DEPARTMENT OF AUTOMOBILE ENGINEERING
INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING
INDUS UNIVERSITY

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –III TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	SH0301	Differential Equations and Integral Transforms	3	2	0	4	05	30	10	60	00	00	100
2	AU0301	Kinematics of Machines	4	0	2	5	06	30	10	60	40	60	200
3	AU0302	Fluid Mechanics	3	0	2	4	05	30	10	60	40	60	200
4	AU0303	Machine Design & Industrial Drafting	3	0	2	4	05	30	10	60	40	60	200
5	AU0304	Automobile Measurements and Metrology	3	0	2	4	05	30	10	60	40	60	200
6	AU0305	Automobile Manufacturing Processes	4	0	2	5	06	30	10	60	40	60	200
7	SH0307	Human Values and Professional Ethics	1	0	0	0	01	-	-	-	-	-	100
TOTAL			**21**	**2**	**10**	**26**	**33**	**180**	**60**	**360**	**200**	**300**	**1200**

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

DEPARTMENT OF AUTOMOBILE ENGINEERING
INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING
INDUS UNIVERSITY

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –IV TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	SH0401	Complex Analysis and Numerical Methods	3	2	0	4	5	30	10	60	0	0	100
2	AU0401	Engineering Thermodynamics	4	2	0	5	6	30	10	60	0	0	100
3	AU0402	Vehicle Transport Management	3	0	0	3	3	30	10	60	0	0	100
4	AU0403	Strength of Materials	3	2	2	5	7	30	10	60	40	60	200
5	AU0404	Automobile Machining Processes	3	0	2	4	5	30	10	60	40	60	200
6	AU0405	Automobile Systems	4	0	2	5	6	30	10	60	40	60	200
7	CE0407	Cyber Security and IPR	1	0	0	0	1	-	-	-	-	-	100
TOTAL			**21**	**6**	**6**	**26**	**33**	**180**	**60**	**360**	**120**	**180**	**1000**

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

DEPARTMENT OF AUTOMOBILE ENGINEERING
INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING
INDUS UNIVERSITY

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –V TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	AU0501	Heat Transfer	3	2	2	5	7	30	10	60	40	60	200
2	AU0502	Automobile Engines	4	0	2	5	6	30	10	60	40	60	200
3	AU0503	Two & Three Wheeler Technology	4	0	2	5	6	30	10	60	40	60	200
4	AU0504	Automobile Electrical Systems	3	0	2	4	5	30	10	60	40	60	200
5	AU0505	Vehicle Body Engineering	3	0	0	3	3	30	10	60	00	00	100
6	AU0506	Alternate Fuels & Pollution Control	3	0	2	4	5	30	10	60	40	60	200
7	SH0507	Technical Communication and Soft Skill	1	0	0	0	1	-	-	-	-	-	100
TOTAL			**21**	**2**	**10**	**26**	**33**	**180**	**60**	**360**	**200**	**300**	**1200**

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DEPARTMENT OF AUTOMOBILE ENGINEERING
INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING
INDUS UNIVERSITY

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –VI TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE					
			L	T	P			MID	IE	ESE	CIE	ESE	
1	AU0601	Off Road Vehicles	3	0	0	3	3	30	10	60	00	00	100
2	AU0602	Automobile Component Design	3	2	2	5	7	30	10	60	40	60	200
3	AU0603	Automotive Hydraulics & Pneumatics Systems	3	2	2	5	7	30	10	60	40	60	200
4	AU0604	Vehicle Fault Diagnosis & Testing	3	0	4	5	7	30	10	60	40	60	200
5	AU0605	Automotive Safety, Ergonomics & Auxiliary systems (DE-I)	3	0	2	4	5	30	10	60	00	00	100
6	AU0615	Tires and Alignment Basics – MOOC (DE-I)	-			4	Offered by www.class-central.com						
7	AU0606	Automotive and Combustion Engine Technology (DE-I)	3	0	0	3	3	30	10	60	-	-	100
	AU0607	Automobile Materials (DE-II)											
	AU0608	Industrial Engineering (DE-II)											
	AU0609	Automotive Infotronics & Autotronics (DE-II)											
	AU0611	Vehicle Performance & Testing (DE-II)											
	AU0612	Automotive Quantitative Techniques (DE-II)											
	AU0613	Automobile Air Conditioning (DE-II)											
8	SH0607	Advanced Technical Communication and Soft Skill	1	-	-	-	1	-	-	-	-	-	100
TOTAL			**19**	**4**	**10**	**25**	**33**	**180**	**60**	**360**	**120**	**180**	**1000**

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DEPARTMENT OF AUTOMOBILE ENGINEERING
INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING
INDUS UNIVERSITY

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –VII TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017

SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
			L	T	P			CIE		ESE	CIE	ESE	
1	AU0701	Automobile Systems Design	3	2	2	5	7	30	10	60	40	60	200
2	AU0702	Vehicle Dynamics	3	0	2	4	5	30	10	60	40	60	200
3	AU0703	Computer Integrated Manufacturing	3	0	2	4	5	30	10	60	40	60	200
4	AU0704	Modern Quality Tools	4	2	0	5	6	30	10	60	40	60	100
5	AU0705	Electric and hybrid vehicles	3	0	2	4	5	30	10	60	00	00	200
6	AU0706	Fuel Cells & Applications (DE-III)	03	00	00	03	03	30	10	60	00	00	100
	AU0707	Automobile Computer Aided Design(DE-III)											
	AU0708	Advanced Automotive Technology(DE-III)											
	AU0709	Nano technology (DE-III)											
	AU0710	Noise Vibration & Harshness (DE-III)											
	AU0711	Automotive Instrumentation and Testing (DE-III)											
	AU0712	Tribology (DE-III)											
	AU0714	Production Technology (DE-III)											
7	CV0707	Disaster Management	1	0	0	0	1	-	-	-	-	-	100
TOTAL			**20**	**4**	**08**	**25**	**32**	**180**	**60**	**360**	**160**	**240**	**1100**

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DEPARTMENT OF AUTOMOBILE ENGINEERING
INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING
INDUS UNIVERSITY

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –VIII TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017														
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME						
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	AU0801	Project	00	00	40	20	40	00	00	00	40	60	100
TOTAL			**00**	**00**	**40**	**20**	**40**	00	00	00	40	60	**100**

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3RD SEMESTER

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B-TECH AUTOMOBILE ENGINEERING, SEMESTER –III TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	SH0301	Differential Equations and Integral Transforms	3	2	0	4	05	30	10	60	00	00	100
2	AU0301	Kinematics of Machines	4	0	2	5	06	30	10	60	40	60	200
3	AU0302	Fluid Mechanics	3	0	2	4	05	30	10	60	40	60	200
4	AU0303	Machine Design & Industrial Drafting	3	0	2	4	05	30	10	60	40	60	200
5	AU0304	Automobile Measurements and Metrology	3	0	2	4	05	30	10	60	40	60	200
6	AU0305	Automobile Manufacturing Processes	4	0	2	5	06	30	10	60	40	60	200
7	SH0307	Human Values and Professional Ethics	1	0	0	0	01	-	-	-	-	-	100
TOTAL			**21**	**2**	**10**	**26**	**33**	**180**	**60**	**360**	**200**	**300**	**1200**

Subject: **Differential Equations and Integral Transforms**								
Program: **B.Tech. Automobile Engineering**				Subject Code: SH0301			Semester**: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	24/60	-	16/40	-	100

Course Objectives

1. To provide an ability to see differential equations as a rigorous way of modeling physical phenomena.
2. To provide an ability to derive major differential equations from physical principles.
3. To provide an ability to understand the role of initial and boundary conditions in determining the solutions of equations.
4. To provide an ability to choose and apply appropriate methods for solving differential equations.
5. To provide an ability to undertake problem identification, formulation and solution.

CONTENTS

UNIT 1 **[10]**

ORDINARY DIFFERENTIAL EQUATIONS WITH APPLICATIONS

Revision of ordinary differential equation: Introduction of Mathematical Modeling, Basic Definitions, First Order First Degree Differential Equations, Variable Separable equation, Homogeneous Equation, Exact Differential Equations, Reduction of Non-exact Differential Equations to exact form using Integrating Factors, First Order Linear Differential Equation, Bernoulli Equation, Applications: Orthogonal Trajectories, Simple Electric Circuits., Solution of Linear differential equations of higher order with constant coefficients, complimentary function and particular integral

UNIT 2 **[13]**

ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS WITH APPLICATIONS

Method of variation of parameters, Method of Undetermined coefficients, Linear differential equations with variable coefficients (Cauchy's and Legendre forms), Simultaneous linear differential equations, Bessel and Legendre functions, Application of Linear differential equation - Application of Deflection of Beams, Electric circuits, Series Solution of Ordinary Differential Equations – Power series method, Formation of Partial differential equations, Directly Integrable

equation, Method of separation of variables, solution of one dimensional wave equation, heat equation and Laplace equation.

UNIT 3 **[13]**

LAPLACE TRANSFORMS

Relation between Laplace and Fourier Transform, 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

UNIT 4 **[12]**

FOURIER SERIES, FOURIER INTEGRALS, FOURIER TRANSFORMS AND Z-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, Introduction to Z-transforms: Definition and Standard Z-transforms, Linearity Property, dumping Rule and some standard results, Some useful Z-transforms

Text Books

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),Tata – McGraw Hill Publication.
5. Merel C Potter, J L Goldberg: Advanced Engineering Mathematics (3rd Ed.), Oxford India Publication

Course Outcomes

1. Construct the mathematical modelling of systems using differential equations
2. Apply knowledge of the differential equations and methods in solving engineering problems.

3. To understand the physical problems in fluid mechanics, heat and mass transfer, circuit and network analysis etc.
4. To understand the method of variation of parameters, undermined coefficients.
5. To determine the linear differential equation with variable coefficients and their applications.
6. Formation of partial differential equation.
7. To apply the method of variable separable for one dimensional heat, wave and Laplace equations
8. Apply the knowledge of Laplace transforms in solving engineering problems
9. The problem of circuit and network analysis, system and signal processing, boundary value problems etc.
10. Apply the knowledge of Fourier series.
11. To understand the concept of Fourier transform and Fourier integrals to solve many practical problems of various fields.

Web Resources

1. http://freevideolectures.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/

Subject: **Kinematics of Machines**								
Program: **B.Tech. Automobile Engineering**			Subject Code: AU0301				Semester**: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	0	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. The course has been designed to cover the basic concepts of kinematic aspects of mechanical machines.
2. It is intended to introduce essential elements of machines and their functionality and engenders skills for kinematics analysis of machine elements like linkages, cams, and gears, within the general machine design context.

CONTENTS

UNIT 1

[12 hours]

MECHANISMS AND SPECIAL 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. . Straight line mechanism, Indicator diagram Hooke's Joint, Steering Mechanism

VELOCITY & ACCELERATION ANALYSIS OF MECHANISM

Angular and linear velocities in link mechanism, Instantaneous center method, Relative Velocity method and Acceleration Diagram for slider - crank chain and four-bar chain mechanism including coriolis component of acceleration.

UNIT 2

[18 hours]

BELT, ROPE AND CHAIN DRIVES

Introduction, belt and ropes drives, selection of belt drive, types of belt drives, V-belts, materials used for belt and rope drives, wire rope, Slip and Creep of belt, length of Open belt drive and Cross belt drive, Power transmitted by a belt, Ratio of Driving tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains, Classification, length, angular speed ratio, Power Transmitting chains.

TOOTHED GEARING AND GEAR TRAINS

Classification of gears, types of motion, Gear Terminology, Law of Gearing, Velocity of Sliding, Forms of teeth, involute and cycloid tooth profile - interference of gears - minimum number of teeth to avoid interference, Interference between Rack and Pinion, contact ratio. Helical, spiral, worm and bevel gears, Efficiency of Helical, Spiral, Worm, Worm Gear, and Bevel Gears

Introduction, Types of Gear Trains, Simple, compound & reverted gear trains, Epicyclic gear train, Compound Epicyclic gear train, Epicyclic Gear train with Bevel gears, Torques in Epicyclic gear trains.

UNIT 3

[15 hours]

CAMS

Classification of cams and followers, nomenclature, displacement diagrams of follower motion, kinematic coefficients of follower motion, Drawing a cam profiles for a given displacement - time diagram, SHM, Uniform velocity, Uniform Acceleration, Cylcoidal motion, Uniform Acceleration & Retardation, jump phenomenon in cam and follower system

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

[15 hours]

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.

Course Outcomes

1. Students will be able to identify functional characteristics various machine elements.
2. Students will demonstrate the ability to synthesize and analyse mechanisms.
3. Students will demonstrate ability to design and analyse cams.

4. Students will demonstrate the ability analyse gear trains.

Text Books

1. S.S.Rattan, "Theory of Machines", Tata Mc Graw Hill publishing company limited, 3rd edition, 2009
2. R.S.Khurmi, "Theory of Machines", S.chand Publication, 14th edition, 2014

Reference Books

1. Jagdish Lal, "Theory of Machines", Metropolitan Book Co., 2nd edition, 1998
2. Amitabha Ghosh & Mallik "Theory of Mechanisms and Machines" by A. K East West Press, 2nd edition, 2007
3. Rao J. S. and Dukkipati R. V. "Mechanism & Machine Theory" by New Age International Pub, 2nd edition, 2006
4. Charles Wilson &J.Peter Sadler E. "Kinematics and Dynamics of Machinery", Pearson Education publications, 3rd edition, 2003.

Web Resources

1. https://www.youtube.com/watch?v=8JtcEjaqc4Y&list=PL2336BA23777EFD5D – Mechanics & Special Mechanics
2. https://www.youtube.com/watch?v=mKhYGt8J4BE&list=PLW4Rtyezg8ymoqJS8LDKoFG3fVaP83dK - Velocity & Acceleration Analysis Of Mechanism
3. https://www.youtube.com/watch?v=BIE8_IxM2pA – toothed gear & Gear trains
4. https://www.youtube.com/watch?v=YbjmphKVVpA - Cams &Followers
5. http://kmoddl.library.cornell.edu/ - syllabus of whole subject is included

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Study of different types of mechanisms and their Inversions	(a) To study basics of Kinematics of machines. (b) To study four bar chain, Single slider chain and Double slider chain. (c) To study inversions of afore mentioned mechanisms.
2.	Study of belt and chain drive.	(a) To study Belt and chain drive. (b) To study analysis of forces and power transmission.

3.	Sheet-1 To perform cam analysis using cam apparatus and generate cam profile.	(a) Demonstrate working of any type of cam and followers. (b) Prepare one sheet on construction of cam profile for given data. This should include one problem of knife edge follower and another of roller follower.
4.	Study of different types of gears train.	(a)To study of different types of gears and gear train. (b) To solve numerical on Epicyclic gear train.
5.	To study and perform gyroscopic effect.	To find experimentally the Gyroscopic couple on Motorized Gyroscope and compare with applied couple.
6.	Study of simple pendulum	(a) To find periodic time theoretically. (b) To study and find periodic time experimentally.
7.	Sheet-2 Velocity analysis.	(a) To determine Velocity of different mechanisms. (b) Prepare one sheet on Velocity diagrams for given data.
8.	Sheet-3 Acceleration analysis.	(a) To determine Acceleration of different mechanisms. (b) Prepare one sheet on Acceleration diagrams for given data.
9.	To perform experiment on Porter Governors to prepare performance characteristic Curves, and to find stability & sensitivity	To perform experiment on Porter Governors to prepare performance characteristic Curves, and to find stability & sensitivity.
10.	To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.	To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
11.	Study of balancing and its application in automobile.	(a) To determine balancing mass and its angular position for dynamic balancing of the given system (b) To study the principal method of Static and Dynamic balancing.
12.	Study about longitudinal vibration of a spring mass system.	(a) To perform experiment on longitudinal vibration of a spring mass system. (b) To determine the stiffness of the spring. (c) To determine the time period. (d) To determine the frequency of oscillation.

Subject: **Fluid Mechanics**								
Program: **B.Tech. Automobile Engineering**			Subject Code: AU0302				Semester**: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. The course is designed with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to fluid flow problems.
2. The course is designed to give fundamental knowledge of properties of the fluid and mathematical techniques of practical flow problems.

CONTENTS

UNIT 1

[10 hours]

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 STATICS

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

[14 hours]

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. Momentum of momentum equation, Introduction to Notches and Weirs

UNIT 3

[13 hours]

DIMENSIONAL ANALYSIS AND SIMILARITIES

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: Reynold's model law, Fraude's model law, Euler's model law, Weber's model law, Mach's model law.

FLOW THROUGH PIPES

Major energy losses, Minor energy losses, Hydraulic gradient and total energy lines, Pipes in series and parallel, Equivalent pipes, Siphon, power transmission through pipe, Flow through nozzle at end of pipe, Water hammer in pipes

UNIT 4

[12 hours]

VISCOUS & TURBULENT FLOW

Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe-Hagen Poiseuille formula, Flow of viscous fluid between two parallel fixed plates, Expression for coefficient of friction -Darchy Weish bach Equation, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes.

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.

Course Outcomes

After successful completion of the course the students shall be able to:

1. Describe types of fluid and determine their properties
2. Measure pressure and calculate hydrostatic pressures and forces on flat/curved surfaces
3. Analyze forces on floating and immersed bodies and understand fluids in relative equilibrium
4. Know the basics of fluid kinematics and dynamics and understand and apply the Bernoulli principle.
5. Calibrate fluid flow measuring devices like venturimeter, orificemeter, notches, orifice, mouthpieces.
6. Understand the concept of drag and lift on various objects.
7. Know the basics of compressible fluid flow.

Text Books

1. Rajput R. K,"A text book of Fluid Mechanics and Hydraulic Machines", S Chand and Company Ltd, New Delhi, 4th edition, 2010.
2. Bansal R K , "Fluid Mechanics and Hydraulics Machines", Laxmi publications (P) Ltd., New Delhi, 9th Edition, 2006.

Reference Books

1. Yunush A. Cengel, John M. Cimbala, "Fluid Mechanics", TMH , 7th edition, 2012
2. E. Rathakrishnan , "Fluid Mechanics: An Introduction", PHI Publication , 3rd edition, 2012
3. PN Modi,& SM Seth, "Hydraulics and Fluid Mechanics Including Hydraulic Machine" Standard, Delhi, 20th edition, 2004

Web Resources

1. https://www.youtube.com/watch?v=e6a2q9k2JCA - Properties Of Fluid & Fluid Statics
2. https://www.youtube.com/watch?v=lGL7Dp8xK_U – Fluid Statics & Fluid Dynamics
3. https://www.youtube.com/watch?v=XfEM85T4xMQ – Dimensional Analysis and Similarities
4. https://www.youtube.com/watch?v=kD0WPNzBuOI – Flow through Pipes
5. https://www.youtube.com/watch?v=CswlMNcaAvI – Viscous & Turbulent Flow
6. https://www.youtube.com/watch?v=BJ96HCVTTew - Boundary Layer Theory & Fluid Flow Over Bodies
7. http://nptel.ac.in/courses/112105171 - Syllabus of whole subject – video courses

LIST OF EXPERIMENTS

No.	Title	Learning Outcome
1.	Introduction to Fluid Properties	(a) To study properties of Fluids i.e Specific weight, specific gravity, viscosity, bulk modulus etc. (b) To provide the students with a solid foundation in fluid flow principles (c) To study surface tension, capillarity, vapour pressure, cavitation.
2.	Study of Buoyancy & Floatation	(a) To study Buoyancy and floatation. (b) To study conditions of submerged body and floating body.
3.	Calculation of Meta-Centric Height	To determine the Metacentric height of a given floating body.

