive Aerodynamics**

Code: **AU410528**

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Objective:

At the end of the course, the students will be able to apply basic principles of aerodynamics for the design of vehicle body.

Course Content:

UNIT 1

INTRODUCTION

Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to Vehicles, external and internal flow problem, resistance to vehicle motion, performance, fuel Consumption and performance potential of vehicle aerodynamics, vehicle shape and aerodynamics

AERODYNAMIC OF DRAG OF CARS

Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of Aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag Profiles.

UNIT 2

SHAPE OPTIMIZATION OF CARS

Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and Square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

Case studies on modern vehicles.

UNIT 3

VEHICLE HANDLING

The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments,

Characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag

Reduction in commercial vehicles and racing cars.

UNIT 4

WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS

Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale

Models, full scale wind tunnels, measurement techniques, equipment and transducers, road

Testing methods, numerical methods.CFD analysis.

TEXT BOOKS

1. Hucho .W.H. – “Aerodynamic of Road Vehicles” – Butterworths Co., Ltd., - 1997

REFERENCE BOOKS

1. A. Pope – “Wind Tunnel Testing” – John Wiley & Sons - 2nd Edition, New York – 1974.

2. “Automotive Aerodynamic”, Update SP-706 – SAE – 1987

3. “Vehicle Aerodynamics” – SP-1145-SAE-1996.

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Alternate Fuels and Control Lab	AU410512	0	0	2	2	1

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Total Practical Hours/Week: **02**

Total Practical Hours/Sem: **30**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

List of Experiments:

1. Study of physical & chemical properties of fuels.
2. Study of use of alternate liquid fuels for S.I. engines.
3. Study of use of alternate liquid fuels for C.I. engines.
4. Study of fuel cell powered vehicle.
5. Study of use of alternate gaseous fuels for S.I. engines.
6. Study of use of alternate gaseous fuels for C.I. engines.
7. Study of solar powered vehicle.
8. Study of battery operated vehicles.
9. Layout preparation for Hybrid vehicles

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Automobile Heat Transfer Lab	AU410513	0	0	2	2	1

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Total Practical Hours/Week: **02**

Total Practical Hours/Sem: **30**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

List of Experiments:

1. To study the fundamentals of heat transfer
2. Thermal conductivity of insulating powder
3. Heat transfer co-efficient for composite wall
4. Temperature distribution and the effectiveness of the fin
5. Heat transfer co-efficient by natural convection.
6. Heat transfer co-efficient in force convection
7. Study of Heat Transfer with change of phase
8. Determination of Stefan Boltzmann constant
9. Emissivity measurement
10. Study of heat exchangers
11. Study of cooling system and component for Automobile.

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
FEA Lab	AU410514	0	0	2	2	1

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Total Practical Hours/Week: **02**

Total Practical Hours/Sem: **30**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

List of Experiments:

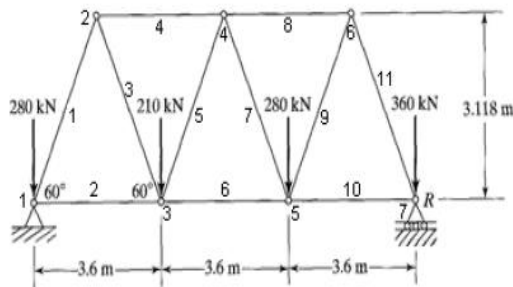
Experiment: 1

Introduction to ANSYS

An introduction to using ANSYS, including a quick explanation of the stages of analysis, how to start ANSYS, and the use of the windows in ANSYS, and using Creo with ANSYS.

Experiment: 2

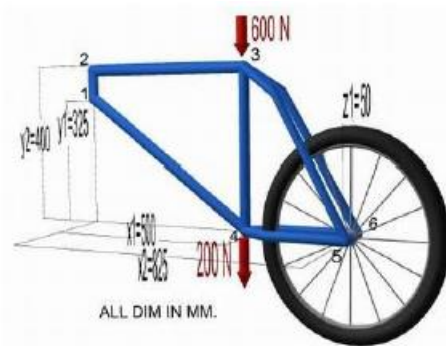
Solve a simple 2D Truss problem, determine the nodal deflections, reaction forces, And stress for the truss system
($E = 200\text{GPa}$, $A = 3250\text{mm}^2$).



Experiment: 3

Create Simple 3D space frame problem.

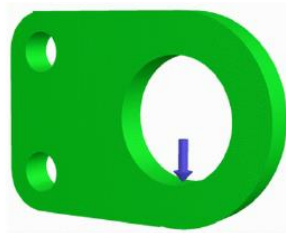
The problem to be modelled in this example is a simple bicycle frame shown in the following figure. The frame is to be built of hollow aluminium tubing having an Outside diameter of 25mm and a wall thickness of 2mm.



Experiment: 4

Analyze Plane Stress Bracket

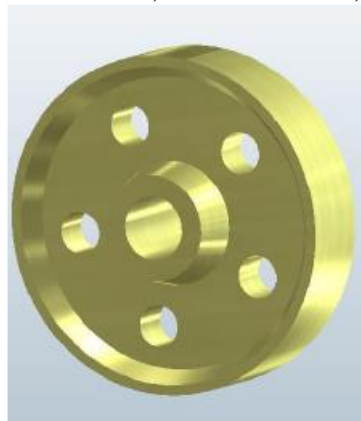
The problem to be modeled in this example is a simple bracket shown in the following figure. This bracket is to be built from a 20 mm thick steel plate. A figure of the plate is shown below. This plate will be fixed at the two small holes on the left and have a load applied to the larger hole on the right.



Experiment: 5

Solid Model Creation

Create model of the pulley (OuterDia 600 , Inner Dia 300 , Flange thickness 5 mm)



References:

1. UNIVERSITY of Alberta
2. UNIVERSITY of Manitoba
3. Cornell UNIVERSITY
4. UNIVERSITY of Texas Arlington

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Automobile Chassis Lab	AU410515	0	0	2	2	1

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **V**

Total Practical Hours/Week: **02**

Total Practical Hours/Sem: **30**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

Purpose:

List of Experiment

1. Vehicle layouts.
2. Different types of clutch.
3. To study about the performance of vehicle.
4. Different types of manual gear boxes.
5. Rear axle, final drive and differential.
6. Automatic Transmission system.
7. Different types of tyres and wheels.
8. Different types of automobile brakes.
9. Steering systems.
10. Different types of suspension system.

6th Semester

INDUS University, Ahmadabad (Gujarat)

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Automobile Component Design	AU410601	4	2	0	6	5
2	Total Quality Management	AU410602	3	2	0	5	4
3	Two And Three Wheelers	AU410609	3	0	0	3	3
4	Vehicle Maintenance And Garage Practice	AU410610	3	0	0	3	3
5	Elective-2		3	0	0	3	3
6	Automobile Hydraulics and Pneumatics systems	AU410608	4	0	0	4	4
7	Vehicle Maintenance And Garage Practice Lab	AU410611	0	0	4	4	2
8	Automobile Hydraulics and Pneumatics systems Lab	AU410612	0	0	2	2	1
9	Two And Three Wheelers Lab	AU410613	0	0	2	2	1
9	NC-4	AU410614	2	0	0	2	0
10	Library/Sports/Expert Lecture	AU410615	0	0	1	1	0
TOTAL			20	6	9	35	26

Department Elective-1

1	Finite Element Analysis	AU410627	3	0	0	3	3
2	Modern Manufacturing Processes	AU410628	3	0	0	3	3
3	Modern Vehicle Technology	AU410629	3	0	0	3	3

INDUS University, Ahmadabad (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Automobile Component Design	AU410601	4	2	0	6	5

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total Theory Periods: **60 hrs**

Total Tutorial Periods: **30**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes:

- It Consists Of Application Of Scientific Principles, Technical Information, And Imagination For New Product Development In Automobile Sector.
- To learn the importance of Design of Components for Assembly Manufacturing.

Contents

Unit – 1

Chapter 1 Design Considerations: 05

Manufacturing and assembly considerations. Design of components for casting, welding, forging, hot & cold working, machining etc. Design for creep (thermal considerations). Wear considerations in design.

Chapter 2 Design of Bearings 08

Rolling Contact Bearing: Types of rolling contact bearings, static and dynamic load capacities, Equivalent bearing load, load life relationship, Bearing life, Load factor, Selection of bearings from manufacturer's catalogue. Lubrication and mountings/dismounting of bearings, Oil seals and packing.