4.	To Verify Bernoulli's Theorem	Students can able to understand to analyze practical problems and verify Bernoulli's theorem.
5.	To determine the Friction Factor for Pipes of Different Sizes	(a)Determination of coefficient of friction for different pipes i.e Different Diameters and Different materials (b) Students will be able to compare discharge and coefficient of friction.
6.	To determine the different Regimes of Flow by Reynolds's experiment	To determine the flow type by decreasing or increasing the rate of flow; as the flow changes from laminar to turbulent.
7.	To study about Open Channel Flow over a Notch and to find Co-Efficient of Discharge of Rectangular Notch	(a)To study Open Channel flow over a Rectangular Notch and to find actual discharge, theoretical discharge and co-efficient of discharge of Rectangular notch. (b) Use of a rectangular notch to measure flow rate in an open channel is the subject of this experiment.
8.	To study about Open Channel Flow over a Notch and to find Co-Efficient of Discharge of V-Notch	(a)To study Open Channel flow over a V-notch and to find actual discharge, theoretical discharge and co-efficient of discharge of V- notch. (b) Use of a V- notch to measure flow rate in an open channel is the subject of this experiment.
9.	Calibration of Venturi Meter	To obtain the coefficient of discharge from experimental data by utilizing venturi meter and, also the relationship between Reynolds number and the coefficient of discharge.
10.	Calibration of Orifice Meter	To obtain the coefficient of discharge from experimental data by utilizing Orifice meter and, also the relationship between Reynolds number and the coefficient of discharge

Subject: **Machine Design & Industrial Drafting**								
Program: **B.Tech. Automobile Engineering**			Subject Code: AU0303				Semester: **III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

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

CONTENTS

UNIT 1

[14 hours]

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

[12 hours]

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

[11 hours]

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.

UNIT 4

[11 hours]

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

INTRODUCTION TO CAD

Introduction to AutoCad, Commands, Methods For2D & 3D Drafting.

ASSEMBLY DRAWINGS

Drawings of assembled view for the part drawings of the following using Propionate dimensions. Cotter joint, Coupling, Knuckle joint Sheet

Course Outcomes

After learning the course the students should be able to:

1. Students will be able to analyse components subjected to various mechanical loads.
2. Students will be able to analyse beams and columns for stresses and deflection.
3. Students will be able to design and analyse shafts, keys and couplings.
4. Students will be able to select fasteners and design welded / riveted joints.
5. Students will be able to generate and interpret assembly and production drawings

Text Books

1. P.C Sharma and D. K. Aggarwal “Machine Design”, S.K. Kataria & Sons, Edition 3, 2009.
2. V. B. Bhandari “Design of Machine Elements”, McGraw Hill Publication Publishing Co, Edition 2, 2011.

Reference Books

1. William Orthein, “Machine Component Design (Vol. I & II)”, M/s. Jaico Publishing, 1998 - 99
2. N.D. Bhatt, “Machine Drawing”, Charator Publication, Edition 50, 2014.

3. P.S. Gill, “Machine Drawing” -S.K. Kataria & Sons, New Delhi, 2009
4. S. G. Kulkarni, “Machine Design” - Solved Problems”, McGraw Hill Publication Publishing Company Ltd., New Delhi, Edition 3, 2008.
5. Joseph Edward Shigley and Charles R. Mischke, “Mechanical Engineering Design”, McGraw Hill International, Edition 10, ISBN-13: 978-0073398204.

Web Resources

http://nptel.ac.in/courses/112105124/ - Syllabus of whole subject included

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Introduction to computer aided drafting tools.	Basic knowledge of CAD software and tools
2.	Using drafting software, generate Assembly and Production drawings (emphasis should be to demonstrate guidelines of IS SP 46 2003).	Basic knowledge of Assembly and components drawings in CAD software
3.	Solve problems related to Eccentric Loading; Cotter and Knuckle Joints; Design and Analysis of Levers: Cranked, Bell Crank, Foot, Rocker arm. Also prepare 3D models and detailed drawings of Cotter and Knuckle Joints	Problems of cotter and knuckle joints and CAD model based on Calculations, Design of levers and other assemblies in CAD software.
4.	Design of shafts, keys and Couplings. Also generate 3D models and detailed drawings of couplings designed	Calculations od shafts, keys and couplings. Models based on calculation in CAD software
5.	Study different types of threaded fasteners and rivets. Problems for design of joints using welding, riveting and fasteners	Calculations on Joints using welding, riveting and fastening. Models based on calculation in CAD software

Subject: **Automobile Measurements and Metrology**								
Program**: B.Tech. Automobile Engineering**				Subject Code: AU0304			Semester**: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. To understand the concept of measurement
2. To Study application of Different measuring instrument.
3. To study advanced technologies in measurement

CONTENTS

UNIT 1

[12 hours]

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 - interferometery, optical flats, - Comparators: limit gauges Mechanical, pneumatic and electrical comparators, applications. Angular measurements: -Sine bar, Sine center, bevel protractor and angle Decker..

UNIT 2

[12 hours]

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.

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.

UNIT 3

[11 hours]

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

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.

UNIT 4

[10 hours]

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.

Course Outcomes

After learning the course the students should be able to:

1. Students will describe basic concepts of Metrology
2. Students will select linear measuring instrument for measurement of various components
3. Students select angular and taper measurement devices for measurement of various components
4. Students will discriminate between various screws by measuring their dimensions Mechanical Optical Comparators, Electrical Comparators, Pneumatic Comparators
5. Students will separate different gears through measurement of various dimensions of gears
6. Students will discriminate capabilities of machining process by measuring surface finish of the component produced
7. Students will evaluate quality of surface produced using various methods
8. Students will describe basic concepts of mechanical measurement and errors in measurements.
9. Students will select appropriate temperature measuring device for various applications
10. Students will describe methods of measurement for various quantities like force, torque, power, displacement, velocity/seed and acceleration

Text Books

1. Doeblin,"Measurement System Application &Design" McGraw Hill ,New Delhi, 2000
2. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005
3. Donald Deckman, "Industrial Instrumentation", Wiley Eastern, 1985

Reference Books

1. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2000
2. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2006

Web Resources

1. http://nptel.ac.in/courses/112106138/ - Whole syllabus included.
2. https://www.youtube.com/watch?v=F7uCEeipdCw – Sine Bar
3. https://www.youtube.com/watch?v=dduZx61R-eg – Sine Center
4. https://www.youtube.com/watch?v=mMv0qlmzxPk – optical comparator
5. https://www.youtube.com/watch?v=k0Ns7OYr6qc – profile Projector
6. https://www.youtube.com/watch?v=ZwXtPW0gdD0 - Thermocouple
7. https://www.youtube.com/watch?v=9lWpPOGI42Y - strain gauge
8. https://www.youtube.com/watch?v=RARjXXaFEQ0 – low pressure measurement
9. https://www.youtube.com/watch?v=cOTi-xjMzaE – Mcleod gauge
10. https://www.youtube.com/watch?v=99zzBRKYLwQ – Surface finish parameters

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Precision Measuring Instruments	Basic Introduction of Engineering Instruments, Safety and methods of measurements.
2.	Linear Measurement	Relevance of the linear measurement in the Automobile Field
3.	Angular Measurement	Basic Understanding of Instruments used to measure the angles.
4.	Micrometer Calibration	Basic Understanding of Micrometer operation and application
5.	Surface Roughness Measurement	Understanding of different surface finishes and roughness measurement techniques.
6.	Gear Tooth Thickness Measurement	Gear tooth nomenclature and thickness measurement
7.	Pressure Measurement	Understanding the pressure difference and relevant pressure measuring techniques.
8.	Temperature Measurement	Different temperature measurement techniques and their methods.
9.	Flow Measurement	Different measurement techniques and instruments used to measure the flow.
10.	Strain Gauge Transducer	Understanding of Transducers and applications.

Subject: **Automobile Manufacturing Processes**								
Program**: B.Tech. Automobile Engineering**				Subject Code: AU0305			Semester: **III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	0	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. The Automobile Manufacturing Processescourse is to learn the basic processes available to make a part/product.
2. It will help the students to select the best manufacturing process based on quality/time/cost/ mechanical properties.

CONTENTS

UNIT 1

[12 hours]

INTRODUCTION

Importance of manufacturing, economic and technological definition of manufacturing, Classification of manufacturing processes, Selection of manufacturing process

FOUNDRY

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, Melting furnaces – cupola, resistance furnace, induction and arc furnace.

UNIT 2

[18 hours]

CASTING AND MACHINING

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

[14 hours]

FORMING PROCESSES

Plastic deformation of metals: Variables in metal forming and their optimization. Dependence of stress strain diagram on Strain rate and temperature. Hot and cold working of metals, classification

of metal forming processes. Rolling: Pressure and Forces in rolling, types of rolling mills, Rolling defects. Forging: Smith Forging, Drop and Press forging, M/c forging, Forging defects. Extrusions: Direct, Indirect, Impact and Hydrostatic extrusion and their applications, Extrusion of tubes Wire drawing methods and variables in wire –drawing. Brief introduction to sheet metal working: Bending, Forming and Deep drawing, shearing. Brief introduction to explosive forming, coating and deposition methods

UNIT 4

[16 hours]

SUPER FINISHING PROCESSES

Introduction, Grinding, Lapping, Horning, Buffing, Barrel Tumbling, Burnishing, Powder coating, Polishing

METAL JOINING PROCESSES

Welding - Principle of welding, Classification of welding and allied processes, Arc welding, Gas welding and cutting, Resistance welding, Special welding processes, Advanced welding processes, Friction and Explosive welding, Welding defects and their remedies. **Brazing and soldering –** Principle of soldering and brazing, compositions of solder, Different equipmentsand Processes involved in brazing and soldering process.

Course Outcomes

After learning the course the students should be able to:

1. The student will demonstrate the ability to think in core concept of their engineering application by studying various topics involved in branch specific applications.
2. The student will demonstrate the ability to use different processes and its process parameters to obtain qualitative solutions.
3. Students will understand the relevance and importance of the Different manufacturing techniques and real life application in industry.
4. Learn about different process parameter.

Text Books

P.N. Rao, “Manufacturing Technology” Vol-II, Tata McGraw Hill, 3rd edition, 2010

Reference Books

1. R. K. Jain, “Production Technology” khanna publishers 5th edition 1977
2. S. Kalpakajain, “Manufacturing Engg. And Technology”, PHI/Pearson. 6th edition 2016
3. O.P.Khanna, “Welding technology”, Dhanpat Rai publishers. 22nd edition 2008

Web Resources

1. http://nptel.ac.in/courses/112107145/ - Whole syllabus included.
2. https://www.youtube.com/watch?v=R1ifDegeq-g – Metal forming fundamentals
3. https://www.youtube.com/watch?v=Y75IQksBb0M – Extrusion process
4. https://www.youtube.com/watch?v=XTU0Z-FkhtU – Forging operations
5. https://www.youtube.com/watch?v=szOwGvYO_Tc – sand Casting process
6. https://www.youtube.com/watch?v=0v2SNH_ho08 – Brazing and soldering process

LIST OF EXPERIMENTS

No.	Title	Learning Outcomes
1.	Fundamentals of metal forming technology	Student will learn about Fundamentals of metal forming
2.	Study of forging and extrusion process	Student will learn about forging and extrusion process
3	Study of press working operations	Student will learn about press working operations
4	Introduction to metal forming processes	Student will learn about metal forming processes
5.	Study of pattern making	Student will learn about pattern making
6.	Study of casting processes	Student will learn about casting processes in detail
7.	Introduction to plastic process	Student will learn about super finishing processes
8.	Study of super finishing processes	Student will learn about brazing and soldering
9.	Study of brazing and soldering	Student will learn about sheet-metal forming
10.	Study of sheet-metal forming	Student will learn about Fundamentals of metal forming

Subject: Human Values and Professional Ethics								
Program:B.Tech. ALL				**Subject Code:SH0307**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)-Theory**	**Continuous Internal Evaluation (CIE)-Practical**	**Total**
1	0	0	0	24/60	0	16/40	0	100

Course Objectives:

1. To provide a much needed orientation input in value education to the young enquiring minds.
2. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.
3. Understand what morality is and how it connects to professional ethics
4. To appreciate ethical dilemma while discharging duties in professional life.
5. Understand through readings and homework the central values found in moral professional behavior

Unit 1: Values and Self Development [04]

Social Values and individual Attitudes, Work ethics, Indian vision of Humanism, Moral and non moral valuation, Standards and principles, Value judgments. Importance of cultivation of values, Sense of duty, Devotion, Self reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.

Unit 2: Personality and Behavior Development [04]

Soul and scientific attitude. Goad and scientific attitude, positive thinking, integrity and discipline, punctuality, love and kindness. Avoiding fault, finding. Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, True friendship, Happiness vs. suffering love for truth. Aware of self destructive habits, Association and cooperation, doing best, saving nature.

Unit 3: Character and Competence [04]

Science vs. God, Holy books vs. Blind faith, Self management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of women, All religions and same message, Mind your mind, Self control, Honesty, Studying effectively.

Unit 4: Engineering Ethics [04]

Senses of 'Engineering Ethics', variety of moral issues, types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, consensus and controversy, models of professional roles, theories about right action, self interest, customs and religions, uses of ethical theories, Valuing time, Co-operation and commitment, Code of ethics, Sample codes – IEEE, ASCE, ASME and CSI.

Text Books:

1. Chakraborty, S. K., Values and Ethics for Organization Theory and Practice, Oxford University Press, New Delhi, 2001
2. Gaur R. R., Sangal R., Bagaria G. P., *A foundation course in Value Education*, 2009.
3. Gaur R. R., Sangal R., Bagaria G. P*., Teacher's Manual*, 2009.
4. Mike Martin and RolandSchinzinger, *Ethics in Engineering*, Mc Graw Hill. New York, 1996.

Reference Books:

1. Govindrajan M., Natrajan S. and Senthil Kumar V. S., Engineering Ethics (including Human Values), Prentice hall of India Ltd., New Delhi, 2004.
2. Frankena, W. K., *Ethics*, Prentice Hall of India, New Delhi, 1990.
3. Dhar P. L., Gaur R. R., *Science and Humanism*, Commonwealth Publishers, 1990.
4. TripathyA. N., *Human Values*, New Age International Publishers, 2003.
5. Seebauer E. G. and Robert L. Berry, *Fundamentals of Ethics for Scientists andEngineers*, Oxford University Press, 2000.
6. Banerjee B. P., *Foundations of Ethics and Management*, Excel Books, 2005.
7. Bajpai B. L., *Indian Ethos and Modern Management*, New Royal Book Company, 2004.

Course Outcomes:

1. The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument or any other person cannot enable them to verify with authenticity; it will only develop assumptions.
2. The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
3. The students will be able to understand, what a profession is and what it means to act professionally. It will include a discussion of the features of moral reasoning and provide a case resolution method for dealing with ethical issues of the work place. The course will cover in-depth those values central to moral life of any professional: integrity, respect for persons, justice, compassion, beneficence and Non-maleficence, and responsibility.

Web Resources: (Relevant websites, movies and documentaries)

1. http://uhv.ac.in, http://www.uptu.ac.in - Value Education websites
2. http://www.storyofstuff.com - Story of Stuff
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story
6. Gandhi A., Right Here Right Now, Cyclewala Productions

4TH SEMESTER

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –IV TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	SH0401	Complex Analysis and Numerical Methods	3	2	0	4	5	30	10	60	0	0	100
2	AU0401	Engineering Thermodynamics	4	2	0	5	6	30	10	60	0	0	100
3	AU0402	Vehicle Transport Management	3	0	0	3	3	30	10	60	0	0	100
4	AU0403	Strength of Materials	3	2	2	5	7	30	10	60	40	60	200
5	AU0404	Automobile Machining Processes	3	0	2	4	5	30	10	60	40	60	200
6	AU0405	Automobile Systems	4	0	2	5	6	30	10	60	40	60	200
7	CE0407	Cyber Security and IPR	1	0	0	0	1	-	-	-	-	-	100
TOTAL			**21**	**6**	**6**	**26**	**33**	**180**	**60**	**360**	**120**	**180**	**1000**

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

Subject: **Complex Analysis and Numerical Methods**								
Program: **B.Tech. Automobile Engineering**				Subject Code: SH0401			**S**emester: **IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	24/60	0	16/40	0	100

Course Objectives:

1. 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.
2. To provide an ability to prove certain fundamental theorems about analytic functions, e.g. Cauchy's integral formula
3. To provide an ability to determine the images of curves under simple complex mappings.
4. To provide an ability to determine the stability of certain dynamical systems using complex functions.
5. To provide an ability to use conformal mapping to solve certain applied problems regarding heat conduction, electrical engineering and fluid mechanics.
6. To provide an ability to use Taylor and Laurent expansions to derive properties of analytic and meromorphic functions.

COURSE CONTENTS:

UNIT 1 **[12 hours]**

COMPLEX ANALYTIC FUNCTIONS

Complex Numbers, Demoivere's Theorem, Roots of Complex Numbers, Elementary complex 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 **[14 hours]**

INTERPOLATION

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

UNIT 3 [13 hours]

NUMERICAL METHOD

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

UNIT 4 [12 hours]

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.

Text Books

Erwin Kreyszig: Advanced Engineering Mathematics (8th Ed.) , 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. Dr. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi.
4. R K Jain, S R K Iyengar: Advanced Engineering Mathematics. Third Edition, Narosa Publishing House
5. Murray Spiegel: Advanced Mathematics for Engineering & Science: (Schaum's Outline Series),Tata – McGraw Hill Publication
6. Merel C Potter, J L Goldberg: Advanced Engineering Mathematics (3rd Ed.), Oxford India Publication

Course Outcomes:

1. Apply the knowledge of algebra of complex variables.
2. Complex analytic functions in solving many types of problems of complex analysis.
3. Construct and correlate the regions of complex functions using conformal mappings
4. Focus on mathematical, engineering and practical problems using numerical methods.
5. To find the solution by interpolation for equal and unequal intervals.
6. To understand the concept of numerical differentiation and numerical integration
7. To determine the Solution of Algebraic and Transcendental Equations by numerical methods.
8. To determine the numerical solutions of linear system of equations and ordinary equations.
9. Evaluate Line integrals.
10. To understand the concept of Contour integrals and power series expansion of complex functions

Web Resources:

1. http://freevideolectures.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

Subject: **Engineering Thermodynamics**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0401			Semester: **IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	2	0	5	24/60	0	16/40	0	100

Course Objectives

1. To study various energy interactions notably heat and work transfer based on certain laws of nature which are never seen to be violated.
2. To develop the idea of thermodynamics and topics like first law of thermodynamics, second law of thermodynamics, concept of entropy, properties of pure substances, gas power cycles, vapour power cycles, refrigeration etc.
3. To evaluate the thermal performance of different heat engines and refrigeration cycles through the calculation of their thermal efficiency or coefficient of performance.

CONTENTS

UNIT 1

[12 hours]

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, Mollier 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, heat exchanger, throttling process, comparison of S.F.E.E. with Euler and Bernoulli Equation and unsteady flow process like filling and emptying process.

UNIT 2

[14 hours]

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

[15 hours]

THERMODYNAMIC RELATIONS

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

VAPOUR & 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

[14 hours]

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'sequation, 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

Course Outcomes

After learning the course the students should be able to

1. Understand basic terms used in thermodynamics.
2. Understand laws of thermodynamics and its applications.
3. Comprehend the concept and applications of energy, entropy and exergy.
4. Understand various gas and vapour power cycles.