Unit – 2

Chapter 3 Design consideration of gears, material selection and Gear lubrication. 08

Spur Gears:

Force analysis, Number of teeth, Face width & Beam strength of gear tooth
.Dynamic tooth load. Effective load on gear tooth. Estimation of module based on beam strength. Wear strength of gear tooth. Estimation of module based on wears strength. Spur gear design for maximum power transmission.

Chapter 4 Helical Gears: 06

Virtual number of teeth, Tooth proportions, Force analysis, Beam strength& Wear strength of helical gears, Effective load on gear tooth, Design of helicalGears.

Chapter 5 Bevel Gears: 06

Terminology of bevel gears, Force analysis, Beam strength of bevel gears, Wear strength of bevel gear, Effective load on gear tooth, Design of bevel gear.

Chapter 6 Worm Gears: 04

Force analysis, Friction in worm gear, Vector method, Strength rating of worm gears, Wear rating of worm gear.

Unit – 3

Chapter 7 Design of Gearbox 07

Design considerations of gearbox, selection of proper gear ratios for an Automobile gearbox, Speed Chart Construction, Ray Diagram construction, Gear ratio selection, Arithmetic Progression, Geometrical Progression for gear ratio selection.

Chapter 8 Design of I.C. Engine Components-I 08

- Engine power requirements, Selection of engine type, Stroke & Bore, compression ratio, clearance volume and swept volume, mean piston speeds.

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- Design of Piston & Piston pin: Materials used, design of piston crown, pin Dimensions.
 - Connecting Rod - Forces, material, types, design Criteria, dimensions etc
 - Design of cylinder head: Stresses, materials, Combustion chamber design

Unit – 4

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Chapter 9 Design of I.C. Engine Components-II

08

- Design of Crankshaft.
- Cylinder block dimension, Types of liner – Dry & Wet type liners.
- Valve mechanism Design: Valve, rocker arm, Valve spring design, Push Rod, cam shaft and cam follower etc.
- Design Consideration for Exhaust System of I.C.Engine

Text Book(s)

- Design of machine element By V.B.Bhandari, Tata Macgraw Hill
- Design of Machine Element By J.S.Soni, Nirav & Roopal Prakashan
- Mechanical System Design By S.P.Patil, Jaico Publication

Reference Books

- Joseph E. Shigley & Larry D. Mitchell, “Mechanical Engineering Design”, Fourth Edition, McGraw-Hill International Book Company
- Machine Design by R.S.Khurmi & J.K.Gupta, S.Chand & Co.
- Mechanical System Design By S.P.Patil, Jaico publication
- Auto Design By R.B.Gupta, Satya Prakashan, New Delhi
- Machine Design By Abdul Mubeen By Khanna Publisher
- Design Data book for Engineers By PSG, Coimbatore

LIST OF TUTORIALS

1. Design Considerations for Automotive Components
2. Design of Rolling contact Bearings
3. Study and Design of Spur Gear
4. Study and Design of Helical Gear
5. Study and Design of Bevel Gear
6. Study and Design of Worm & Worm Gear
7. Design of Commercial Gearbox
8. Design of I.C. Engine Components
 - i. Design of Cylinder
 - ii. Design of Piston
 - iii. Connecting rod
 - iv. Crankshaft
9. Design of Valve operating Mechanism used in I.C.Engine
10. Design Of Intake & Exhaust Manifold in I.C.Engine.

INDUS University, Ahmadabad (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Total Quality Management	AU410602	3	2	0	5	4

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **30**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes:

- Develop an understanding on quality management philosophies and frameworks
- Develop in-depth knowledge on various tools and techniques of quality management
- Learn the applications of quality tools and techniques in both manufacturing and service industry
- Develop analytical skills for investigating and analyzing quality management issues in the industry and suggest implement able solutions to those.

Develop the importance of ISO and Quality systems, Audit systems.

Unit – 1

Chapter 1 Introduction of Quality Management

World scenario, quality education, benefits of quality management, changing criteria of quality, efficiency v/s effectiveness, drivers of quality, definition of quality, Internal & External customers, Understanding of Vision and Mission Statements. Objectives, Goals, Targets & action plan to align with the Vision statement.

Chapter 2 Principles & Philosophies of Quality management:

Principles of TQM by Deming, Crosby and Juran. Importance of TQM in comparison to quality-inspection/control/assurance, Evolution of TQM. Tools and Techniques for preparation and models of TQM. SWOT Analysis, strategic planning, Organization culture.

Unit – 2

Chapter 3 Customer Orientation

Customer focus, Customer satisfaction & retention models, Quality function deployment, Customer satisfaction measurement

Chapter 4 Human Dimension & Team Development

Top Management commitment, Leadership for TQM. Change management. Motivational strategies. Quality circle philosophy. Synergy. Team Building. Communication and transactional analysis.

Unit – 3

Chapter: 5 TQM Tools & techniques Problem Solving Tools:

- 1. Problem Solving Tools:** Process of problem solving. Brain storming, histogram, check sheets, Ishikawa diagrams, Pareto analysis, scatter diagrams, statistical process control and control charts – application of these tools.
- 2. Seven Quality management tools.**
- 3. Continuous Improvement Strategies:** Deming wheel, Zero defects Concept, Bench marking. Six sigma (6 _)
- 4. Preventive Techniques:** Failure Mode Effect Analysis (FMEA). Poka Yoke.
- 5. Quality Ambiance:** 5S, Time Management.

Unit – 4

Chapter: 6 – Quality Certification

ISO 9000 series, ISO 14000 series and QS 9000 certification. EURO standards, Quality Auditing. Quality Awards.

Chapter: 7 – Reliability

Failure rate analysis, Mean failure rate, Mean time to failure (MTTF), Mean time between failures (MTBF). Graphical representation of λ , Z and R. Generalization in graphic and integral form. Hazard model. System reliability, availability, maintenance – reliability centered maintenance (RCT), total preventive maintenance (TPM), and overall equipment effectiveness (OEE) model

TEXT BOOKS:

- Suganthi, L. and Samuel, A.A. “Total Quality Management”, Prentice Hall of India Private Limited., 2012, 8th Edition
- Janakiraman, B and Gopal, R.K. “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.

REFERENCE BOOKS:

- Logothetis, N. “Managing for Total Quality: From Deming to Taguchi and SPC”, Prentice-Hall of India Private Limited.
- Feigenbaum, A. “Total Quality Control”, Mc Graw Hill.
- Mitra, A. “Fundamentals of quality control and improvement”, Pearson Education.
- Hansen, B.L. and Ghare, P.M. “Quality control and application”, Prentice-Hall of Indian Private Limited.
- Dale H. Besterfield, et al., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint (2006).

Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.

ACTIVITY BASED LEARNING TOPICS:

1. Case Study Exercise on formulation of Objectives, Goals, Targets & action plan to align with the Vision statement
2. Case Study Exercise on SWOT Analysis
3. Case Study Exercise on application of Deming wheel (PDCA)
4. Case Study Exercise on application of Failure Mode Effect Analysis (FMEA)
5. Tutorials for various Problem Solving Tools
6. Mini Project on 5S
7. Tutorials on calculation of Failure rate analysis, MTTF, MTBF, OEE

INDUS UNIVERSITY, AHMEDABAD (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Two And Three Wheelers	AU410609	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total Theory Periods: **45 hrs**

Total Tutorial Periods:

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

OBJECTIVES:

To make the students to know and understand the constructional details, operating characteristics and vehicle design aspects of Two & Three Wheelers.

Syllabus Content:

UNIT 1

Introduction :

Development, Classification & layouts of two wheelers (motorcycles, scooters, mopeds) and Three wheelers, applications & capacity – goods & passengers, study of technical specification of Two & Three wheelers.

UNIT 2

Power Unit :

Selection of engine for two wheeler & three wheeler, Design considerations for two wheeler & three wheeler power plants, special systems requirements for lubrication, cooling, starting. Recent engine developments

Transmission Systems :

Clutch – special requirements, different types used in two & three wheelers, need of

primary reduction, belt and chain drive, selection of transmission - gear transmission, gear shift mechanism, belt transmission, automatic transmission (Continuous Variable Transmission - CVT, Epicyclic), final drive & differential for three wheeler, wheel drive arrangement.

UNIT 3

Steering & Suspension :

Steering geometry, steering column construction, steering system for three wheelers, Suspension requirements, design considerations, trailing & leading link, swinging arm, springs & shock absorbers, SNS for suspension

Brake, Wheel & Tyres :

Design consideration of brake, types of brakes – disc, drum, braking mechanism – mechanical, hydraulic & servo, wheel types - spokes, disc, split, special tyre requirements for two & three wheelers.

UNIT 4

Frames & Body :

Types of frame, construction, loads, design consideration, materials, Types of three wheeler bodies, layout, RTO regulations, aerodynamic, aesthetic & ergonomics considerations for body work, side car.

Maintenance:

Preventive & brake down maintenance, factors affecting fuel economy & emission.

Books:

1. Newton Steed, “The Motor Vehicle”, McGraw Hill Book Co. Ltd., New Delhi
2. Siegfried Herrmann, “The Motor Vehicle”, Asia Publishing House, Bombay.
3. “Two stroke Motor Cycles”, Staff & Motor Cycles, London Iife Books.
4. G.B.S. Narang, “Automobile Engineering”, 5th Edition, Khanna Publishers, Delhi.
5. Irving, P.E., Motor cycle Engineering, Temple Press Book, London, 1992.
6. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.

INDUS University, Ahmadabad (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Two And Three Wheelers LAB	AU410613	0	0	2	2	1

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total LAB Periods: **15**

Total Tutorial Periods: **NA**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

LIST OF EXPERIMENTS

1. Study about two and three wheeler engine
2. Study of motorcycle & scooter carburetors & petrol injection system
3. Study of two wheeler Clutch and Gear box
4. Study of steering system for two and three wheeler
5. Study of three wheeler drive line & chassis
6. Study about Rear & front brake and its overhauling & adjustments
7. Study about cooling system for two wheeler engine
8. Study of wiring diagram & electrical systems
9. Study about suspension system of two wheeler

INDUS University, Ahmadabad (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Vehicle Maintenance And Garage Practice	AU410610	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total Theory Periods: **45 hrs**

Total Tutorial Periods:

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes:

To have a complete understanding and hands-on experience of the vehicle maintenance procedures and acquire skills in handling situations where the vehicle is likely to fail.

Unit – 1

Chapter 1 Vehicular Maintenance Practices

Importance & Types of maintenance schedules (daily, weekly and monthly), Scheduled Maintenance Charts, Breakdown, Preventive, Predictive maintenance practices.

Chapter 2 Service Station Operations

Service station, functions and operations, activities, depot and workshop layouts. Study of Workshop documents & records (job cards, bill, satisfaction voucher, history sheet, manufacturer's service coupon book, warranty policy etc.) Study of Workshop Manual, Parts Catalogue and Parts price list. Billing procedure. Customer complaint Handling & consumer cases in case of any dispute.

Chapter 3 Tools & Equipments

Various Tools and equipment, Garage measuring instruments and testing,

calibration, repair equipments: their function, usage and testing procedures.

Unit 2

Chapter 4 Engine Maintenance – Repairs & Overhauling

Cylinder Block bore – measurement, Cylinder boring & honing, Cylinder liners fitting, Cylinder head - facing, valve seat lapping, Study Valve timing & Fuel injection pump timing procedure and timing gear train. Rocker arm gap adjustment / setting procedure, engine tune up.

Chapter 5 Maintenance of Fuel Systems, Cooling Systems & Lubrication System

Petrol Engine - Carburetor- tuning and setting of MPFI engines, Diesel engine - Fuel injection pumps and fuel injector's calibration, Cleaning of water cooling system, water pump & radiator maintenance, maintenance of lubricating system

Unit 3

Chapter 6 Chassis Maintenance

Repairing of gear box and shifting mechanism, Final drive and differential maintenance, differential back lash adjustment, Wheels and tyre maintenance, re-treading of tyres, wheel balancing, Steering system linkages, Wheel alignment: toe in, toe out, caster and camber.

Hydraulic brakes circuit- brake adjustment, bleeding of brakes, Study of Air Brakes circuit & system components, Chassis greasing, wheel bearing greasing, Bearing Preload adjustment, Suspension system – lubrication, Adjustment of clutch pedal free play, repair/replacement of clutch parts, Repair & maintenance of Propeller shaft “U” joints and Centre bearing.

Unit 4

Chapter 7 Electrical System Maintenance - Servicing & Repairs

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern

electronic controls, checking and servicing of dash board instruments.

Chapter 8 Miscellaneous Systems – Servicing & Repair

Air Conditioning Systems, Body repairing and denting.

Text Book(s)

1. Vehicle Maintenance & Garage Practices by Doshi, Panchal & Maniar, PHI India
2. Automotive mechanics by Crouse, TMH

Reference Books

1. Fleet Management, John Doke, McGraw-Hill Co., 1984
2. Advanced Engine Performance Diagnosis, James D Halderman, PHI, 1998
3. Automobile Systems, Anil Chikara
4. Automechanics, Joseph Heitner, East West Press
5. Advance Vehicle Technology, Heinz Heisler, Butterworth Heinemann Publication
6. Advance Automotive Fault Diagnosis, Tom Denton, Butterworth Heinemann Publication
7. Automotive Technology, Service & Maintenance, Don Knowles, Cengage Learning

INDUS University, Ahmadabad (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Vehicle Maintenance And Garage Practice LAB	AU410611	0	0	4	4	2

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total LAB Periods: **30**

Total Tutorial Periods:

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

LIST OF EXPERIMENTS

1. Study of Garage Layouts and its significance
2. Study of Tools and Equipment in Automobile Workshop
3. Study of Workshop Management and Operational Tools
4. Cylinder Bore Measurement
5. Cylinder Head – Disassembly & Assembly
6. Cylinder Block – Disassembly & Assembly
7. Crankshaft – Disassembly & Assembly
8. Engine Compression Testing
9. Spark Plug Cleaning & Testing
10. Petrol Injector Cleaning & Testing
11. Study of Wheels & Tyres
12. Wheel & Tyre Maintenance, Performance of Wheel Balancing

-
13. Performance of Computerized Wheel Alignment
 14. Routine Servicing, Testing, Troubleshooting and Overhauling of Clutch
 15. Routine Servicing, Testing, Troubleshooting and Overhauling of Gear Box & Final Drive
 16. Routine Servicing, Testing, Troubleshooting and Overhauling of Braking System
 17. Routine Service and Maintenance of Water Cooling System and Radiator
 18. Battery Maintenance
 19. Alternator Testing on a Growler Tester
 20. Assembly and Disassembly of McPherson Strut Suspension System

INDUS University, Ahmadabad (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Automobile Hydraulics and Pneumatics systems	AU410608	4	0	0	4	4

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total Theory Periods: **60 hrs**

Total Tutorial Periods:

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes:

- By the end of this course the student will be able to understand the hydraulic and pneumatic principles, components and its selection.
- Also, design the hydraulic & Pneumatic circuit and control for automotive applications.

Contents

Unit – 1

Introduction to fluid power

Classification, application of various fluids in engineering, various Symbols used in hydraulic and pneumatic (ISO/JIC), transmission of power at static and dynamic states.

Types of hydraulic fluids and their properties, effect of temperature on fluids.

Hydraulic system elements: Control of fluid power elements

Requirement of pressure control, direction control, flow control valves. Principles of pressure control valves, direction control valves, and pilot operated relief valve, pressure reducing valve, quick exhaust valve, sequence valves. Types of direction control valves – two way two position, four way two position, four way three position, open center, close center, tandem center, manual operated, solenoid, pilot operated direction control valves,

check valves. Flow control valves: principle and their types, meter-in and meter-out circuit and flow through circuit. Actuators – linear and rotary, hydraulic motors, types of hydraulic cylinders and their mountings. Calculation of piston velocity, thrust under static and dynamic operation & Application, consideration of friction and inertia loads.

Unit – 2

Typical Automotive Applications:

Hydraulic tipping mechanism, power steering, fork lift hydraulic gear, hydro-pneumatic suspension (Air suspension), Clutch actuating System, Brakes – Hydraulic AND Pneumatic.

Pneumatic Systems:

Application of pneumatics, physical principles, basic requirement of pneumatic system. Comparison with hydraulic systems. Elements of Pneumatics, Air compressors, Pneumatic control valves, Pneumatic actuators – types and the mountings, Air motors – types

Maintenance and trouble shooting of hydraulic & pneumatic circuits.