5. Understand the properties of gas mixtures

Text Books

P.K. Nag, "Engineering Thermodynamics" Tata McGraw-Hill, 5th edition, 2013.

Reference Books

1. R.Yadav, "Fundamentals of Engineering Thermodynamics", Central Publishing House, 3rd edition, 1996.
2. Yunus Centel & Boles, "Thermodynamics – An Engineering Approach", Tata Mc Graw-Hill, 3rd edition, 2013.
3. YVC Rao , "An introduction to Thermodynamics", New Age publishers, 2nd edition, 1993.

Web Resources

1. http://nptel.ac.in/courses/112105123 - Whole syllabus included.
2. https://www.youtube.com/watch?v=ub86Dhg67tM – combustion of fuels
3. https://www.youtube.com/watch?v=RzAPQPWOlNI – Properties of gases and mixtures

Subject: **Vehicle Transport Management**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0402			Semester: **IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

Subject will cover various transport management aspects and motor vehicle laws after studying this subject the students will be able to manage a transport fleet and their related activities for minimizing operational cost.

CONTENTS

UNIT 1

[10 hours]

INTRODUCTION

Introduction to various transport systems, Advantages of motor transport, Staff administration, Recruitment and Training, welfare, driver's health and safety, Basic principles of supervising, Organizing time and people, Driver and mechanic hiring, economical and safe driving tips for city and highway, understanding of traffic rules, Trip leasing, Vehicle operation and types of operations.

UNIT 2

[12 hours]

TRANSPORT MANAGEMENT

Transport organization structure, operations, Planning Scheduling operation & control, Propaganda, publicity and passenger amenities Parcel traffic, General set up, transport industry, government / (STU) State Government Undertakings and private Bus transport organizations, Bus depot organization structure, Truck fleet operators' organization, Requirements and Problems on fleet management. Firebrigade fleet and Ambulance operations management. 108 Organizational activities and it's benefits for the society

SCHEDULING AND FARE STRUCTURE

Principal features of operating costs for transport vehicles, Fare structure, and Various types of fare collecting methods, Basic factors of bus scheduling, Problems on bus scheduling.

UNIT 3

[13 hours]

PLANNING FOR NEW TRANSPORT ORGANIZATION

Geographical considerations, economic factors, vehicles used, planning of trips. Concept of BRTS operations. Organization of Transport Services: Records and fleet management, vehicles 8schedule, booking and reservation, statistical records, recording of goods transport Scheduling of goods transport, Management Information System (MIS) in passenger / goods transport operation. Storage & transportation of petroleum products, Advanced Techniques in Traffic Management, Traffic navigation, Global positioning system. Study of BRTS concept, sysrem and management. It's advantages and disadvantages interms of mass transportation.

MOTOR VEHICLE ACT

Acts & definitions, Licensing of drivers and conductors, registration of vehicles, control of transport, RTO and other regulations, offences, penalties and procedures, types of form and procedures, licensing of taxies and buses, rules and regulations, testing and passing of vehicles. Description of goods carrier, delivery van, tanker, tipper, municipal, fire fighting and break down service vehicle. Taxation: Structure, method of laying taxation, goods vehicle taxation, passenger vehicle taxation, mode of payment, tax exemption, one / life time taxation. Service Life of vehicles. Toll tax reasons & operational management. Build Operate Transfer arrangement. Highway traffic rules, Traffic signs, National and international driving conditions / rules.

UNIT 4

[10 hours]

ACCIDENT & PREVENTION

Vehicle accident, laws, injury, safety precautions, road transport regulations, Insurance: Insurance & Finance Classes/types of insurance, accident claims and settlements, duty of driver in case of accident, hire purchase.

LAWS RELATED TO POLLUTION UNDER CONTROL (PUC)

Pollution Under control certification agency, Authority & procedure for PUC certification agency. Harmful exhaust gas constituents, permissible limits, Euro / Bharat Stage -I, II, III, IV norms and implementation, testing and measurements. Study of Odd-Even formula, high power to weight ratio & higher capacity diesel vehicles and other possible methods for reduction of atmospheric pollution and it's impact., EURO reforms.

Course Outcomes

After learning the course the students should be able to:

1. Understand and have knowledge about different aspects related to transport system and will be able to manage.
2. Understand various Features of scheduling, fixing the fares.

3. Understand various types of insurance and taxation policies.
4. Know about the motor vehicle act and laws related to PUC Norms

Text books

1. "Motor Vehicle Act" - Govt. of India Publications.
2. Shrivastava S.K "Economics of Transport", S. Chand & Co. New Delhi. 1987.
3. Shrivastava. S. K, "Transport Development in India", S. Chand & Co. Pvt. Ltd., New Delhi.,-2005.

Reference books

1. Santosh Sharma, "Productivity in Road Transport", 2nd Edition, Association of State Road Transport Undertakings, New Delhi.
2. Patankar. P. G, "Quality in Road Passenger Transport in India", CIRT, Pune, 1986.
3. Kulshrestha. D. K, "Management of State Road Transports in India", Mittal Publications, 1989.
4. Jegadish Gandhi. P, John Gunaseelan. G, "Indian Transport System: An Appraisal of Nationalised Bus Services", Mittal Publications, 1994.
5. Kulshrestha. D. K, "Transport Management in India", Mittal Publications, 1989.

Web Resources

1. http://ocw.mit.edu/11254576- Whole syllabus included.
2. chdtransport.gov.in/Forms/MVA1988.pdf – the Motor vehicle act – 1988
3. lawgic.info/the-law-on-pollution-under-control-puc-in-india/ - PUC

Subject: Strength of Materials								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0403			Semester: **IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

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

CONTENTS

UNIT 1

[11 hours]

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

[12 hours]

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

[12 hours]

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

[12 hours]

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

Course Outcomes

Students who successfully complete this course will have demonstrated ability to:

1. Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.
2. Calculate the stresses and strains in axially-loaded members, circular torsion members, and members subject to flexural loadings.
3. Calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels.

Text Books

1. S.S.Rattan, Strength of Materials, McGraw Education (India) Private Limited, New Delhi, Edition 2, 2011.
2. William Nash, Strength of Materials, Schaum's Out Lines, McGraw Hill Publication, Edition 6, 2013.

3. Ramamurtham S., Strength of material, Dhanpatrai publication, Edition 16, 2011.

Reference Books

1. Gere & Timoshenko, 'Mechanics of Materials', McGraw Hill, Edition 6, 2014
2. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, Edition 3, 2002.
3. Timoshenko's. And Young, D.H., Elements of Strength of Materials, T.Van Nostrand Co. Inc., Princeton, N.J., Edition 5, 2012.

Web Resources

http://nptel.ac.in/courses/112107147/- whole syllabus included

LIST OF EXPERIMENTS

No.	Title	Learning Outcome
1.	To study the Universal Testing Machine.	Basic knowledge of working of UTM
2.	To perform the Tensile Test of Mild Steel on U.T.M and To Draw Stress–Strain Curve.	Behavior of material under tensile load
3.	To determine strength of wood on U.T.M (i) Along the Grain (ii) Across the Grain.	Behavior of material under Compressive load along the grain and across the grain
4.	To determine shear strength of Mild Steel on U.T.M.	Shearing behavior of Mild steel under stresses on UTM.
5.	To observe Flexural Behavior of Timber specimen and to determine it's strength under transverse loading on U.T.M.	Behavior of timber specimen under loading conditions on UTM.
6.	To study the Impact Testing Machine and test specimen of Izod and Charpy.	Basic knowledge and working of Izod impact testing machine
7.	To determine Izod and Charpy Value of the given mild steel specimen.	Failures of different specimen used for Izod impact test and charpy test.
8.	To study the Fatigue Testing Machine and to discuss the procedure to find out endurance limit of given material.	Basic knowledge and working of Fatigue testing machine and procedure to find the endurance limit of a given material
9.	To study the Spring Testing Machine.	Basic knowledge and working of Spring testing machine

Teaching Scheme				Examination Evaluation Scheme				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. The purpose of this course is to introduce machine tools in their proper perspective and present the necessary to grasp the subject
2. To learn and apply the basic terminology associated with different fields of manufacturing.

CONTENTS

UNIT 1

[13 hours]

INTRODUCTION

Material removal processes, Manufacturing processes, Types of machine tools

METAL CUTTING AND MACHINE TOOLS

Types of metal cutting, cutting tool materials, chip formation, thermal aspects, tool wear and tool life, cutting fluids, classification of machine tools, motions in machine tools: working and auxiliary

METAL CUTTING LATHES

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 , description of other types of lathes, Capston and turret lathes, cutting speed, feed, depth of cut and machining time calculation for lathe, Alignment tests of lathes

UNIT 2

[10 hours]

DRILLING MACHINES

Purpose and field of application of drilling machines upright drill processes, radial drilling machines, alignment tests of drilling machine

BORING MACHINE

Purpose and field of application of Horizontal boring machines, Vertical boring machines, Precision boring machines.

UNIT 3

[13 hours]

MILLING MACHINES

Purpose and types of milling machines, general purpose milling machines, different types of milling operations, milling cutters, attachments extending the processing capabilities of general purpose milling machines, Cutting speed, feed depth of cut and machining time calculation, Alignment tests of milling machine

PLANERS, SHAPERS AND SLOTTERS

Classification: Attachments extending the processing capacities of each

UNIT 4

[11 hours]

SAWING AND BROACHING, MACHINES

Metal sawing classification: reciprocating sawing machines, circular sawing machines, band sawing machines. Types of broaching machines, advantage and limitations of broaching

GRINDING MACHINES AND ABRASIVES

Classification of grinding machines, cylindrical grinders, internal grinders, Surface grinders, tool and cutter grinders, grinding wheels, surface finishing. Abrasives, manufacture of grinding wheels, cutting speed, feed depth of cut and machining time calculations in grinding

INTRODUCTION TO PRECISION MACHINING

Unconventional machining-need-classification-brief overview ,Ultrasonic Machining (USM) • Water-Jet Machining & Abrasive-Jet Machining • Chemical Machining • Electrochemical Machining (ECM)

Course Outcomes

After learning the course the students should be able to:

1. Become familiar with the machining manufacture and production fundamentals.
2. Become familiar with the actual manufacturing technology and standards adopted on shop floor through hands on experimentation.
3. Decide and graphically represent the sequence of machining operations, which are most appropriate from the functionality point of view.
4. Learn the concepts of machining manufacture, which are important to minimize the production cost and production time along with the significant improvement in the quality of end product.

Text Books

Prof. PN Rao, "Manufacturing Technology (Metal cutting & Machine tools)", Tata Mcgraw Hill Publication. New Delhi, 3rd edition 2013

Reference Books

1. Hajra & Choudhari, "Workshop Technology Vol. II.", Media Publishers & Promoters 3rd edition 2010
2. O.P. Khanna, "Manufacturing Processes", Dhanpat Rai Publications 3rd edition 2013
3. R. K. Jain, "Production Technology", khanna publishers 5th edition 1977

Web Resources

http://nptel.ac.in/courses/112104028/ - whole syllabus included

LIST OF EXPERIMENTS

No.	Title	Learning Outcomes
1.	Introduction to basic machine tools	Basics of machine tools will be learnt
2.	Introduction to Lathe machine.	Basics of lathe machines will be learnt
3.	Various parts, mechanism, attachments and operations of lathe.	Knowledge on late operation will be inculcated in to students
4.	Drilling machines its classification & Operation	Students will basics of drilling machines and its operation
5.	Boring machines its construction and operation	Students will learn basics of boring machines and its operation
6.	Milling machines its construction and operation	Students will learn basics of milling machines and its operation
7.	Principle, construction & operations of shaping, planning & slotting machine	Students will learn basics of shaping machines and its operations
8.	Principle, construction & operations of sawing and broaching machine	Students will learn basics of broaching machines and its operations
9.	Grinding machines its classification and operation	Students will learn basics of grinding machines and its operations
10.	Gear cutting and indexing methods	Students will learn Gear cutting and indexing methods

Subject: **Automobile Systems**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0405			Semester: **IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	0	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. Develop an understanding on working of Automobile System.
2. Develop in-depth knowledge on various systems in Automobile System

CONTENTS

UNIT 1

[16 hours]

CHASSIS & BODY

Classification of vehicle, layout with reference to power plant, steering location and drive, chassis, construction and details (frames, sub-frames, defects in frame, frameless vehicles, vehicle dimensions), details of chassis & body materials, Integrated body construction, BIW type and corresponding design parameters, Vehicle interior system (dash board & seating system), Cosole design, Pillar trims (Type A, B, C), head roofs.

TRANSMISSION & DRIVELINE

Clutches, principle, types, Fluid coupling and torque convertors, problems on performance of automobile such as resistance to motion, tractive efforts, engine speed, power and acceleration requirements. Determination of gear box ratios for different vehicle applications, different types of gear boxes, Automatic transmission, Effect of driving thrust and torque-reaction, Hotchkiss drives, Torque tube drive, radius rods, Propeller shaft, Universal joints, Final drive- different types, two speed rear axle, Rear axle construction: full floating, three quarter floating and semi-floating arrangements, Differential: conventional type & Non-slip type, differential locks

UNIT 2

[12 hours]

FRONT AXLE & STEERING

Front axle types, rigid axle and split axle, constructional details, materials, front wheel geometry viz., camber, castor, kingpin inclination, toe-in and toe-out, Wheel alignment and balancing, Condition for true rolling motion of road wheels during steering. Steering geometry. Ackermann and Davis steering. Construction details of steering linkages. Different types of steering gear box. Steering linkages layout for conventional and independent suspensions. Turning radius,

instantaneous centre, wheel wobble and shimmy. Over-steer and under-steer. Power and power assisted steering**.**

UNIT 3

[18 hours]

BRAKING SYSTEM

Type of brakes, Principles of shoe brakes. Constructional details – materials, braking torque developed by leading and trailing shoes. Disc brake, drum brake theory, constructional details, advantages, Brake actuating systems. Factors affecting brake performance, Parking & Exhaust brakes, power & power assisted brakes, Antilock Breaking System (ABS).

SUSPENSION SYSTEM

Types of suspension, factors influencing ride comfort, types of suspension springs (leaf & coil springs), independent suspension (front and rear). Rubber, pneumatic, hydro-elastic suspension, Shock absorbers, types of wheels, construction of wheel assembly, types of tyres and constructional details, Static and rolling properties of pneumatic tyres, tubeless tyres and aspect ratio of tubed tyres

UNIT 4

[14 hours]

WHEELS & TYRES

Types of wheel rims, Tread patterns, Types of tyres, Cross ply, Radial & tubeless tyres, Specifications of tyres

PERFORMANCE OF VEHICLE

Vehicle motion, Resistances during motion, Power required for acceleration and constant velocity motions, Tractive efforts and draw bar pull, Power required and engine characteristics, Gear ratio requirement, Motion on gradient

Course Outcomes

After learning the course the students should be able to:

1. Understand the various vehicle classification and its layouts.
2. Understand the different types of suspension systems.
3. Understand the functions of different types of clutches and brakes.
4. Understand the types of gear boxes and transmission systems.
5. Understand the steering requirements and types of front axle.
6. Understand the performance of vehicle.
7. Understand the types of wheel rims and tires with their specifications.

Text Books

1. Kripal Singh, “Automobile Engineering”, Standard Publishers Distributors Delhi, Edition 13, 2012.
2. R.B. Gupta, “Automobile Engineering", Satya Parkashan, New Delhi, Edition 2, 2015.

Reference Books

1. James D Halderman, “Automotive Engineering”, Pearson, Edition 4, 2012.
2. Dr. K.M. Gupta, Automobile Engineering Vol-I & II, Edition 12, 2011.
3. Dr. N. K. Giri, “Automobile Mechanics”, Seventh reprint, Khanna Publishers, Delhi, Edition 5, 2014

Web Resources

1. http://web.iitd.ac.in/~achawla/public_html/736/1-Automobile_intro-v5_1.pdf - Introduction
2. http://www.ignou.ac.in/upload/Unit-1-61.pdf - vehicle classification and its layouts
3. https://www.howacarworks.com/basics/how-a-car-clutch-works - Clutch
4. http://www.carbibles.com/brake_bible.html - Brakes
5. http://www.carbibles.com/steering_bible.html - Steering
6. http://www.carbibles.com/transmission_bible.html - Transmission
7. http://www.carbibles.com/tyre_bible.html - Tires
8. http://www.carbibles.com/suspension_bible.html - Suspension

LIST OF EXPERIMENTS

No	Title	Learning Outcome
1.	To study about vehicle layouts	Basic knowledge of different drive systems
2.	To study about different types of clutch	Knowledge of construction and working of clutch and its mechanism
3.	To study about the performance of vehicle	Knowledge of construction and working of rear axle, final drive and differential
4.	To study about the different types of gear boxes	Knowledge of vehicle performance on grades
5.	To study about rear axle, final drive and differential	Basic knowledge of construction and working of gearbox
6.	To study about Automatic Transmission system	Basic knowledge of construction and working of epicyclic gearbox
7.	To study about different types of tires and wheels.	Basic knowledge of construction and working of different types of tires and wheels
8.	To study of different types of automobile brakes.	Knowledge of Construction and working of hydraulic brakes

9.	To study of steering systems	Basic knowledge of construction and working of different types of steering mechanism and linkages.
10.	To study about different types of suspension system	Basic knowledge of construction and working of different suspensions used in automobile

Subject: Cyber Security and Intellectual Property Rights								
Program: **B.Tech.**				Subject Code: CE0407			Semester: I**V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	0	0	0	24/60	0	16/40	0	100

UNIT-I **[3]**

Introduction:

Information Security Overview, Cyber security, Cyber security objectives and policies, Differences between Information Security & Cyber security, Cyber security Principles, Introduction of Cyber crime, Classifications of Cybercrimes.

UNIT-II **[3]**

Security Threats and vulnerabilities:

Overview of Security threats, Hacking Techniques, Password Cracking, Insecure Network connections, Malicious Code, Programming Bugs, Cyber crime and Cyber terrorism, Information Warfare and Surveillance. Applicationsecurity(Database,E-mailandInternet).

UNIT-III **[3]**

Overview of Security Management:

Overview of Security Management , Security Policy , Security Procedures and Guidelines , Risk Management , Security Laws**, System Security** (Desktop, email,web), **I**ntrusion Detection Systems, SecurityTechnology-FirewallandVPNs,Backup SecurityMeasures.

UNIT-IV **[3]**

Cyber law- Intellectual property right:

Introduction, Objectives of Intellectual property law, Types of IPR, Advantages of IPR, IPR in India, Offences and Penalties.

Text Books

1. "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Nina Godbole, Sunit Belapur, Wiley India Publications, April, 2011

Reference Books

1. Charlesfleeger,ShariLawerancePfleeger,"AnalysingComputerSecurity", PearsonEducationIndia.
2. .K.Pachghare,"CryptographyandinformationSecurity",PHI LearningPrivateLimited,DelhiIndia.
3. Dr.SuryaPrakashTripathi,RitendraGoyal,PraveenkumarShukla,"Introductionto InformationSecurityandCyberLaw"WilleyDreamtechPress.
4. Schou,Shoemaker,"InformationAssurancefortheEnterprise",TataMcGrawHill.
5. CHANDER,HARISH**,"**CyberLawsAndIt Protection**"**,PHILearningPrivateLimited,Delhi,India

5TH SEMESTER

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –V TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	AU0501	Heat Transfer	3	2	2	5	7	30	10	60	40	60	200
2	AU0502	Automobile Engines	4	0	2	5	6	30	10	60	40	60	200
3	AU0503	Two & Three Wheeler Technology	4	0	2	5	6	30	10	60	40	60	200
4	AU0504	Automobile Electrical Systems	3	0	2	4	5	30	10	60	40	60	200
5	AU0505	Vehicle Body Engineering	3	0	0	3	3	30	10	60	00	00	100
6	AU0506	Alternate Fuels & Pollution Control	3	0	2	4	5	30	10	60	40	60	200
7	SH0507	Technical Communication and Soft Skill	1	0	0	0	1	-	-	-	-	-	100
TOTAL			**21**	**2**	**10**	**26**	**33**	**180**	**60**	**360**	**200**	**300**	**1200**

Subject: **Heat Transfer**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0501			Semester: **V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. To get the basic knowledge of heat transfer.
2. To understand the application of heat transfer in automobile.
3. To study designing of components for effective heat transfer, such as fins for cooling.

CONTENTS

UNIT 1

[12 hours]

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

[11 hours]

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

[12 hours]

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 it's 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 EXCHANGE BETWEEN SURFACES

Introduction, Shape Factor, Radiation heat exchange between Non black bodies, Radiation heat exchange between gray bodies, electrical network method for radiant heat exchange between gray and black surfaces, Radiation shields.

UNIT 4

[12 hours]

DESIGN OF 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 Heat transfer features, pressure drop, laminar and turbulent flow and thermal performances. Air cooled heat exchanger, construction, fin requirements, pressure drops and overall heat transfer coefficients. Design criteria for air cooled engine: heat transfer & fin design. Heat exchanger test including geometrical similarity, thermal balance and flow test, endurance test.

AUTOMOBILE COOLING SYSTEM

Radiator construction, Design parameters for radiator & water pump design, hoses, 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.

Course Outcomes

After learning the course the students should be able to:

1. Understand basic concept of heat transfer
2. Able to do basic calculations involving heat transfer as is typical for a mechanical engineer. This includes conduction, convection and radiation heat transfer as well as heat exchanger design.
3. Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to conduction, convection and radiation heat transfer.

Text Books

1. D.S. Kumar , "Heat and mass transfer", S.K.Kataria & Sons, 7th edition, 2008.
2. R.C. Sachdeva, "Fundamentals of Engineering Heat and Mass Transfer", New Age International, 4th Edition, 2010

Reference Books

1. J.P. Holman, "Heat Transfer", Tata McGraw Hill, 9th Edition, 2004.
2. F.P. Incropera, D.P. Dewitt, T.L. Bergman, A.S. Lavine, KN Seetharamu and T.R. Seetharam, "Fundamentals of Heat and Mass Transfer", Wiley India, 1st Edition, 2013.
3. Cengel and Ghajar, "Heat and Mass Transfer: Fundamental and Applications", Mc-Graw hill education, 4th edition, 2011.
4. S. P.Sukhatme,"A text book on Heat Transfer", University press, 4th edition, 2005.
5. P. K. Nag,"Heat and Mass Transfer", Tata Mc GrawHill education, 3rd edition, 2007.

Web Resources

1. nptel.ac.in/courses/112101097/ - whole syllabus included
2. https://www.youtube.com/watch?v=9joLYfayee8&list=PLpU09Q_AVrWgEPejrBIcZPkSLlAPXcTTS – Principle of Heat transfer and Heat transfer by conduction
3. https://www.youtube.com/watch?v=sE8GA-HO2ks – Heat Transfer with Change of Phase
4. https://www.youtube.com/watch?v=lnFjt30goiY - Heat Transfer by Convection
5. https://www.youtube.com/watch?v=YEn-vX4duUc - Heat Transfer by Radiation
6. https://www.youtube.com/watch?v=GZbp6PJRM-w – Design of Heat Exchangers

LIST OF EXPERIMENTS

No.	Title	Learning Outcomes
1.	To study the fundamentals of heat transfer	Basics of heat transfer and modes of heat transfer: Conduction, Convection and radiation.
2.	Thermal conductivity of insulating powder	Determine thermal conductivity of insulating powder using sphere in sphere method.
3.	Heat transfer co-efficient for composite wall	Overall heat transfer coefficient for given composite wall with the help of composite wall apparatus.
4.	Temperature distribution and the effectiveness of the fin	Study temperature distribution and the effectiveness of the Pin fin.
5.	Heat transfer co-efficient by natural convection	To determine the surface heat transfer coefficient for a vertical tube losing heat by natural convection.

6.	Heat transfer co-efficient in force convection	To determine convective heat transfer coefficient in forced convection.
7.	Determination of Stefan Boltzmann constant	To determine Stefan Boltzmann constant for the problem of radiation
8.	Emissivity measurement	To determine emissivity for the given surface.
9.	Study of heat exchangers	Study of heat exchangers like boilers, HVAC system, etc.
10.	Study of Automobile Engine cooling system	Study of various cooling system used in an automobile engine.

Subject: **Automobile Engines**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0502			Semester: **V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	0	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. Develop an understanding on working of Automobile engines.
2. Develop in-depth knowledge on various systems in Automobile engines.
3. Develop analytical skills for investigating and analyzing the performance of the different types of engines.

CONTENTS

UNIT 1

[15 hours]

ENGINE COMPONENENTS & CYCLES

Classification of engine types (including construction of two stroke and four stroke engines), Engine parts/aggregates and their functions & operations. Phenomena of scavenging, Analysis of Engine Cycles, Analysis of fuel-air cycle and actual cycles

FUEL SUPPLY SYSTEM IN SI ENGINE

Fuel supply system layout, Fuel feed pump, Filters, Carburetion, Types of carburetors, Mixture requirements, Idling, Cold starting, Economy, Power and acceleration, Chokes petrol injection, Multi-point fuel injection.

FUEL SUPPLY SYSTEM IN CI ENGINE

Fuel injection pump, fuel feed pump, injectors, nozzles, cold starting devices (glow plugs), types of governors, Common Rail Diesel Injection (CRDI) System

UNIT 2

[14 hours]

PROCESS OF 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

PROCESS OF 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

UNIT 3

[14 hours]

IGNITION SYSTEM

Requirements of Ignition system, Types of Ignition Systems, Modern Ignition System (Transistorized Coil Ignition System, Capacitive Discharge Ignition System)

ENGINE COOLING SYSTEMS

Types of cooling systems (water & air cooling), Types of cooling fans, Water pump, Radiators, Thermostat, Coolant/anti freeze solution

LUBRICATION SYSTEM

Functions & types of lubrication systems and it's components including Engine Lubrication circuit, Types of Lubricating pumps, Oil coolers, Types of oils, Lubricant properties and additives for lubricants, Big end & small end bearings

UNIT 4

[14 hours]

INTAKE AND EXHAUST SYSTEM

Exhaust/Intake systems, Types of air cleaners, Supercharger, Turbo charger, Silencers, Catalytic convertor, Emission norms, Exhaust gas emission constituents and analysis

ENGINE PERFORMANCE AND TESTING

Study of various performance parameters, Valve timing, Friction losses, Ignition timing, Compression ratio, Inlet temperature etc., Measurement of power, Fuel consumption, Air-fuel ratio, Efficiency, Heat balance sheet, Engine troubleshooting.

Course Outcomes

After learning the course the students should be able to understand the basic working principles of engines, its Construction and Operation, phenomena of Combustion and Design of Combustion Chambers, Engine Testing and Performance and Performance characteristics.

Text Books

1. V. Ganesan, "Internal Combustion Engines", Tata McGraw-Hill Education, Edition 4, 2013.

2. Domkundwar, “Internal Combustion Engines”, Dhanpat Rai Publication, 2013.

Reference Books

1. James D Halderman, “Automotive Engines”, Pearson, Edition 4, 2014
2. S Srinivasan, “Automotive Engines”, Tata McGraw-Hill Education, Fifth Reprint, 2007

Web Resources

1. nptel.ac.in/courses/112104033/ - engine emissions
2. nptel.ac.in/downloads/112104033/ - engine combustion
3. nptel.ac.in/courses/103105110/m5l40.pdf – Engine classifications and fuels

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Engine components and Engine operating cycles.	Basic knowledge of engine components, and different operating cycles in IC engines
2.	Performance test on Two stroke, Single cylinder Petrol engine	Measuring performance parameters of 2 stroke single cylinder engines
3.	Performance test on Four stroke, Single cylinder Diesel engine	Measuring performance parameters of 4 stroke single cylinder diesel
4.	Performance test on Four stroke, Three cylinder Petrol engine	Measuring performance parameters of Four stroke, Three cylinder Petrol engine
5.	Morse test on four stroke, Three cylinder petrol engine	Measuring performance parameters of four stroke, Three cylinder petrol engine
6.	Experimental study of smoke meter	Knowledge of exhaust pollutants coming from diesel engines
7.	Air Pollution from IC Engines	Knowledge of exhaust pollutants coming from petrol engines
8.	Ignition systems	Basic knowledge and fundamentals of battery / magnetic ignition system
9.	Lubrication systems	Basic knowledge and fundamentals of different lubricating system
10.	Fuel injection systems use in S.I.Engine and C.I.Engine	Knowledge and various parameters for fuel supply in SI and CI engines
11.	Cooling systems	Basic knowledge and fundamentals of different cooling system
12.	Pollution Control Norms &Testing	Euro Norms, Bharat Stage Norms

Subject: **Two & Three Wheeler Technology**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0503			Semester: **V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	0	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. To make the students to know and understand the constructional details of two & three wheelers
2. Study about operating characteristics and vehicle design aspects of Two & Three Wheelers.

CONTENTS

UNIT 1

[15 hours]

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

[18 hours]

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.

UNIT 3

[12 hours]

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 & TIRES

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

[15 hours]

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.

Course Outcomes

1. Learning of different types of two and three wheelers.
2. Learning of special parts and their importance and working in two and three wheelers.
3. Learning of maintenance of two and three wheelers

Text Books

1. Newton Steed, "The Motor Vehicle", McGraw Hill Book Co. Ltd., New Delhi,2010
2. Siegfried Herrmann, "The Motor Vehicle", Asia Publishing House, Bombay,2011
3. Staff & Motor Cycles ,"Two stroke Motor Cycles", London llefe Books,2003
4. Dhruv U Panchal,"Two and three wheelers", Pearson Publications,2007

Reference Books

1. G.B.S. Narang, "Automobile Engineering", 5th Edition, Khanna Publishers, Delhi,2010
2. Irving,P.E., "Motor cycle Engineering", Temple Press Book, London, 1992.

Web Resources

1. http://www.carbibles.com/suspension_bible_bikes.html - Motorcycle Suspension
2. http://www.carbibles.com/brake_bible.html - Brakes
3. http://www.carbibles.com/fuel_engine_bible.html - Fuels & Engines

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Dismantling & assembling of a two wheeler engine	Ability to understand the assembly and layout pattern of Two wheelers and engine.

2.	Study of motorcycle & scooter carburetors & petrol injection system.	Ability to understand the carburetion process and function of carburetor.
3.	Dismantling & assembling of two wheeler gear box	Gearbox assembly and functionality
4.	Study of I) Kick starter mechanism ii) Moped cranking mechanism iii) Button Start mechanism	Understanding of (a) Kick starter mechanism (b) Moped cranking mechanism (c) Button Start mechanism
5.	Study of three wheeler drive line & chassis	Understanding of driveline layout and function
6.	Rear & front brake overhauling & adjustments	Understanding of working and importance of brakes in two and three wheelers.
7.	Study of handle bar controls & adjustments	Basic understanding of handlebars of different kinds and their mounts.
8.	Dismantling & assembling of flywheel magneto & setting ignition timing	Understanding of assembly of flywheel magneto & setting ignition timing
9.	Study of wiring diagram & electrical systems	Understanding of wiring diagram & electrical systems
10.	Dismantling & assembling of the suspension system	Understanding ofDismantling & assembling of the suspension system

Subject: **Automobile Electrical Systems**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0504			Semester: **V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

The course aims to impart basic skills and understanding of automotive electrical systems, equipment and their working details.

CONTENTS

UNIT 1

[12 hours]

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, color 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

UNIT 2

[13 hours]

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.

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

UNIT 3

[12 hours]

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 4

[10 hours]

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 indictor, 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

Course Outcomes

After learning the course the students should be able to:

1. Understand the basic auto electrical systems.
2. Understand the layout of wiring and connections of electrical systems in automobiles.
3. Understand the working of different electrical components used in automobiles.

Text Books

1. L. Statini , “Automobile Electrical and Electronics” by, Delmar Publications ,2010
2. P. L. Kohli “Automotive Electrical Equipments”, by, Tata McGraw Hill Pub. Co. Ltd,2007

Reference Books

1. Young, Griff “The Automobile Electrical & Electronic Equipments” , The English Language Book Co., London.,2014
2. W. Crouse ,”Automotive mechanics” by, TMH,2012

Web Resources

http://www.nptel.ac.in/courses/108103009/ - Whole Syllabus covered

LIST OF EXPERIMENTS

No.	Title	Learning Outcomes
1.	Characterization of Alternator and its Testing.	Understanding of Characterization of Alternator and its Testing
2.	Characterization of Battery, Regulators & its testing.	Understanding of Characterization of Battery, Regulators & its testing
3.	Characterization of Starter Motor and its testing.	Understanding of Characterization of Starter Motor and its testing
4.	Characterization of Dynamo and its Testing.	Basic understanding of Characterization of Dynamo and its Testing
5.	To study about ignition systems.	Basic understanding about ignition systems.
6.	To study about Multi Point Fuel Injection System.	Understanding of Multi Point Fuel Injection System
7.	To study about Sensors and actuators.	Understanding of Sensors and actuator
8.	To study about Electrical Equipments & Accessories	Understanding of Electrical Equipments & Accessories

Subject: **Vehicle Body Engineering**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0505			Semester: **V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To expose the fundamentals in various automotive body construction techniques.
2. To integrate the concepts of aerodynamics in body engineering for better style and low drag.

CONTENTS

UNIT 1

[14 hours]

VEHICLE AERODYNAMICS

Objectives ,Vehicle drag and types ,various types of forces and moments ,effects of forces and moments ,side wind, various body optimization techniques and Aerodynamic Aids for Optimization of drag ,wind tunnel testing of scale model, component balance to measure forces and moments. Case Study of all relevant point of views(Aerodynamics and body engineering)

UNIT 2

[12 hours]

CAR BODY DETAILS

Types of car bodies Constructional details of a passenger car. Visibility: Regulation, Driver's visibility, Seat design, Methods of improving visibility. Safety: Safety aspects in design. Painting process of a passenger car body.

BUS BODY DETAILS

Classification of bus bodies – Based on distance traveled, Based on capacity of the bus and based on style & shape. Types of metal section used in the construction and regulations. Construction of conventional and integral type buses& comparison.

UNIT 3

[10 hours]

COMMERCIAL VEHICLE DETAILS

Classification of commercial vehicle bodies. Construction of Tanker body and Tipper body. Dimensions of driver seat in relation to controls. Driver cabin design for compactness.

COMMERCIAL VEHICLE AERODYNAMICS

Effects of rounding sharp front body edges. Effects of various cabs on trailer body. Fore body pressure distribution. Effects of a cab to trailer body roof height. Commercial vehicles drag reduction devices.

UNIT 4

[12 hours]

BODY MATERIALS

Metal sheets (Steel, Aluminum etc.), plastics, timber, GRP, FRP, Insulating materials, adhesives and sealants. Wind screen, Back light & window Glasses and regulations for glasses. Difference between toughened glass, sheet glass & laminated glass. Composite materials, properties of materials, corrosion, anti-corrosion methods, selection of paint and painting process, body trim items, body mechanisms.

BODY LOADS

Idealized structure, structural surface, shear panel method, symmetric and asymmetric vertical loads in a car, longitudinal load, different loading situations, chassis frame design, Construction of Doors, door apertures, windows. Spare wheel carrier construction and design for different types of vehicle and weight distribution criteria in relation to Spare wheel location. Sources of body noises testing and methods of elimination. Water leakage test.

Course Outcomes

After learning the course the students should be able to:

1. Understand and have knowledge about different aspects related to body and chassis.
2. Understand various safety provisions.
3. Design the chassis and able to select the section of same.
4. Design the cabin and frame component to transfer the force and optimize from safety and cost point of view.

Text books

1. Heinz Heisler, “Advanced Vehicle Technology”, 2nd edition, Butterworth –Heinemann, 2002.
2. Wolf-Heinrich Hucho, “Aerodynamics of road vehicles”, 4th edition, 2000.

Reference Books

John Fenton, “Vehicle Body layout and analysis”, Mechanical Engineering Publication Ltd., 1984

Web Resources

1. https://en.wikipedia.org/wiki/Commercial_vehicle - Commercial vehicles

2. http://www.techno-preneur.net/technology/project-profiles/mechanics/bus5.html - Bus Body
3. http://web.iitd.ac.in/~achawla/public_html/736/3-Automotive_chassis-design-v2.pdf - Auto. body design
4. https://www.slideshare.net/friendsrtg/vehicle-body-engineering-introduction - Vehicle Body Engineering
5. https://www.osti.gov/scitech/servlets/purl/1116021/ - Lightweight composite materials for heavy duty vehicles

Subject: **Automobile Fuels & Pollution Control**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0506			Semester: **V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

This course will provide knowledge about reasons for automobile pollutants and means to reduce them and provide opportunity to develop skills in measuring pollutions and maintain Emission control devices.

CONTENTS

UNIT 1

[12 hours]

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, NOx, 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:- Thermal Converters, Catalytic Converters, Chemical Methods, Ceramic Engine coatings, Evaporative emission Control; future sources of energy other than alternate fuels

UNIT 2

[14 hours]

ALCOHOL

Sources of Methanol and Ethanol, methods of it's 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 DIESEL

Base materials used for production of Bio Diesel (Karanji 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

[11 hours]

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

[12 hours]

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)

Course Outcomes

After learning the course the students should be able to:

1. Get the introduction to alternative fuels like biofuels – Alcohol , Biodiesel, Biogas
2. Understand hydrogen gas as fuel of the future
3. Get the introduction to fuel cell technology for automobiles
4. Get the introduction of Electric and Hybrid vehicles

Text Books

1. Pundir.B.P, "Engine Emissions", Narosa Publishing House, 2007, ISBN-10: 8173198195
2. Ganesan.V, Internal Combustion Engines, Tata McGraw Hill Co., Edition 4, 2013.
3. Ramalingam.K.K, "Automobile Engineering", Scitech Publications Pvt. Ltd., 2011, ISBN-10: 8188429481

Reference Books

1. Amitosh De, "Automobile Engineering", Galgotia Publications Pvt. Ltd., 2011, ISBN-10: 8175156406
2. Heywood. J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., Edition 1, 1988.