Maintenance Schedule, Trouble – Possible causes & Remedies

Unit – 3

Hydraulic Circuit and working

Basic hydraulic circuit, impulse operation, speed control, Hydraulic motor circuit, sequencing of motion, time delay circuits and their applications, and other hydraulic circuits.

Unit – 4

Pneumatic circuits and working

Basic pneumatic circuit, impulse operation, speed control, pneumatic motor circuit, sequencing of motion, time delay circuits and their applications, and other pneumatic circuits.

Text Book(s)

- Fluid Power with applications – A. Esposito- PHI
- Hydraulic and Pneumatic Controls – R Srinivasan – Tata McGraw Hill

Reference Books

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- Hydraulic & pneumatics- Andrew Parr-Jaico Publishing House.
 - Basic fluid power- by D.A. Pease-PHI

INDUS University, Ahmadabad (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Automobile Hydraulics and Pneumatics systems LAB	AU410612	0	0	2	2	1

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total Theory Periods: **15**

Total Tutorial Periods:

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

List of Experiments

1. Symbols used in hydraulics and pneumatics
2. To and fro motion of the double acting cylinder.
3. Three different speed of piston in one stroke.
4. Sequential operation of the two linear actuators using sequence valve
5. Determine effect of Bleed Off and Regenerative Circuit on the movement of actuator.
6. Speed control of the linear actuator with Meter In and Meter out Circuits.
7. To and fro motion of the double acting cylinder for Pneumatics.
8. AND operation using twin pressure valve and to study OR operation with shuttle Valve.
9. Pneumatic circuit using flow control valve and time delay valve.
10. Cascading of two cylinder and three cylinders

INDUS University, Ahmadabad (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Finite Element Analysis	AU410627	3	0	0	3	3

OBJECTIVES:

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I

INTRODUCTION

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – RitzTechnique – Basic concepts of the Finite Element Method.

UNIT II

ONE-DIMENSIONAL PROBLEMS

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation –Transverse deflections and Natural frequencies of beams.

UNIT III

TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts –Quadrilateral elements – Higher Order Elements.

UNIT IV

TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

ISOPARAMETRIC FORMULATION

Natural co-ordinate systems – Isoperimetric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems –Introduction to Analysis Software.

OUTCOMES:

- Upon completion of this course, the Students can able to understand different mathematical Techniques used in FEM analysis and use of them in Structural and thermal problem

TEXT BOOKS:

1. Reddy. J.N., “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGraw-Hill, 2005
2. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

REFERENCES:

1. Rao, S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butterworth Heinemann, 2004.
2. Logan, D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.
4. Chandrupatla & Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice Hall College Div, 1990.

5. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons,2013

INDUS University, Ahmadabad (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Modern Manufacturing Processes	AU410628	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **NA**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

COURSE OBJECTIVE

To develop the ability to understand the advanced manufacturing techniques Evolved in manufacturing scenario.

INSTRUCTIONAL OBJECTIVES

At the end of this course the student should be able to understand

1. Advanced techniques in casting
2. Advanced forming and powder metallurgy
3. Fabrication of microelectronic devices
4. Manufacturing of composites
5. Rapid prototyping

UNIT I

ADVANCES IN CASTING

Evaporative Pattern Casting Process, Process Description of Evaporative Pattern Casting, Hybrid Evaporative Pattern Casting Process, Vacuum Assisted Evaporative Pattern Casting Process (VAEPC), Vacuum Sealed Molding Process, Investment Casting Process, Ceramic Shell

Investment Casting Process (CSIC), Wax Preparation, Blending and Process Parameters in CSIC, Shell Moulding, Processing Steps and Parameters in Shell Molding, Squeeze casting

UNIT II

ADVANCED FORMING AND POWDER METALLURGY PROCESSES

High speed forging machines - Die materials - semisolid metal forming- Peen forming of sheet metals - Super plastic forming – Forming and shaping glass. Design consideration for Powder Metallurgy forming - Production of metal powders – Compaction – Sintering – Finishing of sintered parts – Secondary and finishing operations.

UNIT III

ADVANCE WELDING PROCESSES

Introduction and Submerged Arc, Submerged Arc Welding (SAW), automatic welding, Welding Process, Resistance Welding Process, Resistance Seam Welding, Projection Welding, resistance spot welding, Solid State Welding Process, Ultrasonic Welding (USW), Ultrasonic Spot Welding (USSW), Explosive Welding (EXW), Friction Welding Process, Friction Stir Welding , Electron Beam and Plasma Arc Welding Process, Laser Beam Welding Process

UNIT IV

NON CONVETNTINAL MACHING

EDM, IBM, ECM, ECG, CM, AJM, Wire cut EDM, USM, LBM process principle, process parameters and their applications. Process capabilities and their applications.

TEXT BOOKS

1. Serope Kalpakjian, “*Manufacturing Engineering and Technology*”, 3rd Edition, Addison-Wesley Publishing Co., Boston, 2009.
2. Madou M. J, “*Fundamentals of micro fabrication and nanotechnology*”, 3rd edition, CRC Press, USA, 2011.

REFERENCES

1. Amstead B. H, Ostwald Phillips and Bageman R.L, “*Manufacturing Processes*”, John Wiley & Sons, New York, 1987.
2. Jaeger R.C, “*Introduction to microelectronic Fabrication*”, Addison Wesley, Boston, 1988.
3. Chua C. K, “*Rapid Prototyping - Principles and Applications*”, World Scientific Publishing Company, 2010.
4. Hilton P. D and “*Marcel Dekker*”, Rapid Tooling, New York, 2000.

INDUS UNIVERSITY, AHMEDABAD (Gujarat)

SUBJECT NAME	SUBJECT CODE	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Modern Vehicle Technology	AU410629	3	0	0	3	3

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VI**

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **NA**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Objectives:

- Student will learn in detail about working of ECU.
- Students will learn about Active and Passive Safety systems on modern cars.
- Students will learn about the aerodynamics of modern cars.

Unit 1

Chapter 1 :Introduction:

A brief introduction of Modern Engine Technology and Modern Car body technology.

Chapter 2 :Electronics Control Unit (Engine):

Electronics Control Unit, Control of Air/Fuel Ration, Control of idle speed, Crank angle sensor, Lambda sensor, MAP sensor, On-Board Diagnostics Tool.

Unit 2

Chapter 3 :Electronic Fuel Ignition System:

Components of Electronic Fuel Ignition system, Comparing various EFI systems

developed by different manufacturers. Studying different Fuel Maps and Ignition Maps.

Chapter 4 :Engine Management Systems:

Electronic Valve Control, Control of Variable Valve Timing, Engine Start-Stop systems, Exhaust Gas Recirculation System (EGR), Supercharger and Turbocharger.

Unit 3

Chapter 5 :Modern Car Safety Systems:

Active & Passive safety systems, Monocoque and space frames, Chassis design considerations (A,B,C Pillers), Cross bars, Fog lamps, Defogger and demister, Airbags, seatbelts, 5-point harness, Crash testing, Crumple zones and bumpers.

Chapter 6 :Security Systems:

Central locking (Fixed code/Rolling code), immobilizers, Key-less Entry, Power windows, Anti-pinch, Power boot, Power sunroof.

Unit 4

Chapter 7 :Automatic Transmission Systems

Tiptronic transmission, Semi-automatic Transmission, Dual Clutch Transmission (DCT), Continuously Variable Transmission (CVT), Paddle shifting, 4x4, Full-time 4WD, All Wheel Drive (AWD), Individual Wheel Drive (IWD), Transfer boxes, Audi's Quattro, Locking Differential, Limited Slip Differentials and Zero Slip Differentials.