Web Resources

1. http://nptel.ac.in/courses/112104033/pdf_lecture/lecture39.pdf - properties of Alternate fuels, alcohol: methanol & ethanol, natural gas, effect of Natural Gas on emission, LPG
2. http://nptel.ac.in/courses/112104033/39 - Alternate Fuels
3. http://nptel.ac.in/Clarify_doubts.php?subjectId=112104033&lectureId=40 – Hydrogen Fuels & Quality Requirements

LIST OF EXPERIMENTS

No.	Title	Learning Outcome
1.	Study of physical & chemical properties of fuels	The physical and chemical properties of fuel will indicate the behavior of the duel during combustion
2.	Study of use of alternate liquid fuels for S.I. engines	Study will be done on the fuels which are easy to manufacture or obtain will be done that exhibits the properties of liquid fuels of SI engine
3.	Study of use of alternate liquid fuels for C.I. engines	Study will be done on the fuels which are easy to manufacture or obtain will be done that exhibits the properties of liquid fuels of CI engine

4.	Study of fuel cell powered vehicle	Student will understand the procedure of obtaining Hydrogen generation with the help of Fuel cell
5.	Study of use of alternate gaseous fuels for S.I. engines	Study will be done on the fuels which are easy to manufacture or obtain will be done that exhibits the properties of gaseous fuels of SI engine
6.	Study of use of alternate gaseous fuels for C.I. engines	Study will be done on the fuels which are easy to manufacture or obtain will be done that exhibits the properties of gaseous fuels of CI engine
7.	Study of solar powered vehicle.	Generation and storage of power used in the vehicle by solar energy will be studied and understood.
8.	Study of battery operated vehicles.	Basic knowledge of construction and working of battery.Also, the capability enhancement of the battery will be studied
9.	Layout preparation for Hybrid vehicles	Basic knowledge of different layout of Hybrid system will be understood

Subject: **Technical Communication and Soft Skills**								
Program: **B.Tech. All Branches**				Subject Code: **SHO507**			Semester: **V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	0	0	0	60	0	40	0	100

Course Objectives

1. To enable students to interact with a degree of fluency and spontaneity that makes regular interaction with fluent English speakers quite possible without strain for either party.
2. To understand with ease virtually everything heard or read.
3. To express themselves spontaneously, very fluently and precisely, differentiating finer shades of meaning even in the most complex situations.
4. To understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment).
5. To communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters
6. To understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in their field of specialization.

COURSE CONTENTS:

	Sr. No.	**Content**
Listening	1	**Listening: Cloze test**
	2	**Listening to Talks (BBC, TED) 1**
	3	**Listening to Talks 2**

Speaking	**4**	**Phonetics: Sounds & Symbols & Accent Patterns**
	5	**Vocabulary Games: Intermediate Level**
	6	**Vocabulary Games: Intermediate Level**
	7	**Building Dialogues: Situational Conversation**

	8	**Role Play**
	9	**Group Discussion**

Reading	**10**	**How to Read effectively**
	11	**Reading to Remember : SQ3R**

Writing	**12**	**Grammar Intermediate: Sentence Transformation**
	13	**Common Errors in English**
	14	**Précis Writing**
	15	**Effective Paragraph Writing**

6TH SEMESTER

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –VI TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017														
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME						
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	AU0601	Off Road Vehicles	3	0	0	3	3	30	10	60	00	00	100
2	AU0602	Automobile Component Design	3	2	2	5	7	30	10	60	40	60	200
3	AU0603	Automotive Hydraulics & Pneumatics Systems	3	2	2	5	7	30	10	60	40	60	200
4	AU0604	Vehicle Fault Diagnosis & Testing	3	0	4	5	7	30	10	60	40	60	200
5	AU0605	Automotive Safety, Ergonomics & Auxiliary systems (DE-I)	3	0	2	4	5	30	10	60	00	00	100
6	AU0615	Tires and Alignment Basics – MOOC (DE-I)	-			4	Offered by www.class-central.com						
7	AU0606	Automotive and Combustion Engine Technology (DE-II)	3	0	0	3	3	30	10	60	-	-	100
	AU0607	Automobile Materials (DE-II)											
	AU0608	Industrial Engineering (DE-II)											
	AU0609	Automotive Infotronics & Autotronics (DE-II)											
	AU0611	Vehicle Performance & Testing (DE-II)											
	AU0612	Automotive Quantitative Techniques (DE-II)											
	AU0613	Automobile Air Conditioning (DE-II)											
8	SH0607	Advanced Technical Communication and Soft Skill	1	-	-	-	1	-	-	-	-	-	100
TOTAL			**19**	**4**	**10**	**25**	**33**	**180**	**60**	**360**	**120**	**180**	**1000**

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

Subject: Off Road Vehicles								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0601			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. Classification and requirements of off road vehicles
2. Tractors, Earth moving machines, Scrapers and graders, Shovels and Ditchers.
3. Classification and requirements of Off road vehicles

CONTENTS

UNIT 1

[10 hours]

INTRODUCTION TO OFF ROAD VEHICLES

Land clearing machines Earth moving machines Scrapers and graders Shovels and ditchers' Power plants, chassis and transmission, multiaxle vehicles.

STUDY OF WORKING PRINCIPLES & DESIGN CONSIDERATIONS

Power system, transmission, final drive, lubrication, electrical, braking, steering, pneumatic & hydraulic control circuits.

UNIT 2

[12 hours]

CONSTRUCTIONAL WORKING FEATURES AND INSTRUMENTATION

Transport equipment: Powered equipment, Tractors and Trollies, Trailers, Platform lift trucks, Fork lift trucks, containers and Supports. Hauling equipment: Types of dump trucks, On-high way vehicles, off high way vehicles. Hoisting equipment: Jacks, truck mounted crane, Crawler crane, Outriggers.

UNIT 3

[13 hours]

TRACTORS

Tractors and tractors units; Tractors in earth moving ,applications of tractors, Rating of Tractors, Wheeled and Crawler tractor, Recent trends in tractor design, power shift transmission and final drive in caterpillar tractor. Motor grader, recent trends, control mechanism of a caterpillar motor grader.

EARTH MOVING MACHINES

Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self-Powered types - dump trucks and dumpers - loaders, single bucket, multi bucket and rotary types - power and Capacity of earth moving machines.

UNIT 4

[12 hours]

SCARPER AND GRADERS

Scrapers, elevating graders, self-powered scrapers and graders. Shovels and Ditchers: Power shovel, revolving and stripper shovels - drag lines - ditchers - capacity of shovels. Land clearing machines: Bush cutter, stampers, tree dozer, rippers.

SHOVELS AND DITCHERS

Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

SPECIAL PURPOSE VEHICLES

All terrain vehicles, Defence Vehicles,Special Purpose Electric Vehicles, Solar Vehicles and Hybrid Vehicles. Types, architecture and parameters of design considerations.

Course Outcomes

1. Students will be able to understand special type of vehicles based on the need and purpose.
2. Students will be able describe the working principles.
3. Students will be able to understand design considerations and features of special purpose vehicles.

Text book

Abrosimov. K. Bran Berg. A. and Katayer. K., “Road making Machinery”, MIR Publishers, Moscow, 1971.

Reference Books

1. Wang. J. T., “Theory of Grand vehicles”, John Wiley & Sons, New York, 1987.
2. Mahesh Varma, “Construction Equipment and its Planning and Applications, Metropolitan Books Co., Delhi, 2004.

Web Resources

1. https://drive.google.com/drive/folders/0B5ghhqKc4g0dUkVqbG42cU8wYlU - Whole Syllabus

2. http://www.uotechnology.edu.iq/dep/building/LECTURE/structural%20engineering/third_class/Methods%20of%20Construction%20-%203rd%20Class/semester1/6-Excavating% 20 Equipment –Power%20Shovels.pdf– Shovels
3. http://www.bis.org.in/sf/med/me07_1237.pdf- Earthmovers
4. www.hillagric.ac.in/edu/coa/agengg/lecture/.../Lecture%209%20Farm%20tractor.pdf - Farm Tractors, power tillers and their types.

Subject: : Automobile Component Design								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0602			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

To make student get acquainted with to standardize the automobile part after designing the component like gear, gear box, piston, connecting rod, piston pin, crank shaft, valve mechanism, Cylinder liner, flywheel etc and to select the required bearing for same by considering the different design considerations.

CONTENTS

UNIT 1

[11 hours]

DESIGN CONSIDERATIONS

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.

DESIGN OF BEARINGS

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

[12 hours]

DESIGN CONSIDERATION OF GEARS, MATERIAL SELECTION AND GEAR LUBRICATION

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.

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

Bevel Gears: 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.

UNIT 3

[12 hours]

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

DESIGN OF GEARBOX: 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.

UNIT 4

[12 hours]

DESIGN OF I.C. ENGINE COMPONENTS

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

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

PART-II : 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.

Course Outcomes

1. Student will be able to select and design the different automobile components.
2. Student will be able to standardize the different parts.
3. Student will be able to give reasons of assumptions made while designing the component with reference to manufacturing assembly, thermal and wear considerations point of view.

Text Books

1. V.B.Bhandari,"Design of machine element",Tata Macgraw Hill,2010.
2. J.S.Soni ,"Design of Machine Element",Nirav & Roopal Prakashan,2008.
3. S.P.Patil ,"Mechanical System Design",Jaico Publication,2nd Editition,2004.

Reference Books

1. Joseph E. Shigley & Larry D. Mitchell, "Mechanical Engineering Design",McGraw-Hill International Book Company,Fourth Edition.
2. R.S.Khurmi & J.K.Gupta ,"Machine Design",S.Chand & Co.,2005.
3. R.B.Gupta ,"Auto Design",Satya Prakashan,New Delhi,2003.

Web Resources

1. http://confident-instruments.com/Piston_Study.htm- Modern Piston Design
2. http://www.youtube.com/watch?v=gfNR4kGhChs- Piston Design Evolution
3. http://en.wikipedia.org/wiki/Connecting_rod - Connecting rod
4. http://www.youtube.com/watch?v=M8TF1lY2T-4 - Connecting rod design procedure
5. http://en.wikipedia.org/wiki/Crankshaft - Crankshaft
6. http://en.wikipedia.org/wiki/Flywheel - Flywheel
7. http://www.youtube.com/watch?v=1wDmsevZsRY - Clutch Design

LIST OF EXPERIMENTS

No.	Title	Learning Outcomes
1.	Design Considerations for Automotive Components	Students are understand the basic steps of design procedure
2.	Design of Rolling contact Bearings	Students have knowledge about design procedure of Rolling contact Bearings for manufacturing
3.	Study and Design of Spur Gear	Students are familiarity about Spur gear and also have knowledge to design the spur gear
4.	Study and Design of Helical Gear	Students are familiarity about Spur gear and also have knowledge to design the Helical Gear
5.	Study and Design of Bevel Gear	Students are familiarity about Spur gear and also have knowledge to design the Bevel Gear
6.	Study and Design of Worm & Worm Gear	Students are familiarity about Spur gear and also have knowledge to design the Worm & Worm Gear
7.	Design of Commercial Gearbox	Students got knowledge about design procedure and types of commercial gear box
8.	Design of I.C. Engine Components	
	(a) Design of Cylinder	To be aware of and study design procedure of Cylinder block
	(b) Design of Piston	To be aware of and study design procedure of Piston
	(c) Design of Connecting rod	To be aware of and study design procedure of Connecting rod
	(d) Design of Crankshaft	To be aware of and study design procedure of Crankshaft
9.	Design of Valve operating Mechanism used in I.C.Engine	Students got knowledge about design procedure of valve operating mechanism
10.	Design Of Intake & Exhaust Manifold in I.C.Engine	Students got knowledge about design procedure of Intake & Exhaust Manifold

Subject: Automotive Hydraulics & Pneumatics Systems								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0603			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

1. Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application. Develop a circuit diagram.
2. Visualize how the hydraulic/pneumatic circuit will work to accomplish the function.

CONTENTS

UNIT 1

[10 hours]

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

[12 hours]

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

[14 hours]

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

[14 hours]

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.

Course Outcomes

After learning the course, the students should be able to:

1. Identify and analyse the functional requirements of a power transmission system for a given application. (Application involving fluid power transmission)
2. Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application. Develop a circuit diagram.
3. Visualize how the hydraulic/pneumatic circuit will work to accomplish the function.

Text Books

1. A. Esposito , “Fluid Power with applications” ,PHI, 3rd edition, 2010
2. R Srinivasan , “Hydraulic and Pneumatic Controls”, Tata McGraw Hill, 2nd edition, 2003.

Reference Books

1. Andrew Parr , “Hydraulic & pneumatics”, Jaico Publishing House, 4th edition, 2004.
2. D.A. Pease , “Basic fluid power”, PHI, 2nd edition, 2005.
3. S R Majumdar , “Basic Pneumatic Systems, Principle and Maintenance” , McGraw-Hill, 2nd edition, 1996.

Web Resources

1. http://nptel.ac.in/courses/112105046/27 - Introduction To Fluid Power /Types Of Hydraulic Fluids And Their Properties
2. http://www.nitc.ac.in/dept/me/jagadeesha/mev303/Chapter2_Hydraulics_control_in_machine_tools.pdf - Hydraulic System Elements: Control Of Fluid Power Elements
3. http://nptel.ac.in/courses/112106175/downloads/Module%201/FAQ/FAQ-Lecture%201.pdf - Hydraulic Servo-System For Rotary And Linear Motions
4. http://www.iranfluidpower.com/pdf/BTP%20Fluid%20power/Hydraulic%20Troubleshooting.pdf - Maintenance And Trouble Shooting Of Hydraulic Circuits
5. http://nptel.ac.in/courses/112105046/35 - Pneumatic Systems & Pneumatic Circuits

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Symbols used in hydraulics and pneumatics	Students will be given a list of symbols for Hydraulic and Pneumatic components. They will use the software and prepare the symbols with designation. This sheet will be attached.
2.	To and fro motion of the double acting cylinder.	Design the circuit using Hydraulic power pack, Double acting cylinder, Direction control valve, Hydraulic motor.
3	Three different speed of piston in one stroke.	Design the circuit using pump unit, 4/3 DCV, three 2/2 DCV, two Flow control valve, check valve, one cylinder
4.	Sequential operation of the two linear actuators using sequence valve	Design the circuit using Hydraulic power pack, Two Double acting cylinder, Direction control valve, Two sequence valve, Two check valves.
5.	Determine effect of Bleed Off and Regenerative Circuit on the movement of actuator.	Design the circuit using Hydraulic power pack, Double acting cylinder, Direction control valve, flow control valve.
6.	Speed control of the linear actuator with Meter In and Meter out Circuits.	Design the circuit using Hydraulic power pack, Double acting cylinder, Direction control valve, flow control valve.
7.	To and fro motion of the double acting cylinder for Pneumatics.	Design the circuit using Pneumatic power pack, Double acting cylinder, 3/2 DCV,5/2 DCV
8.	AND operation using twin pressure valve and to study OR operation with shuttle Valve.	Design the circuit using Pneumatic power pack, Double acting cylinder, twin pressure valve,5/2 DCV, shuttle Valve.

9.	Pneumatic circuit using flow control valve and time delay valve.	Design the circuit using Pneumatic power pack, Double acting cylinder, flow control valve,5/2 DCV, time delay valve.
10.	Cascading of two cylinder and three cylinders	Design the circuit using Pneumatic power pack, Double acting cylinder, flow control valve,5/2 DCV, time delay valve

Subject: **Vehicle Fault Diagnosis & Testing**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0604			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	4	5	24/60	24/60	16/40	16/40	200

Course Objectives

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

CONTENTS

UNIT 1

[12 hours]

VEHICULAR MAINTENANCE PRACTICES IMPORTANCE & TYPES OF MAINTENANCE SCHEDULES

(Daily, weekly and monthly), Scheduled Maintenance Charts, Breakdown, Preventive, Predictive maintenance practices.

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.

TOOLS & EQUIPMENTS VARIOUS TOOLS AND EQUIPMENT

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

UNIT 2

[12 hours]

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.

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

[11 hours]

CHASSIS MAINTENANCE REPAIRING OF GEAR BOX AND SHIFTING MECHANISM

Final drive and differential maintenance, differential back lash adjustment, Wheels and tire 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

[12 hours]

ELECTRICAL SYSTEM MAINTENANCE - SERVICING & REPAIR

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.

MISCELLANEOUS SYSTEMS

Servicing & Repair Air Conditioning Systems, Body repairing and denting

Course Outcomes

1. Learning of maintenance types/techniques.
2. Learning of different garage equipments and practices.
3. Learning of workshop documents and records.

Text Books

1. Doshi, Panchal & Maniar ,"Vehicle Maintenance & Garage Practices" PHI India ,2016
2. Crouse "Automotive mechanics" , TMH Publications,2013

Reference Books

1. John Doke "Fleet Management", , McGraw-Hill Co., 1984
2. James D Halderman "Advanced Engine Performance Diagnosis", , PHI, 1998
3. Anil Chikara "Automobile Systems"-2012

Web Resources

1. https://www.youtube.com/watch?v=oE2ol2qyqnA – Four post hoist demonstration
2. https://www.youtube.com/watch?v=bRN9hJB8O-8 – Wheel balancing
3. https://www.youtube.com/watch?v=MiYJwJvbFoQ – Wheel Alignment
4. https://www.youtube.com/watch?v=uz6l3cmXcy0 – Overhauling of Diesel Engines
5. https://www.youtube.com/watch?v=FfTX88Sv4I8&list=PL6475B40A65E70AF6 – Engine overhauling sessions

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Study of modern workshop layout	Understanding of modern workshop layouts
2.	Study of different types of job cards & maintenance schedule chart.	Understand different types of job cards & maintenance schedule chart.
3.	Study of measuring, gauging & service equipments	Operate and understand the importance of measuring, gauging & service equipments
4.	Demonstration on tire inflator and hydraulic hoist.	Operate and understand the importance of on tire inflator and hydraulic hoist
5.	Demonstration on tire changer and car washer unit.	Demonstration on tire changer and car washer unit
6.	Performance on wheel balancer.	Understanding of Performance on wheel balancer
7.	Performance on wheel aligner.	Understanding of Performance on wheel alinement
8.	Cleaning and testing of petrol injector	Understanding of Cleaning and testing of petrol injector
9.	Cleaning and testing of different types of nozzles.	Understanding of Cleaning and testing of different types of nozzles
10.	Bleeding of hydraulic brakes	Understanding of Bleeding of hydraulic brakes
11.	Performing the tappet clearance and use of feeler gauge.	Understanding of Performing the tappet clearance and use of feeler gauge.
12.	Study of different workshop documents & records	Understanding of different workshop documents & records

Subject: **Automobile Safety, Ergonomics and Auxiliary Systems (DE-I)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0605			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. To provide an understanding of automotive safety, comfort systems &its future prospects.
2. This Subject also focuses on the ergonomic and its related issues.

CONTENTS

UNIT 1

[11 hours]

DESIGN OF AUTOMOTIVE BODY AND SAFETY

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

UNIT 2

[12 hours]

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 3

[12 hours]

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 4

[12 hours]

COLLISION WARNING AND AVOIDANCE

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

COMFORT SYSTEMS

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

Course Outcomes

After learning these subject students will able to:

1. Understand and analyze the safety systems requirements for automobiles
2. Understand and analyze the comfort system requirements for automobiles

Text books

Vivek D. "Ergonomics in the Automotive Design Process" Bhise publisher CRC press, Taylor and Francis group,-2005.

Reference Books

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

Web Resources

1. http://drivingergonomics.lboro.ac.uk/downloads/vehicle%20ergonomics%20and%20best%20practice%20guide.pdf - Ergonomics for vehicles
2. https://onlinecourses.nptel.ac.in/noc17_me26/preview- Safety procedures for Automobiles

LIST OF EXPERIMENTS

No	Title	Learning Outcome
1.	Study of safety parameters in passenger vehicle.	Basic of safety standards
2.	Study of behavior of vehicle body during different operating conditions.	Vehicle testing methods
3.	Design and safety analysis of roll cage for off-road car.	Roll cage design basics and Testing for safety

4.	Design and safety analysis of roll cage for Formula Car.	F1 design constraints and testing of F1 chassis
5.	Ergonomics study of a car.	Basic of ergonomics related to Cars
6.	Ergonomics study of commercial vehicle.	Basics of ergonomics related to commercial vehicles
7.	Study of various advanced system designed developed to avoid collision.	Study of various advanced systems for collision protection
8.	Study of noise level of different vehicles.	Basics of noise testing
9.	Study of various crash tests to be carried out on a vehicle.	Different crash testing standards and results
10.	Case study on different vehicle models and comparison in terms of safety and ergonomics	Real time comparison of vehicles in terms of safety and ergonomics

.

Subject: **Automotive and Combustion Engine Technology(DE-II)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0606			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

The course focuses at imparting knowledge and process of combustion regarding automobile engines. Students examine the combustion process and characteristics of different types of internal combustion engines: spark ignition, diesel, stratified-charge, GDI and HCCI engines.

CONTENTS

UNIT 1

[12 hours]

OVERVIEW OF GASOLINE DIRECT INJECTION ENGINES

Introduction, overview of direct injection gasoline engines, potential and technologies for high efficiency direct injection gasoline engine, high pressure fuel injection system, exhaust emissions and after treatment devices

UNIT 2

[12 hours]

STRATIFIED CHARGE COMBUSTION IN DIRECT INJECTION GASOLINE ENGINES

Introduction, thermodynamics and combustion process, production engines with stratified gasoline direct injection

UNIT 3

[12 hours]

TURBOCHARGED DIRECT INJECTION SPARK IGNITION ENGINE

Introduction, historical background: turbocharging for high specific output, problems and challenges associated with turbocharging spark ignition engines, advantages of combining direct injection and turbocharging in spark ignition engines, challenges of applying direct injection to a turbocharged spark ignition engine

UNIT 4

[12 hours]

DIRECT INJECTION GASOLINE ENGINES WITH AUTO IGNITION COMBUSTION

Introduction, principle of auto ignition combustion in the gasoline engines, approaches to auto ignition combustion operation in gasoline engines, operation and control of direct injection gasoline engines with auto ignition combustion.

HOMOGENOUS CHARGE COMPRESSION IGNITION (HCCI) ENGINES

Introduction, HCCI combustion fundamentals, Gasoline HCCI engine, Diesel HCCI combustion engines, operational limits and emissions.

Course Outcomes

After learning the course the students should be able to:

1. They will got knowledge latest technology of automobile engineering field
2. They got knowledge about future of I. C. engine.
3. Describe basic concepts of combustion process in SI, CI, HCCI, GDI engine.
4. Describe and analysis effect of super charging in petrol engine.
5. Describe and analysis effect of stratification in engine.

Text Books

1. H Zhao, ”Advanced Direct Injection Combustion Engine Technologies and Development”, ,Elsevier, Vol.1
2. H Zhao ,“HCCI And CAI Engines For The Automotive Industry”,Elsevier,2007
3. H.N. GUPTA, ”Fundamentals of Internal Combustion Engines”, PHI Learning Pvt. Ltd., 2nd ed.,2012

Reference Books

1. V Ganesan ,”Internal combustion engine”, Tata McGraw-Hill Education, 2002
2. Dennis N Assanis , Fuquan Zhao , James A Eng , John E Dec , Paul M Najt , Thomas N Asmus, “Homogeneous Charge Compression Ignition (HCCI) Engines: Key Research and Development Issues Hardcover”,SAE, 2003-1-1

Web Resources

1. https://cdn.intechopen.com/pdfs-wm/43660.pdf - HCCI engines
2. training.sae.org/seminars/c1009/ - GDI engines
3. https://en.wikipedia.org/wiki/Supercharger - Supercharger
4. https://en.wikipedia.org/wiki/Turbocharger - Turbo Charger
5. https://www.youtube.com/watch?v=LjJSbHxIvnM - Bosch gasoline direct injection
6. https://www.youtube.com/watch?v=i534p49-HOI - High Pressure Fuel Injection Pump
7. https://www.youtube.com/watch?v=-bgBA0zvgKk - Stratified Fuel injection Animation
8. https://www.youtube.com/watch?v=d021ePu_3wo- FSI (Fuel Stratified injection)BOSCH
9. https://www.youtube.com/watch?v=H6p0sVdMeeQ - GDI vs PFI Fuel Injection

Subject: **Automobile Materials (DE-II)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0607			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To develop the knowledge of Automotive engineering materials and Selection
2. To develop the knowledge of materials and their applications in automotive
3. Applications in different sectors.
4. To introduce the concepts of heat treatment and surface modification techniques
5. To introduce knowledge in advanced metallic and non metallic materials

CONTENTS

UNIT 1

[12 hours]

REVIEW OF MECHANICAL AND CHEMICAL BEHAVIOR OF MATERIALS

Structure of crystalline solids, imperfections in solids, Plastic deformation Strengthening mechanisms Griffith's theory of failure modes –Damping properties of materials fracture toughness Initiation andpropagation of fatigue cracks Creep mechanisms environmentally induced degradation and preventivesolutions

ENGINEERING ALLOYS

Cast iron, steels, alloy steels - significance of iron – iron carbide equilibrium diagram in design steels and cast irons, stainless steels –, types, specific applications, heat treatment, effect of alloying elements Aluminum, Magnesium and Ti wrought and cast alloys used in automotive applications – Types, specifications, heat treatment

UNIT 2

[12 hours]

AUTOMOTIVE COMPONENTS & MATERIAL SELECTION

Organized process of Selection of Materials for different components. Materials for Power train components like cylinder block ,head& liner, piston &piston rings, gudgeon pin, connecting rod, bearings, crankshaft, flywheel, camshaft, valves, valves seats, springs, gear train, chain &belt drives. Materials for Automobile components like body –in –white, crash worthiness, suspension systems, cabin interiors. Functional requirements, manufacturing processes & failure modes for each.

NON METALLIC MATERIALS

Elastomers and Engineering Plastics, FRP Composite materials, ceramics, laminated &heat treated glass, adhesive bonding, An over view of Manufacturing processing, their characteristics features, types and applications

UNIT 3

[12 hours]

SURFACE MODIFICATION OF MATERIALS

Mechanical surface treatment and coating -Case hardening and hard facing -thermal spraying – vapour deposition-iron implantation -Diffusion coating -Electroplating and Electro-less - Conversion coating -Ceramic and organic coatings – laser based surface modification Diamond coating.

INTRODUCTION TO COMPOSITE MATERIALS

Definitions: Composite material, Fiber, Matrix. Types of fibers and Raw Fiber Properties, Types of Matrix, Prepegs, Fillers and other Additives

UNIT 4

[12 hours]

MODERN MATERIALS AND ALLOYS

Light weight materials & implications on vehicle design,, Micro alloyed, high strength low alloy steel – High strength Steels (HSS), Advanced High Strength Steels (AHSS), Ultra high strength Steels (UHSS), developments in Aluminum and Magnesium alloys, Advanced forming & joining processes like - Hydro forming, Warm forming, Laser welding techniques, Induction heating, etc; carbon fiber composites, Natural fibers, refractory metals, SMART Materials - shape memory alloys (SMA), Piezo-electric materials, MEMS, Metallic glass-Quasi crystal and Nano crystalline materials, metal foams.

BASICS OF COMPOSITES

Mechanical Behavior of Composite Materials. Lamina, Laminate: Thebasic building block of a composite material

Course Outcomes

After learning the course the students should be able to:

1. Understand the significance of replacing existing metal structures with composite materials wherever beneficial
2. Highlight the appropriate use of different material structures in the industry
3. Comprehend the complexity of design of different materials and structures
4. Mainly understand the mechanics of different materials

Text Books

Callister W.D. "Material Science and Engineering- An introduction", Wiley –Eastern Publications 3rd edition (2006)

Reference Books

1. Thomas H. Courtney, “Mechanical Behavior of Materials”, McGraw Hill 2nd edition (2000)
2. Flinn R. A. and Trojan P. K., Engineering Materials and their Applications”, Jaico publications 3rd edition (1999)
3. KENNETH BUDINSKI – “Surface Engineering for wear resistance", Prentice Hall publication 1st edition (1988)
4. Avner S.H., “Introduction to physical metallurgy” –Tata McGraw Hill 5th edition (2006)

Web Resources

1. http://nptel.ac.in/courses/101106038/mod01lec02.pdf- composite materials
2. https://nptel.ac.in/courses/112108150/pdf/PPTs/MTS_01_m.pdf - modern materials
3. https://nptel.ac.in/courses/112101005/downloads/Module_2_Lecture_1_final.pdf - non metallic materials

Subject: **Industrial Engineering (DE-II)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0608			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. Students learn to design and conduct experiments, as well as to analyze and interpret data
2. Students learn to function on multidisciplinary teams
3. Students learn to identify, formulate, and solve engineering problems

CONTENTS

UNIT 1

[12 hours]

LOCATION SELECTION

Nature of Location Decision, Importance of Plant Location, Dynamic Nature of Plant Location, Choice of site for selection, State regulations on location, Government policies on decentralization. Industrial Estates, Economic Survey of Site selection, SEZ, Comparison of location

PLANT LAYOUT

Principles of Plant layout and Types, factors affecting layout, methods, factors governing flow pattern, travel chart, analytical tools of plant layout, layout of manufacturing shop, repair shop and services sectors.

UNIT 2

[13 hours]

PRODUCTION PLANNING AND CONTROL: INTRODUCTION

Types of production systems and their characteristics functions and objectives of P.P.C., product design and development including standardization and simplification,

SALES FORECASTING AND HUMAN RESAOURCES MANAGEMENT

Concept, techniques, application, production planning and process planning,
Sequencing, loading and scheduling, techniques and their selection, line of balance, assembly line balancing, dispatching, progress control, Wage sheet, HR laws, Designing of Human resources values.

INSPECTION AND STATISTICAL QUALITY CONTROL

Inspection – functions, types, objectives and benefits, quality control – principles, Concepts of quality circles, Total quality management, Quality assurance, Quality audit, ISO, and six sigma SQC Concept, variable and attributes, normal distribution curves and its property charts for variable and attributes and their applications and interpretation (analysis) process capability, Acceptance sampling, sampling plans, OC curves and AOQ curves

UNIT 3

[12 hours]

PRODUCTIVITY AND WORK STUDY

Definition of productivity, application and advantages of productivity improvement tools, reasons for increase and decreases in productivity. Areas of application of work study in industry. Reaction of management and labour to work study.Method Study: Objectives and procedure for methods analysis, Recording techniques, Micro motion and macro-motion study: Principles of motion economy, Normal work areas and work place design.

WORK MEASUREMENT

Objectives, Work measurement techniques -time study, work sampling, pre-determined motion time standards (PMTS) Determination of time standards. Observed time, basic time, normal time, rating factors, allowances, and standard time. introduction to ergonomics

UNIT 4

[11 hours]

JOB EVALUATION AND WAGE PLAN

Objective, Methods of job evaluation, job evaluation procedure, merit rating (performance appraisal), method of merit rating, wage and wage incentive plans

INDUSTRIAL LEGISLATION

Need for Industrial legislation, Factories act 1948, Industrial dispute act 1947, The Indian trade unions act 1926, Industrial employment act 1946, Payment of wage act 1936, Workmen compensation act 1923, Payment of bonus act 1965, Employees provident fund scheme 1952

Course Outcomes

After learning the course the students should be able to:

1. Demonstrate location decision and site selection
2. Use of plant layout knowledge for betterment of plant
3. Use of Production planning and control
4. Solve forecasting problem by applying different techniques
5. Understanding planning, scheduling and sequencing problems for shop floor
6. Demonstrate assembly line balancing and dispatching
7. Apply work study techniques and understands its importance for better productivity

8. Demonstrate wage and incentive plans
9. Acquire knowledge of industrial legislation
10. Apply statistical quality control techniques for inspection

Text Books

1. M. Mahajan "Industrial Engineering and Production Management ", Dhanpat Rai & Co.,2010
2. Martand Telsang "Industrial Engineering and Production Management" ,S Chand & Company,2016

Reference Books

1. J.L. Riggs ,"Production System, Planning, Analysis and Control" – By 3rd ed. Wiley,2012
2. S K Sharma "Industrial Engineering and Organization Management" by, Savita Sharma, KATSON Books.,2014

Web Resources

1. www.nptel.com/109870 - Whole Syllabus
2. http://www.economicsdiscussion.net/engineering-economics/work-measurement-definition-objectives-and-techniques/21707 - work measurement
3. https://www.slideshare.net/amirthakarthi/production-planning-control-15402497 - Production Planning & Control
4. http://www.pondiuni.edu.in/storage/dde/downloads/hrmiv_cm.pdf - job evaluation
5. https://sol.du.ac.in/mod/book/view.php?id=794&chapterid=447 –wage plan

Subject: **Automotive Infotronics & Autotronics (DE-II)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0609			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. Understand the basics of Automotive Infotronics & Autotronics.
2. Know the working of sensors and actuators used in vehicle control.
3. Understand the working of electronic fuel supplyand the working electronic steering system.
4. Understand the computer based automotive instrumentation system.

CONTENTS

UNIT 1

[12 hours]

DRIVER ASSISTANCE SYSTEMS

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, collision avoidance, vehicle status monitoring.

TELEMATICS

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems.

UNIT 2

[11 hours]

SAFETY SYSTEMS AND SECURITY SYSTEMS

Airbags, seat belt tightening system, collision warning systems, child lock, anti - lock braking systems. anti - spin regulation, traction control systems. Anti theft technologies, smart card system, number plate coding.

UNIT 3

[12 hours]

ADAPTIVE CONTROL SYSTEMS AND COMFORT SYSTEMS

Adaptive cruise control, adaptive noise control, active roll control system, cylinder cut- off technology. Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tilt able steering column, power windows.

UNIT 4

[12 hours]

BASIC OF AUTOTRONICS

Importance of Autotronics-definition of mechatronics- architecture of mechatranics –system-measurement, open loop and closed loop control system. - signal conditioning-interfacing-analog and digital signals- conversion of analog to digital conversion.-difference between conventional and mechatronics system.

SENSORS AND ACTUATORS

Sensors –variable resistance sensor, pickup coil type sensor, Hall Effect switch, piezoelectric knock sensor, throttle position sensor, MAP sensor, MAF sensor and Actuators.

Course Outcomes

After learning the course the students should be able to:

1. Understand about different vehicle assistance system
2. Understand about safety system about vehicle.
3. Understand about different Control Systems.
4. Overview of different sensors and actuators.

Text Books

1. Ljubo Vlacic, Michel Parent and Fumio Harashima, “Intelligent Vehicle Technologies”, Butterworth-Heinemann publications, Oxford, 2001.
2. Robert Bosch, “Automotive Hand Book”, 5th Edition, SAE, 2000.

Reference Books

1. Bechhold, “Understanding Automotive Electronics”, SAE, 1998.
2. Ronald K Jurgen, “Navigation and Intelligent Transportation Systems – Progress in Technology”, Automotive Electronics Series, SAE, USA, 1998.
3. William B Riddens, “Understanding Automotive Electronics”, 5th edition, Butter worth Heinemann Woburn,1998.

Web Resources

1. https://www.youtube.com/watch?v=jt8EJnAT2_0- Lexus IS: Driver Support Systems
2. https://www.mercedes-benz.com/en/mercedes- benz/innovation/mercedes-benz-intelligent-drive/- Mercedes-Benz Intelligent Drive
3. https://www.youtube.com/watch?v=9V_Mz7NDy3o- Geographic Information Systems (GIS)
4. https://www.youtube.com/watch?v=rYckJqp4XTc- Collision warning systems at the test track
5. https://www.youtube.com/watch?v=own_VaRZ9M8- EN | Bosch Adaptive Cruise Control (ACC)

6. https://www.youtube.com/watch?v=IQ1eKddstxM- Electromagnetic Active Suspension System
7. https://www.mathworks.com/videos/understanding-control- systems-- part-4- - simulating-disturbance- re-1480629735127.html- Understanding Control Systems
8. https://www.youtube.com/watch?v=3P3xxKS-l8E- Knock Sensor using arduino and piezo element

Subject: **Vehicle Performance &Testing (DE-1 b)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0611			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To make students aware about regulations and regulating bodies of automobile engineering and engine testing
2. Various testing and simulation methods learning
3. Prevailing safety and emission norms and standards for automobiles (Globally and India).

CONTENTS

UNIT 1

[11 hours]

INTRODUCTION

Need of vehicle testing and homologation, Vehicle testing organizations, Hierarchy of testing: Individual component approval, System level approval and Whole vehicle approval. Type Approval & Conformity of Production tests.

ENGINE ,FUEL SYSTEMS AND EMISSIONS TESTING

Laboratory testing of basic engine parameters: Measurement of BHP, IHP, Engine testing on dynamometers, different types of dynamometershydraulic, eddy current etc., engine analyzers- for petrol and diesel engines, FIP calibrating and testing, Emission test for CO, HC, NOx, CO2, PM, etc. using exhaust gas analyzers, their types. Orsat apparatus, infrared gas analyzers

UNIT 2

[12 hours]

NOISE VIBRATION AND HARSHNESS TESTING

Review of vibration fundamentals, vibration control, fundamentals of acoustics, human response to sound, automotive noise criteria, Standard noise measurement methods, Noise inside and outside the vehicle, sources of vehicle noise- intake and exhaust noise, combustion noise, mechanical noise, noise from auxiliaries, wind noises, transmission noises, brake squeal, structure noise, noise control methods. Pass by Noise testing method.

VEHICLE PERFORMANCE TESTING

Methods for evaluating vehicle performance- energy consumption in conventional automobiles, performance, emission and fuel economy, Operation of full load and part load conditions, effect

of vehicle condition, tyre and road condition and traffic condition and driving habits on fuel economy, Gradability test, Turning circle diameter test, Steering Impact test, Steering effort test.

UNIT 3

[11 hours]

ROAD AND TRACK TESTING

Initial inspection, PDI, engine running in and durability, intensive driving, maximum speed and acceleration, brake testing on the road, hill climbing, handling and ride characteristics, safety, mechanism of corrosion, three chamber corrosion testing, wind tunnel testing, road testing, test tracks.

VEHICLE TESTING ON CHASSIS DYNAMOMETERS

Two wheel & four wheel dynamometers, vehicle testing lanes - side slip testers, wheel alignment testing, wheel balancing, brake test, head light alignment and light intensity testing.

UNIT 4

[12 hours]

ACTIVE AND PASSIVE SAFETY TESTING

Wheel rim testing for cornering and radial fatigue, Fire resistance test, bumper test, crash test, side impact test, rollover test, safety belt test, Airbag test, Safety belt anchorages, Seat anchorages & head restraints, Occupant protection Impact test, Side door intrusion test.

AUTOMOBILE TESTING STANDARDS

Introduction, overview and study of testing standards like; AIS testing standards, Euro Standards, SAE standards. ISO26262 standards for functional safety of electrical and/or electronic systems in automobiles. Understanding of some AIS Standards: AIS-008 (Installation requirements of lighting and light-signaling devices for motor vehicles having more than three wheels, trailer and semi-Trailer excluding agricultural tractor and special purpose vehicles), AIS-018:2001 (Automotive Vehicles - Speed limitation Devices – Specifications), AIS-037 (Procedure for Type Approval and establishing conformity of production for safety of critical components), AIS- 093 (Code of practice for construction and approval of truck cabs & truck bodies), AIS-003 (Automotive Vehicles - Starting Gradeability - Method of Measurement and Requirements), AIS-038 (Battery Operated Vehicles – Requirements for Construction and Functional Safety).