Chapter 8 :Electronic & Other Driving Aids:

Active/Semi-active Suspension Systems, Anti-lock Braking System (ABS) with Electronic Brake Force Distribution System (EBD), Electronic Stability Program (ESP) with Traction Control System (TCS), Hill Descent, Adaptive Cruise Control System,

Projector lights, Xenon lights, LEDs, Cornering Head lamps, Darkness sensing headlights, Rain sensing wipers, Night Vision, Modern Entertainment Systems (Audio, Video, Speaker systems), GPS Navigation Systems, Parking Aids (Ultrasonic and Camera guided)

Text Book(s)

- Advanced Engine Technology, Heinz Heisler, Butterworth-Heinemann Ltd Publisher
- Advanced Vehicle Technolgy, Heinz Heisler, Butterworth-Heinemann Ltd Publisher
- Automotive Computer Controlled Systems – Diagnostic tools and techniques, Allan W M Bonnick, Butterworth-Heinemann Ltd Publisher

Reference Books

- Low Speed Wind Tunnel Testing, Jewel B Barlow, William H Rae, Alan Pope, Wiley India Pvt Ltd.
- Bosch Handbook, Bentley Publishers; 8 edition

7th Semester

INDUS University, Ahmadabad (Gujarat)

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Automobile Electricals and electronics Systems	AU410705	3	0	0	3	3
2	Vehicle Dynamics	AU410702	3	2	0	5	4
3	Transport Management And Laws	AU410710	3	0	0	3	3
4	Automobile System Design	AU410708	3	2	0	5	4
5	Vehicle Body Engineering	AU410709	4	0	0	4	4
6	Elective-3		3	0	0	3	3
7	Automobile Electricals and electronics Systems Lab	AU410712	0	0	2	2	1
8	Vehicle Dynamics lab	AU410713	0	0	2	2	1
9	Minor Project	AU410711	0	0	8	8	4
TOTAL			19	4	12	35	27

Department Elective-2

1	Vehicle Design Data Characteristics *	AU410727	3	0	0	3	3
2	Computer Integrated Manufacturing	AU410722	3	0	0	3	3
3	Hybrid Vehicle Technology	AU410723	3	0	0	3	3

INDUS University, Ahmadabad (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Subject: **AEE**

Code: AU410705

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes :

- Develop an understanding on working of Automobile electrical and electronic system System.

Contents

UNIT-1

Automobile Electrical Systems and electronics system:

Storage, Distribution systems & Generation of electric energy, Lighting system, 12 Volt & 24 volt systems. Insulation and earth (negative and positive earthing) system, types of cables used, colour codes, cable connectors, wiring, fuse system, circuit breakers, Relays, Switches. Layout and Wiring diagram for 2, 3 and 4 wheeler vehicles, Buses and Commercial vehicles

Battery system:

Various Types of Automotive batteries. Principles, Construction & working of lead acid battery, dry battery & Alkaline battery. Designations & Rating of Batteries. Performance tests: Battery Capacity, Efficiency, Gravimetric test and efficiency. Battery failures. Recharging: Electronic circuits, battery charging current, charging methodology & precautions.

Starting system:

Principle, Starting torque, engine resistance torque, and power required for starting of engine. Starter motor and its circuit. Types of drive mechanisms: bendix drive, pinion type, axial sliding armature starter. Slipping and overrunning of clutches, automatic switches for starting, cold starting devices: Glow plug & choke

UNIT-2

Charging system:

Need. Charging circuit, Types of charging system: D.C. dynamo, AC dynamo, flywheel magneto charging system and Alternator (more emphasis on Alternators). Charging system controlling & regulator system: Relay/cut-out, voltage and current regulator, compensated voltage and current regulator, electronic regulator, regulator characteristics. Drive for Charging system.

Ignition system:

Requirements. Types of Ignition systems: Ballast Resistance, Ignition coil characteristics, Cam angle & contact angle gap, spark advance mechanism, spark plug, ignition timing, multi-cylinder distributor, Distributor (contact breaker ignition system), limitations of coil ignition system, electronic ignition systems. Voltage and current required for Spark. Spark Plug, characteristics, material, types, plug fouling.

Lighting system:

Lighting system of vehicle, head lamp, tail lamp, brake lamp, parking lamp etc, other types of lamps used. Reflector purpose and design, head lamp angle and position, fog lamp, side indicator lamp, warning lights and flashers, instrument panel lights, body interior lights. Safety indicator lights. Engine compartment & Rear boot lamps.

UNIT-3

Horns: AC & DC horns, wind tone horn/air horns, electronic horn, reverse horn. Horn relay. Warning Buzzer. Sensors - Instrument Cluster panel, fuel gauges, oil temperature gauge, warning light sensors, coolant temperature gauge, speedometer, Odometer, tachometer, trip meter, oil level indicator, parking brake indicator, direction indicators.

Electrical Equipments & Accessories: Windscreen wipers, windscreen washers, power windows, doors locks, Rear wind shield glass heating system. Rear view mirror Adjusting, Day light regulating system. Central Locking system. Convertible Mechanism.

Electronic systems: for CRDI & MPFI engine injection system regulation, control & Management. ECU for Engine, ABS and On Board Diagnostic (OBD) systems. Electronic power steering.

UNIT-4

Electrical system for Climate Control system: Air conditioning, Heating & defrosters.

Testing Instruments: Ignition coil tester, Distributor tester, Battery tester, Timing devices, Inspection of electrical systems.

Introduction to Microprocessors, Micro controllers, PLC - Structure and programming applications in Automobiles.

Text Books :

1. Automobile Electrical and Electronics, by A. L. Statini, Delmar Publications.
2. Automotive Electrical Equipments, by P. L. Kohli, Tata McGraw Hill Pub. Co. Ltd.

Reference Books:

1. Automobile Electrical & Electronic Systems, by Tom Denton, Allied Publishers Pvt. Ltd., Chennai.
2. Automobile Electrical & Electronic Equipments, by Young, Griffiths, The English Language Book Co., London.
3. Understanding Automotive Electronics, by Bechford SAE Publications
5. Fundamentals of Automotive Electronics, by V.A.W.Hilliers, Hatchin, London
6. Automotive Computer & Control System, by Tomwather J. R., Cland Hunter, Prentice Hall NJ
7. Understanding Automotive Electronics, by Wiliam B. Ribbens, Allied Publishers Pvt. Ltd. Chennai
8. Automotive mechanics by W. Crouse, TM

INDUS UNIVERSITY, AHMEDABAD (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Subject: **Vehicle Dynamics**

Code: **AU410702**

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes :

- Dynamics related to the vehicles considering the different parameters during the motion will be studied. Stability of the vehicle during motion will be the main concern

Content:

UNIT 1

1. Understanding Vehicle dynamics

History, Fundamental Approach to Modeling (Lumped mass, Vehicle Fixed Coordinate system, Earth Fixed Coordinate System, Euler Angles).

Dynamic loads in moving vehicle

Study of Forces (Newton's Second Law), Dynamic Axle loads (Static Loads on Level ground, Low-speed Acceleration, Loads on Grades) Load transfer during acceleration, braking, constant velocity motions, conditions for traction, layout analysis as front engine, rear engine, front wheel and rear wheel drive.

2. Tires:

Tire Construction, Size and load rating, Terminology and Tyre Axis system, mechanics of Force Generation, Effect on various performance parameters (Slip angle, Tire Type, Vertical load, Inflation pressure, Size and Width, Tread Design, Surface friction, Speed, Path curvature), having Relevance to vehicle performance on Tractive properties, cornering properties, Camber Thrust, Aligning moment, Combined braking and Cornering, Conicity and Ply steer.

3. Acceleration performance of Vehicle

Power-limited Acceleration (based on Engines, Power Train – transmission & final drive ratio, Automatic Transmissions). Traction-limited Acceleration(Transverse weight shift due to drive torque, traction limits)

UNIT 2

4. Braking Performance

Basic Equations (Constant Deceleration, deceleration with wind resistance), Energy / Power absorbed during braking, Braking Forces, Brakes factor, Tireroad Friction, Federal Requirements for Braking Performance, Braking Proportioning, Anti-Lock brake system, Braking Efficiency, Rear wheel Lockup, Pedal Force Gain.

5. Suspension system

Solid axles (Hotchkiss, Four Link, DeDion), Independent suspensions (SLA Front Suspension, Macpherson Strut, Trailing-Arm Rear Suspension, Semi-Trailing Arm, Swing Axle, Multi link rear suspension), Anti-Squat, Anti-pitch and Anti-Dive Suspension Geometry (Equivalent Trailing Arm Analysis, Rear Solid Drive Axle, Independent Rear Drive, Front Solid Drive Axle, Independent front-Drive Axle, four-Wheel Drive), Active suspension, Roll Center Analysis.

UNIT 3

6. The Steering system

Steering linkages, steering geometry error, Front wheel geometry, Forces and moments, Steering system models and its effects - Steering ratio, Understeer, Influence of front-wheel drive (Driveline Torque about the steer axis, Influence of tractive force on tire cornering stiffness and Aligning moment, Fore/ Aft load Transfer, FWD understeerinflunces), Four-Wheel steer (Low-speed Turning, high speed cornering). Force analysis during steering, steering oscillation, tramp, shimmy, wobble, directional stability.