Course Outcomes

After learning the course the student should be able to:

1. Understand the need of number of rules and norms applied to automobiles and its emphasis on safety and environmental protection.
2. Acquire the knowledge of various test that a Newly designed automobiles or automobile models have to pass thoroughly for its performance and safety before it reaches to the users.

3. The activity of automotive homologation for certifying vehicles and every component fitted in a vehicle that satisfy the requirements set by various statutory / regulatory bodies.
4. Mandating to get approval for export of automobile products or its components.

Text Books

1. Raymond M. Brach and R. Matthew Brach, "Vehicle Accident Analysis and Reconstruction Methods", SAE International, 2011
2. J. G. Giles – Vehicle operation and performance, Wildlife Publications, London, 1969.

Reference Books

1. W. H. Crouse and L. Anglin – Motor vehicle inspection, McGraw Hill Book Co. 1978.
2. Dr. N.K.Giri- Automotive technology – Khanna publishers, 2009
3. Ulrich Seiffert and Lothar Wech, “Automotive Safety Handbook”, SAE International, 2007

Web Resources

1. https://www.araiindia.com/services_standard_formulation_AIS.asp - automobile testing standards
2. www.internationaljournalssrg.org/IJME/2014/Volume1-Issue3/IJME-V1I3P103.pdf - Study of Active and Passive Safety Systems
3. https://www.araiindia.com/facilities_emission_chassis_dynamometer_test_facilities.asp- test of vehicle on Chassis Dynamometer
4. http://www.roadandtrack.com/new-cars/road-tests/ - road and track testing

Subject: **Automotive Quantitative Techniques (DE-1 b)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0612			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To study Role of Quantitative techniques in Business and Automotive Industry.
2. To study Quantitative techniques which provide the decision making a systematic and powerful means of analysis based on quantitative data.
3. It is a scientific method employed for problem solving and decision making by the management.

CONTENTS

UNIT 1

[12 hours]

LINEAR PROGRAMMING

Automotive Quantitative approach for decision making, LPP (linear programming problems) – Mathematical formulation and their solution using graphical approach and simplex algorithm, Duality Sensitivity analysis.

TRANSPORTATION

Solving the problem, MODI method to Optimize Transportation Problems. Cases of unbalanced problems, Degeneracy, Maximization objective, Multiple solutions, Prohibited routes.

UNIT 2

[12 hours]

INVENTORY CONTROL

Techniques of selective control, Economic order quantity (EOQ) models, Gradual checking of stock without shortages, Price breaks and planned stock outs, Deciding optimum safety stock and reorder level.

PERT/CPM

Networking with one estimate of time, Networks with three estimates of time, Time-cost trade-off, PERT/cost, Resource allocation, Resource leveling.

UNIT 3

[13 hours]

QUEUING THEORY

Elements of a queuing system, Single Queuing Models with Poisson arrival and exponential services rates, Queuing Model – Infinite and finite population.

REPLACEMENT ANALYSIS

Replacement of capital assets – discrete cases (a) when time value of money is not considered and (b) when time value of money is considered, Replacement of items assets that fail suddenly.

UNIT 4

[12 hours]

STATISTICAL DECISION THEORY

Components of a Problem, Three Types of Problems in Decision Making Under Different Environment, Methods Used for Decision-Making with Uncertainty, Expected Monetary Value, Expected Regret, Expected Value of Perfect Information

SIMULATION

Steps in the Simulation Process, Application of Simulation, Application of Simulation to the Problem of Financial Planning, Steps in the Hertz Simulation Model, Monte Carlo Simulation

DECISION TREE

Meaning of Decision Tree, Steps Involved in Drawing a Decision Tree, Roll-back Technique.

Course Outcomes

After learning the subject the student shall be able to:

1. Define and formulate mathematical problems
2. Select optimal problems solving techniques for a given problem using LP.
3. Formulate and solve transportation, travelling sales man and transshipment problems.
4. Formulate and solve optimization problems related to job/ work assignments.
5. Demonstrate and solve simple models of Game theory.
6. Evaluate optimum solution using dynamic programming for different applications.
7. Choose / devise appropriate queuing model for practical application
8. Solve different problems related to Network

Text Books

Vishal Pandey, P. C. Tulsian , “Quantitative Techniques: Theory and Problems”, Pearson India, 1st edition, 2002.

Reference Books

1. Levin, R.I., D.S. Rubin and J.P. Stingson, "Quantitative Approaches to Management", McGraw – Hill,3rd edition, 1986.
2. Vohra N.D., "Quantitative Techniques in Management", The McGraw Hill companies, 3rd Edition, 2006.
3. Bierman H. Jr, C.P. Bonini and W.H. Hausman, "Quantitative Analysis for Business Decisions, , Homewood, Ill., Irwin, 7th Edition, 1983.

Web Resources

1. https://www.youtube.com/watch?v=y3NO-vBEi2w&list=PL0360AA4B58C6229D – Linear programming
2. https://www.youtube.com/watch?v=-w2z3MVTcQA – Transportation
3. https://www.youtube.com/watch?v=WSQERnKAKDk – Inventory Control
4. https://www.youtube.com/watch?v=H58TPQNr2kM – PERT / CPM
5. https://www.youtube.com/watch?v=xGkpXk-AnWU – Queuing Theory
6. https://www.youtube.com/watch?v=sEYzQwRX1wU – Replacement Analysis
7. https://www.youtube.com/watch?v=3BBk6XZR-bk – Statistical Decision Theory
8. www.investopedia.com/terms/m/montecarlosimulation.asp - Simulation
9. http://study.com/academy/lesson/quantitative-decision-making-tools-decision-trees-payback-analysis-simulations.html - Decision Tree

Subject: **Automobile Air Conditioning (DE-1 b)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0613			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To get the fundamental knowledge of Automobile Air conditioning.
2. To study the operation of the basic refrigeration cycle; diagnose and repair air distribution systems; demonstrate proper procedures for handling refrigerant; and describe the operation of air conditioning and heating controls.
3. Utilizing appropriate safety procedures with Air conditioner maintenance & service

CONTENTS

UNIT 1

[12 hours]

INTRODUCTION

Methods of refrigeration; vapour compression refrigeration system; vapour absorption refrigeration system; applications of refrigeration & air conditioning; Automobile air conditioning; air conditioning for passengers; isolated vehicles, transport vehicles; applications related with very low temperatures.

REFRIGERANT

Classification, properties, selection criteria, commonly used refrigerants, alternative refrigerants, eco-friendly refrigerants, applications of refrigerants, refrigerants used in automobile air conditioning

UNIT 2

[14 hours]

PSYCHROMETRY

Application of psychrometric processes of summer and winter air conditioning (applied psychrometry); review of refrigeration and air conditioning load calculations, factors forming the load on refrigeration & air conditioning systems; cooling & heating load calculations; load calculations for automobiles, effect of air conditioning load on engine performance; Human comfort; Comfort chart

UNIT 3

[10 hours]

AIR CONDITIONING SYSTEMS

Classification, layouts, central / unitary air conditioning systems, components like compressors, evaporators, condensers, expansion devices, fan blowers, heating systems, Automotive heaters, Control used in Refrigeration system, Air conditioning protection, Engine protection, Distribution duct system, sizing, supply / return ducts, type of grills, diffusers, ventilation, air noise level, layout of duct systems for automobiles and their
impact on load calculations

UNIT 4

[12 hours]

AIR CONDITIONING SERVICE

Air conditioner maintenance & service; servicing heater system, removing & replacing components; trouble shooting of air conditioning system; compressor service; methods of dehydration; charging & testing; Air Conditioning Control : Common control such as thermostats, humidistat, control dampers, pressure cut outs, relay

Course Outcomes

After learning the subject the student shall be able to:

1. Identify various components of Vehicle Air conditioning and heating system.
2. Apply various concepts related to Air conditioning and heating system.
3. Operate manually and automatic Air conditioning and heating system.
4. Diagnose various faults in air conditioning system by using suitable tools and instruments.
5. Follow safety rules while servicing of Air conditioning and heating system

Text Books

Arora and Domkundwar, “Refrigeration and Air conditioning”, TMH, 3rd Edition, 2011.

Reference Books

1. Manohar Prasad., “Refrigeration and Air Conditioning”,New Age International Ltd., 2nd Edition, 2006.
2. Ananthanarayanan, “Basic Refrigeration and Air-Conditioning”, TMH, 3rd Edition, 2012
3. William H. Crouse & Donald L. Anglin, “Automotive Air Conditioning”, McGrawHill, Inc, 2nd edition, 1990.
4. Michel Information Services, Inc., Mitchell Automatic Heating & Air ConditioningSystems, Prentice Hall, Inc, 3rd edition, 1989.
5. Paul Weisler, “Automotive Air Conditioning”, Reston Publishing Co.Inc., 1st edition ,1990

Web Resources

1. http://nptel.ac.in/courses/112105128 - Whole Syllabus
2. http://nptel.ac.in/courses/112105128/10 - Introduction to Air Conditioning
3. http://nptel.ac.in/courses/112105128/30 - Refrigerants
4. http://nptel.ac.in/courses/112105128/36 - Psycometry
5. http://nptel.ac.in/courses/112105128/43 - Air Conditioning Systems
6. https://www.youtube.com/watch?v=MduFTMBFAJc – Air Conditioning Service

Subject:**AdvancedTechnical Communication and Soft Skills**								
Program: **B.Tech. All Branches**			Subject Code:**SH0607**			Semester: **VI**		
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	0	0	0	60	0	40	0	100

	Sr. No.	**Content**
Speaking	**1**	**Vocabulary Games: Advanced Level**
	2	**Role Play 1**
	3	**Role Play 2**
	4	**Role Play 3**
	5	**Selected speeches & Songs: Declamation 1**
	6	**Selected speeches & Songs: Declamation 1**
	7	**Report Presentation Seminar**
	8	**Report Presentation Seminar**
	9	**Report Presentation Seminar**
	10	**Interview Skills (Mock Interview Sessions 2)**

Writing	**11**	**Writing Reports**
	12	**Making Proposals**
	13	**Resume Building**
	14	**Letter, Email application**

Reference Books:

1. Fred Luthans, Organizational Behaviour, McGraw Hill
2. Lesikar and petit, Report writing for Business
3. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill

4. Wallace and masters, Personal Development for Life and Work, Thomson Learning
5. Hartman Lemay, Presentation Success, Thomson Learning
6. Malcolm Goodale, Professional Presentations
7. Farhathullah, T. M. Communication skills for Technical Students
8. Michael Muckian, John Woods, The Business letters Handbook
9. Herta A. Murphy, Effective Business Communication
10. Lehman, Dufrene, Sinha BCOM, Cengage Learning

Web Resources/ MOOCs:

1. https://www.youtube.com/watch?v=xC3M9EqduyI - Introduction to English Language & Literature Mod-1 Lec-1
2. https://www.youtube.com/watch?v=HsR4jFszFdw#action=share - The English Language Mod-1 Lec- 3
3. https://www.youtube.com/watch?v=FT4cQkXCc8g - International English Mod-1 Lec-4
4. https://www.youtube.com/watch?v=r5z-lilm-gg - Effortless EnglishRule-1 English Phrases
5. https://www.youtube.com/watch?v=wB8mr4iViy0 - Pronunciation Training Techniques
6. https://www.youtube.com/watch?v=wB8mr4iViy0 - Make Body Language Your Super power
7. https://www.youtube.com/watch?v=wB8mr4iViy0 - English Job Interviews | Best Answers to Questions

7TH SEMESTER

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –VII TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017													
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME					
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	AU0701	Automobile Systems Design	3	2	2	5	7	30	10	60	40	60	200
2	AU0702	Vehicle Dynamics	3	0	2	4	5	30	10	60	40	60	200
3	AU0703	Computer Integrated Manufacturing	3	0	2	4	5	30	10	60	40	60	200
4	AU0704	Modern Quality Tools	4	2	0	5	6	30	10	60	40	60	100
5	AU0705	Electric and hybrid vehicles	3	0	2	4	5	30	10	60	00	00	200
6	AU0706	Fuel Cells & Applications (DE-III)	03	00	00	03	03	30	10	60	00	00	100
	AU0707	Automobile Computer Aided Design(DE-III)											
	AU0708	Advanced Automotive Technology(DE-III)											
	AU0709	Nano technology (DE-III)											
	AU0710	Noise Vibration & Harshness (DE-III)											
	AU0711	Automotive Instrumentation and Testing (DE-III)											
	AU0712	Tribology (DE-III)											
	AU0714	Production Technology (DE-III)											
7	CV0707	Disaster Management	1	0	0	0	1	-	-	-	-	-	100
TOTAL			**20**	**4**	**08**	**25**	**32**	**180**	**60**	**360**	**160**	**240**	**1100**

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

Subject: **Automobile Systems Design**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0701			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	2	5	24/60	24/60	16/40	16/40	200

Course Objectives

To make student get acquainted with to standardize the automobile part after designing the system component like clutch, propeller shaft, axle, steering linkages, braking parts, suspension system etc. within the space limitations and optimize it.

CONTENTS

UNIT 1

[12 hours]

DESIGN OF CLUTCH SYSTEM

Design of various clutch system components (Single plate, multiple plates, centrifugal clutch, lining material) and Pressure Plate Assembly components. Hydraulic Clutch system components (Master Cylinder, Slave cylinder, reservoir clutch fluid – its properties, hydraulic pipes. Clutch Pedal & Clutch hand lever design. Clutch cable Design / selection considerations.

DESIGN OF PROPELLER SHAFT

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 2

[12 hours]

AXLE DESIGN

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.

DESIGN OF BRAKING SYSTEMS

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.

UNIT 3

[12 hours]

DESIGN OF SUSPENSION SYSTEM

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. Types of different suspension springs with their requirements, constructional details and characteristics of leaf spring, coils spring and torsion bar springs, Independent suspension, rubber suspension, pneumatic suspension, hydro elastic suspension, use of anti-roll bar and stabilizer bar, shock absorbers- need, operating principles different types.

DESIGN OF STEERING SYSTEM

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 4

[12 hours]

FINITE ELEMENT ANALYSIS

Review of stress-strain relation and generalized Hooke's Law, Plane stress and Plane strain conditions; Concept of Total Potential Energy; Basic procedure for solving a problem using Finite Element Analysis.

1-D Analysis: Concept of Shape function and natural coordinates, strain -displacement matrix, derivation of stiffness matrix for structural problems, properties of stiffness matrix. 1-D structural problems with elimination and penalty approaches, 1-D thermal and fluid problems.

Trusses and Beams: Formulation of stiffness matrix, simple truss problems to find displacement, reaction and stresses in truss members. Structural analysis using Euler-Bernoulli beam element. Higher Order Element: CST element stiffness matrix formulation, shape functions and applications of Quad and axisymmetric elements

Course Outcomes

After learning the subject, Students will be able to:

1. Select and design the different automobile system for given situation.
2. Standardize the different parts.
3. Optimize the parts for given situation

Text Books

1. R S Khurmi J.K.Gupta , "Machine Design", S chand & Co., 25th revised edition, 2014.
2. P.M.Heldt , "Automotive Chassis" , Chilton Co., NY, 3rd edition, 1982
3. Pandya and Shah, "Machine Design", Charotar Publishing House, 20th edition, 2015

Reference Books

1. DTB donkins , "Elements of Motor Vehicles Design" , TMH,3rd edition, 2005.
2. P.Lukin , "Automobile Chassis Design and calculations" , Mir Publishers, 2nd edition, 2004 .
3. K.M.Agrawal , "Auto design Problems" , Satyaprakashan, 4th edition, 2000.
4. N.K.GIri , "Automotive Mechanics", Khanna Publishers, 1st edition, 1999.
5. Dean Averns, "Automobile Chassis Design" , Lllife Books Ltd, 3rd edition, 1992 .
6. Kirpal Singh, "Automobile Engg. Vol - I & II" , Standard Publisher, 2nd edition, 1999.
7. Joseph E. Shigley & Larry , "Mechanical Engineering Design", 4th edition, 2003.

Web Resources

1. http://nptel.ac.in/courses/112106137/pdf/3_5.pdf - Design of Clutch
2. https://www.researchgate.net/publication/282303288_Design_Optimization_of_Automotive_Propeller_Shafts - Optimization in the design of propeller shaft
3. http://www.dtic.mil/dtic/tr/fulltext/u2/a035143.pdf - Axle Design
4. http://web.iitd.ac.in/~achawla/public_html/736/17-brakes.pdf - Brake design
5. http://www.ijser.org/researchpaper/design-and-analysis-of-suspension-system-for-an-all-terrain-vehicle.pdf - Design of Suspension
6. http://www.iaeng.org/publication/WCE2016/WCE2016_pp1062-1066.pdf - Steering Design
7. https://www.youtube.com/watch?v=NYiZQszx9cQ - Vehicle Performance Testing And Validation Of Design
8. http://www.egsindia.com/pdf/whitepaper-on-cae-for-automotive-industry-using-solidworks-simulation.pdf - Finite Element Analysis

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Introduction and Design Considerations	Basic concept of design in general, Concept of machine design and their types, Factors to be considered in machine design.
2.	Study of Clutch System Design	Function of clutch, Types of clutch, Design consideration, Lining material and dimensions
3.	Study of Propeller Shaft Design	Design consideration for propeller shafts, Bending, torsion and rigidity criteria, Failure theories, Joints, Assembly testing for balancing

4.	Study of Axle Design	Design consideration, Front axle and Rear axle, King pin and steering knuckle, Design of final drive and differential
5.	Study of Brake Design	Design considerations, Drum brake arrangement and disc brake arrangement, Mechanical, hydraulic and air brake arrangement, Friction lining material and hydraulic fluid, Fail safe brake, Braking ratio
6.	Study of Suspension Design	Design considerations, Types of suspension spring based on application, Wahl Correction Factor, Buckling of Compression springs, Design considerations of Belleville Springs
7.	Study of Steering Design	Steering mechanism, Linkage design, Design criterion for mechanical steering and power steering, Steering geometry
8.	Study of Vehicle performance testing and Validation of Design	Importance of performance testing, Design specification, Durability and reliability, Improvements and validate
9.	Major Problem (Clutch System)	Design and prepare two Drawing Sheets of A1 size (1) components (2) Assembly, using given data data.
10.	Major Problem (Suspension System)	Design and prepare drawing sheets of A1 size (1) Component detail (2) Assembly, and bill of material using given data.

Subject: **Vehicle Dynamics**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0702			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. To understand the principle and performance of vehicle in various modes such as longitudinal, vertical and lateral directions.
2. At the end of the course the student will be able to identify the various forces and loads and performance under acceleration, ride and braking.

CONTENTS

UNIT 1

[12 hours]

PERFORMANCE CHARACTERISTICS OF VEHICLE

SAE Vehicle axis system, Forces & moments affecting vehicle, Earth Fixed coordinate system, Dynamic axle loads, Equations of motion, transmission characteristics, vehicle performance, power limited and traction limited acceleration, braking performance, Brake proportioning, braking efficiency.

AERODYNAMICS

Mechanics of Air Flow Around a Vehicle, Pressure Distribution on a Vehicle, Aerodynamic Forces, Drag Components, Aerodynamics Aids.