7. Road Loads

Aerodynamics(Mechanics of air flow around a vehicle, Pressure distribution on a Vehicle, Aerodynamic Forces, Drag Components, Aerodynamics Aids, Drag, Side Force, Lift Force, Pitch Moment, Yawing moment, Rolling Moment, Crosswind Sensitivity), Rolling Resistance(Factors affecting rolling resistance, Typical coefficient), Total road Loads and effect of Road loads on Fuel economy.

UNIT 4

8. Ride:

Excitation sources (Road Roughness, Tire/ wheel assembly, Driveline Excitation, Engine/ Transmission), Vehicle Response Properties(Suspension Isolation, Suspension Stiffness, Suspension Damping, Active Control, Wheel Hop Resonances, Suspension Nonlinearities, Rigid body Bounce/Pitch motions, Bounce/ pitch Frequencies, Special cases). Perception of ride (Tolerance to seat vibrations, other vibration forms).

9. Steady-state Cornering

Basics, Low-speed Turning, High-speed cornering (Tire Cornering forces, Cornering Equations, Understeer Gradient, Characteristic speed, Critical speed, Lateral Acceleration Gain, Yaw velocity Gain, Side slip angle, Static Margin), Suspension effects on Cornering(Rolling moment distribution, Camber Change, Roll steer, Lateral Force compliance steer, Aligning Torque, Effect of tractive force on Cornering).

Text Book:

1. Vehicle dynamics, by Dr. Thomas Gallespie, SAE Publications.

Reference Books:

1. Vehicle dynamics, by R.V.Dukhopati,Narsova Publications.
2. Mechanics of Road vehicles , by Stead,TMH
3. Vehicle Dynamics, by S.R.Ellise,East West Press.
- 4.Automotive Mechanics, by N.K.Giri, Khanna Publishers,

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5. Motor Vehicles, by Khovak, Mir Publishers
 6. Automotive mechanics by Crouse, TMH
 7. Automobile system by Anil Chikara, SatyaPrakashan

INDUS UNIVERSITY, AHMEDABAD (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Subject: **Transport Management And Laws**

Code: AU410710

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes :

- a. Students will learn how to read and understand various sections of the Motor Vehicle Act 1988/89
- b. Students will learn the taxation of various vehicle practices.
- c. Students will learn Licensing and Insurance procedures.
- d. Students will learn how various Transport services are operated.

Subject Content

Unit 1

Chapter 1 **Introduction:**

Learning Objective: Studying the evolution of transport.

History of transport, Types of transport and Modes of transport.

Chapter 2 **Motor Vehicle Act:**

Learning Objective: Understanding the need of Motor Vehicle Act and studying its various chapters.

Short titles & definitions, Laws governing to use of motor vehicle & vehicle transport, Licensing of drivers & conductors, Registration of vehicle, State & interstate permits, Traffic rules, Signals & controls, Accidents, Causes & analysis, Liabilities & preventive measures, Design of road complex,

Responsibility of driver, Public & public authorities, Offences, penalties & procedures, Different types of forms. Government administration structure, Personnel, Authorities & duties, Rules & regulations, Rules regarding construction of motor vehicles

Unit 2

Chapter 3 Passenger Transport Operation:

Learning Objective: Studying the operations of stus.

Structure of passenger transport organizations, Typical depot layouts, requirements, Problems on fleet management, Fleet maintenance, Planning - Scheduling operation & control, personal & training-training for drivers & conductors, Public relations, Propaganda, publicity, passenger amenities, Advertisement work, Parcel traffic. Theory of fares, Basic principles of fare charging , Differential rates for different types of services, Depreciation & debt charges, operation cost, Revenues, Economics & records. AMTS, BRTS and GSRTC operations.

Chapter 4 Goods Transport Operation:

Learning Objective: Studying how the goods transport operations are carried out.

Structure of goods transport organizations, scheduling of goods transport, Management Information System (MIS) in passenger / goods transport operation, storage & transportation of petroleum products

Unit 3

Chapter 5 Licensing :

Learning Objective: Studying the Licensing procedures of RTO.

Licensing of drivers of the drivers, licensing of the conductors, registration of vehicles, taxies, goods vehicle, passenger vehicle, consumer vehicle

Chapter 6 **Taxation :**

Learning Objective: Studying the Taxation procedures of various categories of vehicles.

Objectives, Structure & methods of laying taxation, One time tax, Tax exemption & tax renewal

Unit 4

Chapter 7 **Insurance :**

Learning Objective: Studying the need and procedures related to insurance policies of vehicles.

Insurance types & significance, Comprehensive, Third party insurance, Furnishing of particulars of vehicles involved in accident, Award of the claims tribunal, MACT (Motor Accident Claims Tribunal), Solatium Fund, Hit & Run case, Duty of driver in case of accident, Surveyor & Loss Assessor, Surveyor's report

Chapter 8 **Pollution Control:**

Learning Objective: Studying the need of various emission standards.

Emission Standards according to Euro and BS. Contents of emission

Text Book(s)

(Chapter Wise / Full Text)

1. Motor Vehicle Act - Govt. of India Publications
2. Vehicle Transport Management, S L Bhandarkar, Dhanpat Rai & Co.

Reference Books

8. Santosh Sharma, "Productivity in Road Transport", 2nd Edition, Association of State Road Transport Undertakings, New Delhi.
9. P.G.Patankar, "Passenger Road Transport in India", CIRT, Pune.
10. S.K. Shrivastava, "Economics of Transport"
11. "Transport Development in India", S. Chand & Co. Pvt. Ltd., New Delhi.

Digital Learning Resources

1. http://www.rtoahmedabad.gujarat.gov.in/rtoahmedabad/CMS.aspx?content_id=5876#CHAPTER_II

Question Paper Pattern for End Sem Exam :

Question paper will contain 8 questions (8 full questions distributed in 4 units) covering all the chapters of the course . Student has to answer total FIVE full questions choosing at least one from each unit.

INDUS UNIVERSITY, AHMEDABAD (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Subject: **Automobile System design**

Code: **AU410708**

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes :

LEARNING OBJECTIVES:

- It Consists Of Application Of Design Principles, Technical Information, And Imagination For New System Development In Automobile Sector.
- To learn the importance of Assembly Design of Different Components for Manufacturing.

LEARNING OUTCOME:

- Develop an understanding on Design Process of Different Automobile Systems.
- Develop in-depth knowledge of various System Design in Automobiles.
- Learn to apply Design techniques in both manufacturing and Assembly Process in industry

Contents

UNIT – I

Chapter 1 Design of clutch system:

05

Learning Objective:

To Equip the students with Design & Selection Process in Clutch System

Content:

Design of various clutch system components (Single plate, multiple plates, centrifugal clutch, lining material) and Pressure Plate Assembly components.

Hydraulic Clutch system components (Master Cylinder, Slave cylinder, reservoir clutch fluid – its properties, hydraulic pipes. Clutch Pedal & Clutch hand lever design. Clutch cable Design / selection considerations

Chapter 2 Design of propeller shaft: 05

Learning Objective:

To Understand the basic Function of Propeller shaft used in Automotive Vehicles and to understand the Design procedure of Propeller shaft.

Content:

Design of Propeller shafts for bending, torsion, & rigidity criteria, failure theories. Design of Universal joint and Slip joint. Propeller shaft Assembly testing for balancing.

UNIT – II

Chapter 3 Axle design: 05

Learning Objective:

To make students equipped with design Procedure of different Axle used in gearbox and to understand different design criteria of Axle design.

Content:

Front Axle beam, Steering Knuckle, King pin. Rear Axle (drive Axle) tube, Design of fully floating, half floating axle and dead axle. Design of Final drive and differential: Design of spiral bevel and hypoid type of final drive/differential.

Chapter 4 Design of Suspension System 05

Learning Objective:

To make students equipped with Suspension design Procedure of different Axle used in gearbox and to understand different design criteria of Axle design.

Contents:

Types of suspension springs based on applications. Material of spring, Stress deflection Equation for helical springs, Wahl Correction Factor, Design of

helical springs for Independent Suspension. Buckling of Compression springs, Tension springs, Springs in Series & in parallel, Design Considerations of Belleville springs, Elastomeric springs, Air (Pneumatic) springs, Design of leaf spring for automobile suspension system, Design of coil spring for front independent suspension system

UNIT – III

Chapter 5 Design of Braking Systems:

10

Learning Objective:

To make students aware about detail design procedure of gearbox and selection of gear ratios for different commercial gearbox.

Content:

Internal expanding shoe brake, friction lining material, drum brake arrangements, disc brake arrangement. Mechanical, hydraulic and air brake system and their components, hydraulic brake fluids, vacuum servo assisted braking, parking brake systems, anti-lock braking system, engine exhaust brake, regenerative brake system, fail-safe- brake, brake efficiency & testing, Weight transfer, braking ratios

Chapter 6 Design of steering System:

Learning Objective:

To Understand the Design of Different steering system components.

Content:

Steering mechanism and Linkage design for various types of Steering gear box arrangements and Design criterion for Mechanical & Power steering types. Steering geometry for Ackerman's steering.

UNIT – IV

Chapter 7 Optimum Design:

10

Learning Objective:

To develop the students Professional skill in optimum Design using Rational

Approach.

Content:

Introduction to optimum design, for mechanical elements, adequate & optimum design, and Johnson's method of optimum design-Simple problems in optimum design like axially loaded members like shaft subjected to torsional and bending moments.

Text Book(s)

- Automotive Chassis by P.M.Heldt , Chilton Co., NY (1992)
- Machine Design by Pandya and Shah, Charotar Publishing House.
- Machine Design by R S KhurmiJ.K.Gupta, S chand& Co.

Reference Books

- Elements of Motor Vehicles Design by DTB donkins, TMH
- Automobile Chassis Design and calculations by P.Lukin, Mir Publishers
- Auto design Problems by K.M.Agrawal, Satyaprakashan.
- Automotive Mechanics by N.K.Giri, Khanna Publishers
- Machine Design by Sadhusingh, Khanna Publishers
- Automobile Chassis Design by Dean Averns, Lllife Books Ltd (1992)
- Automobile Engg. Vol - I & II by Kirpal Singh, Standard Pub.
- Automobile Engg. Vol - I & II by K.M.Gupta, Umesh Pub.
- Auto Design by R.B. Gupta, SatyaPrakashan
- “Mechanical Engineering Design”, Fourth Edition, by Joseph E. Shigley& Larry
- D. Mitchell, McGraw-Hill International Book Company
- Design of Machine Elements by Bhandari , Tata McGraw-Hill Publishing
- Company Ltd
- Machine Design by, Sharma and Agrawal, S.K.Kataria& Sons
- Transmission System Design by R.B.Patil, TechMax Pub., Pune.
- Machine Design Vol - II & III by F.Haideri, NiraliPrakashan, Pune.
- PSG Design Data Book.

Digital Learning Resources

- <http://nptel.iitk.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1>
- www.ignou.ac.in/upload/Unit-3-56.pdf
- www.uni.edu/~rao/MD-12%20Spur%20Gear%20Design.pdf

Question Paper Pattern for End Sem Exam :

Question paper will contain 8 questions (8 full questions distributed in 4 units) covering all the chapters of the course. Student has to answer total FIVE full questions choosing at least one from each unit.

Note : Activity Based Learning shall be Tutorial / Site Visit / Seminar / Practical / Workshop Etc

Activity Based Learning/Tutorials Planning

SRNO

ABL

1. Introduction and Design Considerations
2. Study of Clutch System Design
3. Study of Propeller Shaft Design
4. Study of Axle Design
5. Study of Brake Design
6. Study of Suspension Design
7. Study of Steering Design
8. Study of Vehicle performance testing and Validation of Design
9. Major Problem (Clutch System)
10. Major Problem (Suspension System)

INDUS UNIVERSITY, AHMEDABAD (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Subject: **vehicle body engineering**

Code: AU410709

Total Theory Periods: **60 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes:

By the end of this course the student will be able to design a car for safety, identify and develop suitable chassis and select suitable subsystems for the vehicle.

Contents

Unit – 1

Chapter 1: Vehicle Body – Introduction:

Course Content: Car Body: Types, Regulations, drivers visibility, tests for visibility, methods for improving visibility and space in cars, safety design, safety requirements for car, car body construction. Bus Body Details: Types, Mini bus, single-decker, double-decker, two level, split level and articulated bus, bus body layout, floor height, engine location, entrance and exit locations, seating dimensions, constructional details, frame construction, double skin construction, types of metal sections used, regulations, conventional and integral type construction.

Chapter 2: Body Materials, Trim, Mechanisms and Body Repair

Course Content: Types of materials used in body construction-Steel sheet, timber, plastics, GRP, properties of materials. Body trim items-body mechanisms. Hand tools-power tools-panel repair-repairing sheet metal-repairing plastics-body fillers-passenger compartment service- corrosion: Anticorrosion methods, Modern painting process procedure-paint problems

Unit – 2

Chapter 3: Vehicle Aerodynamics:

Course Content: Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel.

Unit – 3

Chapter 4: Car Body:

Course Content: Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility- regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Variou panels in car bodies. Safety aspect of car body.

Chapter 5: Bus Body Details:

Course Content: Types: Types of bus body: based on capacity, distance traveled and based on construction.– Bus body lay out for various types, Types of metal sections used – Regulations – Constructional details: Conventional and integral. driver seat design- Safety aspect of bus body

Unit – 4

Chapter 6: Commercial Vehicle Details:

Course Content: Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of commercial vehicle body - Flat platform body, Trailer, Tipper body and Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design - Regulations.

Text Book(s)

1. “Automotive Chassis & Body”, by P.L.Kohli, Papyrus Publishing House, New Delhi.
2. Powloski, J., Vehicle Body Engineering, Business Books Ltd., 1998.

Reference Books

1. Giles, G.J., Body construction and design, Illiffe Books Butterworth & Co., 1991.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1992.
3. Braithwaite, J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1997.
4. Dieler Anselm., The passenger car body, SAE International, 2000.

Digital Learning Resources

<http://www.scribd.com/>

INDUS UNIVERSITY, AHMEDABAD (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Subject: **Vehicle design data characteristics**

Code: AU410727

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

LEARNING OBJECTIVES:

- To Study and learn the Collection of the various Technical specifications of an Automobile from Journals and Research Papers.
- To Study about calculation and tabulation of various vehicle Performance parameters and to construct the curves using collected data.

LEARNING OUTCOME:

- Develop an understanding on Technical Specification of Automobiles
- Develop in-depth knowledge on various Performance Parameters of Vehicle
- Learn the applications of Different Performance Curves to predict the Performance of Vehicle.
- Develop analytical skills for investigating and analyzing Design Data Characteristics.

Syllabus Content:

UNIT-I

CHAPTER 1 1.PERFORMANCE CURVE

Learning Objective:

To understand the basics of Performance Parameters

Content:

Resistance. Power and torque curves. Driving force against vehicle speed. Acceleration and grad ability in different gears for a typical car or truck plotted from

specifications available in Automobile Journals.

UNIT-II

CHAPTER 2 EXPECTANCY CURVES

Learning Objective:

- To understand various Expectancy Curves and its influence on Vehicle Performance.
- To make the students learn the calculation and plotting the curves of resistance, driving force, Engine power.
- To make the students to be familiar with mechanical efficiency and engine design
- To make the students understand the gear ratio calculation and vehicle performance

Content:

Calculation and plotting the curves of Air and Rolling resistances. Driving force. Horse power, Rear axle ratio. Engine speed. Torque and mechanical efficiency for different vehicle speeds. Pressure volume diagram. Frictional mean effective pressure. Engine capacity. Bore and stroke length. Connecting rod length to crank radius ratio. Piston velocity and acceleration against crank angle. Gas force, inertia force and resultant force against crank angle. Turning moment, side thrust against crank angle on cylinder wall. Determination of gear ratios. Acceleration and grad ability. Typical problems on vehicle performance.

UNIT-III

CHAPTER 3 Body Design : Aerodynamics

Learning Objective:

- To study the role of the stylist and aero dynamist.
- To understand the basic Aerodynamic concepts related to vehicles.
- To analyze the basic computations required aerodynamic design.

CONTENT:

Introduction, Aerodynamic Forces, Drag, Drag Reduction, Stability & Wind Reduction,

Noise, Underhood Ventilation, Cabin Ventilation, Wind Tunnel Testing

UNIT-IV

CHAPTER 4 Chassis Design & Analysis

Learning Objective:

- Introduce the loadings on vehicle structures
- Introduce the different types of vehicle structures and their uses.
- To understand how these loadings can be analyzed simply and with use of computers.

CONTENT:

Load Case, Introduction, Chassis Types & its introduction, Structural Analysis by Simple structural surface Method, Computational Methods.

Text Books:

- Giri. N.K. “Automobile Mechanics” Khanna Publishers – New Delhi – 2002.
- Heldt, P.M., High Speed Combustion Engines, Oxford and I.B.H. Publishing Co., Kolkata, 2002.
- Julian Happian-Smith, An Introduction to Modern Vehicle Design, Elsevier

Reference Books:

- Lichty, IC Engines, Kogakusha Co. Ltd., Tokyo, 1991.
- Automotive Engineering Journals Auto Car, Automotive Industries, Automobile Engineer.
- Mechanical System Design By S.P.Patil, JAICO publications
- I.C.Engine By R.K.Shingal, TechMax Publication.

Digital Learning Resources:

- International Journal of Vehicle Design
- Review of Truck Characteristics as Factors in Roadway Design, Issue 505, Part 1

INDUS UNIVERSITY, AHMEDABAD (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Subject: **Computer Integrated Manufacturing**

Code: AU410722

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

Course Outcomes :

- Recognize The Importance of Cim In Today Technology And Its Impact On Market Competition.
- Locate The Modern Techniques For Integrating CAD/CAM And CIM.
- Understand The Impact Of Quality, Cost And Timeliness Metrics On Manufacturing Performance.
- Automate Tasks For Preparing Most Appropriate Manufacturing And Assembly Processes And Their Sequences.
- Understand Robot Programming.
- Apply The PLC In Manufacturing System Automation.
- Analyze The Engineering And Economical Aspects Of Automatic Storage And Retrieval System\

Contents

Unit 1

Learning Objective Students would learn basic knowledge scope of CIM benefits and nature of CIM

Chapter 1 Introduction to CIM Concepts & scope of CIM, Nature & type of manufacturing system, Evolution, Benefits of CIM,

Learning Objective To understand different methods of programming for CNC machines,NC/CNC tooling, and specifications of CNC system

Chapter 2 Numerical Controls, types, evolution of controllers, components of NC/CNC system, specification of CNC system. Classification of NC /CNC machines, transducers used, salient features, Tape, Tape codes and tape readers used in NC machines, constructional details of CNC machines, axis designation, NC/CNC tooling. Fundamentals of manual part programming, types of format, word address format manual part Programming for drilling, lathe and milling machine operations, subroutines, do loops, canned Cycles, parametric sub routines. Programmable Logic Controllers (PLCs) Automated Programmed Tools language- its types of statement, command and programming.

Unit 2

Learning Objective To understand the coding of parts ,part families and its benefits

Objective

Chapter 3 GROUP TECHNOLOGY:

Introduction, part families, part classification and coding, machining cells, benefits of group technology

Learning Objective To understand components and needs of FMS in detail and JIT

Objective

Chapter 4 FMS:

Introduction & Component of FMS, Needs of FMS, general FMS consideration, Objectives, Types of FMS, advantages of FMS, Automated material movement & AS/RS AGVS , RGV Manufacturing Cells, Cellular & Flexible manufacturing, JIT & GT applied to FMS, FMC & FMS, Tool

Management, Tool supply system, Tool Monitoring System, Work piece Handling, Flexible Fixturing, Flexible Assembly Systems, Flexibility. FMS scheduling, sequencing, FMS lay out and essentials

Unit 3

Learning Objective To understand different aspects of management in CIM in detail

Objective

Chapter 5

CIM ADVANCES:

Role of management in CIM, Expert system & participate management, Impact of CIM on personnel, Role of manufacturing engineers, CIM Wheel.

Learning

To understand fundamentals of PPC like CAPP

Objective

MRPI,MRPII,CAGC etc

Chapter 6

COMPUTER AIDED PRODUCTION MANAGEMENT:

Introduction, PPC fundamentals, Problems with traditional PPC, use of computer in PPC such as CAPP, MRPI, MRPII, CAGC etc.

Unit 4

Learning

To understand working of industrial robots, its manufacturing and

Objective

its uses in different areas

Chapter 7

Robot Technology:

Introduction, Industrial Robots, Robot physical Configuration, Basic Robot motions, Robotic Power sources, Sensors, Actuators, Transducer and Grippers. Technical features, such as work volume, precision of movement speed o movement, weight carrying capacity, Programming of the robot, Introduction to robot languages, End erectors, work cell control and interlocks, Robot applications & economics, Intelligent robots, interfacing of a vision system with a Robot.

Text Books:

1. Computer Aided Manufacturing by TienChien Chang, Pearson Education
2. Automation, Production Systems and Computer Integrated Manufacturing by by Groover, Pearson Education

Reference Books:

1. CNC programming – Dr. S.K.Sinha – Golgotia publications.
2. Flexible Manufacturing Cells and System -William. W. Luggen Prentice Hall, England Cliffs, New jersey
3. P.Radhakrishnan, " Computer Numerical Control ", New Central Book Agency, 1992.
4. Computer integrated manufacturing -S. Kant Vajpayee – Prentice Hall of India.
5. Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill, 1993
6. CAD/CAM, Principles and Applications –P N Rao, McGraw Hill, 2010
7. CAD/CAM, Introduction, -Ibrahim Zeid, Tata McGraw Hill, 2007
8. CAD/CAM, Groovers and Zimmers, Pearson

Digital Learning Resources

<http://nptel.ac.in/courses.php?disciplineId=112>

Question Paper Pattern for End Semester Exam :

Question paper will contain 08 questions (08 full questions distributed in 4 units) covering all the chapters of the course. Student has to answer total FIVE full questions choosing at least one from each unit.

INDUS UNIVERSITY, AHMEDABAD (Gujarat)

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Subject: **Hybrid Vehicle Technology**

Code: AU410723

Total Theory Periods: **45 hrs**

Total Tutorial Periods: **00**

Class Tests: **Two (Minimum)**

Assignments: **Two (Minimum)**

ESE Duration: **Two and Half Hours**

Maximum Marks: **60** Minimum Marks: **24**

COURSE OBJECTIVE

- This course introduces the fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
- This course goes deeper into the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used, energy storage devices, etc. Each topic will be developed in logical progression with up-to-date information.
- A number of chosen problems will be solved to illustrate the concepts clearly.
There shall be a suite of exercises based on MATLAB and Simulink

CONTENT

UNIT-1

1. Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.
2. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.
3. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis

UNIT-2

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4. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.
 5. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT-3

6. Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.
7. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

UNIT-4

8. Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.
9. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

References:

1. Iqbal Hussein, Electric & Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric & Fuel Cell Vehicles: Fundamentals, Theory & Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Automobile Electrical & Electronics Lab	AU410712	0	0	2	2	1

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Total Practical Hours/Week: **02**

Total Practical Hours/Sem: **30**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

List of Experiments:

1. Characterization of Alternator and its Testing.
2. Characterization of Battery, Regulators & its testing.
3. Characterization of Starter Motor and its testing.
4. Characterization of Dynamo and its Testing.
5. To study about ignition systems.
6. To study about Multi Point Fuel Injection System.
7. To study about Sensors and actuators.
8. To study about Electrical Equipments & Accessories.

INDUS University, Ahmadabad (Gujarat)

Subject Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
Vehicle Dynamics Lab	AU410713	0	0	2	2	1

Name of program: **Bachelor of Technology**

Branch: **Automobile Engineering**

Semester: **VII**

Total Practical Hours/Week: **02**

Total Practical Hours/Sem: **30**

Practical Exam: Maximum Marks: **60** Minimum Marks: **24**

CIE Marks: Maximum Marks- **40** Minimum Marks- **16**

List of Experiments:

Sr.No

Title

1. To study the Wind tunnel testing.
2. To study the ride characteristics of vehicles
3. To study the braking performance of vehicles
4. To study the steady state Performance characteristics of road vehicle
5. To study the steady transient Performance characteristics of road vehicle
6. To study the effect of tyre inflation pressure on tyre contact area.
7. Finding the stiffness of wheel with variation of air pressure.
8. Study the handling characteristics with road vehicles

8th SEMESTER

INDUS University, Ahmadabad (Gujarat)

Sr. No.	Course Name	Subject Code	Theory	Activity / Tut.	Practical	Total Hrs	Total Credits
1	Major Project	AU410803	0	0	35	35	20
TOTAL			0	0	35	35	20