UNIT 2

[12 hours]

TIRE MECHANICS

Tire Construction, Size and Load Rating, Terminology and Axis System, Tractive Properties, Cornering Properties, Camber Thrust, Aligning Moment, Combined Braking and Cornering, Conicity and Ply Steer, Slip, Skid, Rolling Resistance, Elastic Band Model for longitudinal slip, Simple model for lateral slip, Combined longitudinal/lateral slip (friction ellipse), Taut string model for lateral slip, Magic Tire Formula

SUSPENSIONS

Suspension Kinematics, Suspension types, Solid Axles, Independent Suspensions, Anti-Squat and Anti-Pitch Suspension Geometry, Anti-Dive Suspension Geometry, Roll Center Analysis, Suspension Dynamics, Multi-body vibration, Body and Wheel hop modes, Invariant points

UNIT 3

[12 hours]

THE STEERING SYSTEM

The Steering Linkages, Steering System Forces and Moments, Steering System Models, Steering Geometry, Steady Handling (2 DOF steadystate model), Understeer and Oversteer, Effect of Tire Camber and Vehicle Roll (3 DOF steady-state model), Transient Handling and Directional Stability (2 DOF unsteady model), Effect of Vehicle Roll on Transient Handling (3 DOF unsteady model), Steady-State and Transient Handling of Articulated Vehicles.

ROLLOVER

Quasi-Static Rollover of a Rigid Vehicle, Quasi-Static Rollover of a Suspended Vehicle, Transient Rollover

UNIT 4

[12 hours]

MOTORCYCLE DYNAMICS

Kinematic structure of motorcycle, geometry of motorcycles, importance of trail, Resistance forces acting on motorcycle (tyre rolling resistance, aerodynamic resistance forces, resistant force caused by slope), Location & height of motor cycle's centre of gravity (C.G), Moments of inertia on Motorcycle. Introduction to Front & Rear suspensions of Motorcycle.

Course Outcomes

After learning the course the students should be able to:

1. Understand the dynamics of vehicle ride
2. Calculate and refer the loads and forces associated to the vehicles
3. Analyse the behavior of the vehicles under acceleration, ride and braking

Text Books

1. Hans Pacejka, "Tire and Vehicle Dynamics" , Elsevier, 2012.
2. Thomas D Gillespie, "Fundamentals of Vehicle dynamics", SAE USA 1992.

Reference Books

1. Rajesh Rajamani, "Vehicle Dynamics & control", Springer-2016
2. R.V. Dukkipati, "Vehicle dynamics", Narsova Publications-2010
3. Wong J Y, "Theory of Ground Vehicles", John Wiley & Sons, New York, 1978.
4. Milliken W F and Milliken D L, "Race car Vehicle Dynamics", SAE,2012
5. Garrett T K, Newton K and Steeds W, "Motor Vehicle", Butter Worths & Co., Publishers Ltd., New Delhi, 2001.
6. Heinz Heister, "Vehicle and Engine Technology", SAE Second Edition, 1999.

Web Resources

http://nptel.ac.in/courses/107106080/ - Whole Syllabus

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Experimental study of mechanism for air flow over different geometry of vehicles.	Develops Basic understanding of mechanism for air flow over different geometry of vehicles
2.	Experimental studies of measurements of drag and lift coefficient for different geometry vehicle using wind tunnel apparatus.	Develops Understanding of methods of Experimental studies of measurements of drag and lift coefficients for different geometry vehicles
3.	To study Anti-lock Brake System (ABS) used in automobile vehicles.	Develops Understanding of Anti-lock Brake System (ABS) used in automobile vehicles
4.	To study Cruise Control and Adaptive Cruise Control (ACC) used in automobile vehicles.	Develops Understanding of Cruise Control and Adaptive Cruise Control (ACC) used in automobile vehicles
5.	To study advanced cornering and parking system used in automobile vehicles.	Develops Understanding of advanced cornering and parking system used in automobile vehicles.
6.	To study automatic wheel alignment and balancing system	Develops Basic understanding of mechanism for air flow over different geometry of vehicles

Subject: **Computer Integrated Manufacturing**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0703			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. Recognize The Importance of CIM In Today Technology And Its Impact On Market Competition.
2. Automate Tasks For Preparing Most Appropriate Manufacturing And Assembly Processes And Their Sequences.
3. Understand Robot Programming..
4. Analyze The Engineering And Economical Aspects Of Automatic Storage And Retrival System

CONTENTS

UNIT 1

[12 hours]

COMPUTER AIDED MANUFACTURING

CAM Concepts, Objectives & scope, Nature & Type of manufacturing system, Evolution, Benefits of CAM, Role of management in CAM, Concepts of Computer Integrated Manufacturing, Impact of CIM on personnel, Role of manufacturing engineers, CIM Wheel to understand basic functions.

NC/CNC MACHINE TOOLS

NC and CNC Technology: Types, Classification, Specification and components, Construction Details, Controllers, Sensors and Actuators, CNC hardware: Re circulating ball screw, anti friction slides, step/servo motors. Axis designation, NC/CNC tooling. Fundamentals of Part programming, Types of format, Part Programming for drilling, lathe and milling machine operations, subroutines, do loops, canned Cycles, parametric sub routines.

UNIT 2

[12 hours]

PROGRAMMABLE LOGIC CONTROLLERS

Relay Device components, Programmable controller architecture, programming a programmable controller, tools for PLC logic design

GROUP TECHNOLOGY AND CAPP

Introduction, part families, part classification and coding systems: OPITZ, PFA, FFA, Cell design, rank order clustering, composite part concepts, Benefits of group technology. Approaches to Process Planning, Different CAPP system, application and benefits

UNIT 3

[12 hours]

FLEXIBLE MANUFACTURING SYSTEM

Introduction & Component of FMS, Needs of FMS, general FMS consideration, Objectives, Types of flexibility and FMS, FMS lay out and advantages. Automated material handling system: Types and Application, Automated Storage and Retrieval System, Automated Guided Vehicles, Cellular manufacturing, Tool Management, Tool supply system, Tool Monitoring System, Flexible Fixturing, Flexible Assembly Systems.

UNIT 4

[12 hours]

ROBOT TECHNOLOGY

Introduction: Robot Anatomy, Laws of Robot, Human System and Robotics, Coordinate system, Specifications of Robot. Power sources, actuators and Transducers, Robotic Sensors, Grippers, Robot Safety, Robot Programming and Robot Applications, Economic Considerations of Robotics system, Robot Kinematics and Dynamics, Robot Arm Dynamics. Concepts of Computer Vision and Machine Intelligence.

INTEGRATED PRODUCTION MANAGEMENT SYSTEM

Introduction, PPC fundamentals, Problems with PPC, MRP-I, MRP-II. Just in Time philosophy: JIT & GT applied to FMS, concepts of Expert System in Manufacturing and Management Information System

Course Outcomes

After learning the course the students should be able to:

1. Describe basic concepts of CIM application and benefits.
2. Prepare CNC programs for manufacturing of different geometries on milling and lathe machines.
3. Prepare logic diagram for different application of automation.
4. Classify different components using different techniques of group technology
5. Prepare Process planning for different components in automobile Industry
6. Select layouts of FMS for industrial applications
7. Describe Robot for preliminary industrial applications like pick and place.
8. Identify application of PPC, JIT, MRP-I, MRP-II, and Expert system to CAM
9. Design and implement concept of automated assembly line in automobile industry

Text Books

1. Tien Chien Chang, “Computer Aided Manufacturing”, Pearson, Edition 3, 2006.
2. Mikell P Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson Education, Edition 4, 2015.
3. S R Deb, S Deb, “Robotics Technology and Flexible Automation”, McGraw Hill Education Private Limited, Edition 4, 2009.

Reference Books

1. P. Radhakrishnan, " Computer Numerical Control ", New Central Book Agency, 2013, ISBN-10**:** 8173811849
2. S. Kant Vajpayee, “Computer integrated manufacturing”, Prentice Hall of India, Edition 3, 2005.

Web Resources

1. http://www.me.nchu.edu.tw/lab/CIM/www/courses/Computer%20Integrated%20Manufacturing/Chapter2%20-CIM-introduction.pdf – CIM Introduction
2. https://www.youtube.com/watch?v=tiarT1YS-lM – Flexible Manufacturing System
3. prolog.univie.ac.at/teaching/LVAs/Layout_und_Design/SS09/Skript%20insel.pdf – Group technology and Cellular Manufacturing
4. http://nptel.ac.in/courses/112102101/ - Whole Syllabus

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	To study about CIM cases	Evolution of CIM, requirements of CIM and application of CIM
2.	To study about NC in Machine Tool	Basic knowledge and fundamentals of Machine tools and axis system
3.	To perform practical on Manual part programming for Turning	Programming and simulation of work piece produced through turning
4.	To perform practical on Manual part programming for Milling	Programming and simulation of work piece produced through milling
5.	To perform practical on Manual part programming for Parametric subroutine	Programming and simulation of work pieceusing parametric subroutine
6.	To perform practical on APT Program for Turning, Drilling & Milling	Programming and simulation of work pieceusing APT

7.	To study about Grouping of given parts for G. T.	Basic knowledge and fundamentals of group technology and different methods of classification
8.	To study about Flexible Manufacturing System	Basic knowledge and fundamentals of Flexible Manufacturing system and different types of FMS
9.	To study about Robot Technology	Basic knowledge and fundamentals of robot work volume and different grippers used in robot technology
10.	To study about Computer aided Production & Operation Management	Basic knowledge and fundamentals of CAPP and different types of CAPP

Subject: **Modern Quality Tools**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0704			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
4	2	0	5	24/60	0	16/40	0	100

Course Objectives

1. To understand the various practices of Quality Management followed in Automobile Industries.
2. To understand the tools & techniques for continuous process improvement
3. To learn the importance of ISO/TS 16949 and Quality systems, Audit systems

CONTENTS

UNIT 1

[14 hours]

INTRODUCTION

Principles of TQM by Deming, Crosby and Juran, SWOT Analysis, Quality management in automobile industries, Quality & ISO/TS 16949, Difference with ISO 9001, Importance of Quality Management, QC Tools, Six Sigma, 5S, Ishikawa(Cause and effect Diagram)

COST OF QUALITY

Characteristics of Quality cost, Micro analysis of Quality cost, Cost of quality – prevention / appraisal / failure; Optimum Cost Relationship with Quality. Measurement of Quality

UNIT 2

[12 hours]

QUALITY TOOLS

Seven Quality management tools, Continuous Improvement Strategies: Deming wheel, Zero defects Concept, Bench marking.. **Preventive Techniques**: Failure Mode Effect Analysis (FMEA). Poka Yoke,, Quality Ambiance: 5S, Time Management.

ISO/TS 16949 REQUIREMENT

Management responsibility, Quality Systems, Contract review, Design control, Document and data control, Purchasing, Product identification & traceability, Inspection and testing, Control of non conforming product, Corrective and preventive actions, Control of records, Internal audit, Training.

IMPLEMENTING ISO/TS 16949

Coherence check, Cultural analysis, System analysis, Process analysis, System Integration, Third party assessment

UNIT 3

[16 hours]

AUTOMOTIVE CORE TOOLS

Advance product quality planning, Production part approval process, statically process control, Measurement system analysis, Failure Mode effect and analysis

SUPPLY CHAIN MANAGEMENT

What is SCM, Importance of SCM, Objectives of SCM, Application of Supply chain management, Implementation Procedure.

UNIT 4

[14 hours]

LEAN MANUFACTURING

Value Stream Mapping, JIT, Kaizen, TPM, Kanban; Six Sigma, Lean Six Sigma

Course Outcomes

At the end of this course the student should be able:

1. To understand Quality concepts
2. To understand maintenance concepts
3. To understand Reliability concepts
4. To understand the modern practices in maintenance.

Text Books

1. Hansen, B.L. and Ghare, P.M. "Quality control and application", Prentice-Hall of Indian Private Limited, Edition 1, 1987.
2. Dale H. Besterfiled, et at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint, Edition 3, 2006.

Reference Books

1. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2006.
2. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd, Edition 1, 2006
3. Mitra, A. "Fundamentals of quality control and improvement", Prentice Hall (India) Pvt. Ltd, Edition 2, 1998.

4. Logothetis. N. “Managing for Total Quality: From Deming to Taguchi and SPC”, Prentice-Hall of India Private Limited, 1992.

Web Resources

1. https://www.slideshare.net/hassanasif/cost-of-quality-7563290 - Cost of Quality
2. asq.org/learn-about-quality/seven-basic-quality-tools/overview/overview.html – Seven basic quality tools
3. https://www.iso.org/standard/52844.html - ISO TS - 16949
4. https://leankit.com/learn/kanban/what-is-kanban/ - Kanban
5. http://asq.org/learn-about-quality/six-sigma/overview/overview.html - Six Sigma

Subject: **Electric and Hybrid Vehicles**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0705			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. This course introduces the fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
2. 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.

CONTENTS

UNIT-1

[12 hours]

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.

CONVENTIONAL VEHICLES

Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

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

[12 hours]

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.

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

[12 hours]

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.

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

[12 hours]

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.

CASE STUDIES

Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

Course Outcomes

1. After studying this subject students will understand types of hybrid vehicles and Design considerations of hybrid vehicles.
2. After studying this subject students will able to design and develop hybrid electric vehicle.

Text Book

Iqbal Hussein, “Electric & Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.

Reference Books

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

Web Resources

http://nptel.ac.in/downloads/108103009/ - Full Syllabus

LIST OF EXPERIMENTS

No	Title	Learning Outcomes
1.	Introduction to Hybrid Electrical Vehicles.	Basics of Hybrid electric vehicles their types
2.	Study of Power Sources for Hybrid Vehicles.	Basics of Engine and Electric motors
3.	Study of Basic Classification of Hybrid Vehicles	Series and parallel hybrids
4.	Study of Two Wheeled Hybrid Vehicles	Hybrid two wheelers, Challenges associated with it
5.	Study of Hybrid Vehicles in Different Vehicles.	Series parallel hybrid system
6.	Study of Various Engine Types in Hybrid Vehicles.	Internal Combustion Engines
7.	Study of Hybrid Vehicle Power Train Configurations	Motors , Mechanical Couplings , Power Coupling
8.	Study of Environmental Impact of Hybrid Vehicles	Need of Hybrids
9.	Study of Electric Components Used In Hybrid Vehicles	Batteries and control System
10.	Case Study on Hybrid Cars	Real time study of different hybrid vehicles

Subject: **Fuel Cells & Applications (DE-III)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0706			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

Understand fundamental concept and working of various fuel cells, their relative advantages / disadvantages and hydrogen generation/storage technologies

CONTENTS

UNIT-1

[12 hours]

HYDROGEN – FUNDAMENTALS

Hydrogen as a source of energy, physical and chemical properties, salient characteristics, relevant issues and concerns

UNIT-2

[12 hours]

HYDROGEN STORAGE AND APPLICATIONS

Production of hydrogen, steam reforming, water electrolysis, gasification and woody biomass conversion, biological hydrogen production, photo dissociation, direct thermal or catalytic splitting of water, hydrogen storage options, compressed gas, liquid hydrogen, hydride, chemical storage, safety and management of hydrogen, applications of hydrogen

UNIT-3

[12 hours]

FUEL CELLS- TYPES

Brief history, principle, working, thermodynamics and kinetics of fuel cell process, types of fuel cells; AFC, PAFC, SOFC, MCFC, DMFC, PEMFC – relative merits and demerits, performance evaluation of fuel cell, comparison of battery Vs fuel cell

UNIT-4

[12 hours]

FUEL CELLS -APPLICATION AND ECONOMICS

Fuel cell usage for domestic power systems, large scale power generation, automobile, space applications, economic and environmental analysis on usage of fuel cell, future trends of fuel cells

Course Outcomes

After learning this subject, the student shall be able to

1. Understand different types of Fuel Cells
2. Design considerations of hybrid vehicles.
3. Challenges to design and develop Fuel Cell vehicle.

Text book

Iqbal Hussein, "Electric & Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.

Reference Books

1. Viswanathan, B and M Aulice Scibioh, "Fuel Cells – Principles and Applications", Universities Press ,-2007.
2. Rebecca L. and Busby, "Hydrogen and Fuel Cells: A Comprehensive Guide", Penn Well Corporation, Oklahoma,-2005.
3. Bent Sorensen (Sorensen), "Hydrogen and Fuel Cells: Emerging Technologies and Applications", Elsevier Academic Press, UK,-2004.
4. Kordesch, K and G.Simader, "Fuel Cell and Their Applications", Wiley-Vch, Germany,-2003.
5. Hart, A.B and G.J.Womack, "Fuel Cells: Theory and Application", Prentice Hall, NewYork Ltd., London,-2001.
6. Jeremy Rifkin, "The Hydrogen Economy", Penguin Group, USA,-2005.

Web Resources

http://www.nptel.ac.in/courses/103102015/2 - Full Syllabus

Subject: **Automobile Computer Aided Design (DE-III)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0707			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. Understand and appreciate use of computer in product development.
2. Apply algorithms of graphical entity generation.
3. Understand mathematical aspects of geometrical modelling.
4. Understand and use finite element methods for analysis of simple components.

CONTENTS

UNIT 1

[12 hours]

INTRODUCTION

A typical product cycle, CAD tools for the design process of product cycle, CAD / CAM system evaluation criteria, Input / Output devices; Graphics Displays: Refresh display, DVST, Raster display, pixel value and lookup table, estimation of graphical memory, LCD, LED fundamentals. Concept of Coordinate Systems: Working Coordinate System, Model Coordinate System, Screen Coordinate System.Line and Curve generation algorithm: DDA, Bresenham's algorithms. Graphics exchange standards and Database management systems.

UNIT 2

[12 hours]

CURVES AND SURFACES

Parametric representation of lines: Locating a point on a line, parallel lines, perpendicular lines, distance of a point, Intersection of lines. Parametric representation of circle, Ellipse, parabola and hyperbola. Synthetic Curves: Concept of continuity, Cubic Spline: equation, properties and blending. Bezier Curve: equations, properties; Properties and advantages of B-Splines and NURBS.

UNIT 3

[12 hours]

MATHEMATICAL REPRESENTATION OF SOLIDS

Geometry and Topology, Comparison of wireframe, surface and solid models, Properties of solid model, properties of representation schemes, Concept of Half-spaces, Boolean operations.

Schemes: B-rep, CSG, Sweep representation, ASM, Primitive instancing, Cell Decomposition and Octree encoding.

GEOMETRIC TRANSFORMATIONS

Homogeneous representation; Translation, Scaling, Reflection, Rotation, Shearing in 2D and 3D; Orthographic and perspective projections. Window to View-port transformation.

UNIT 4

[12 hours]

FINITE ELEMENT ANALYSIS

Review of stress-strain relation and generalized Hooke's Law, Plane stress and Plane strain conditions; Concept of Total Potential Energy; Basic procedure for solving a problem using Finite Element Analysis. 1-D Analysis: Concept of Shape function and natural coordinates, strain - displacement matrix, derivation of stiffness matrix for structural problems, properties of stiffness matrix. 1-D structural problems with elimination and penalty approaches, 1-D thermal and fluid problems. Trusses and Beams: Formulation of stiffness matrix, simple truss problems to find displacement, reaction and stresses in truss members. Structural analysis using Euler-Bernoulli beam element. Higher Order Element: CST element stiffness matrix formulation, shape functions and applications of Quad and axis symmetric elements.

Course Outcomes

After learning the course the students should be able to:

1. Understand and appreciate use of computer in product development.
2. Apply algorithms of graphical entity generation.
3. Understand mathematical aspects of geometrical modeling.
4. Understand and use finite element methods for analysis of simple components.

Text Books

Ibrahim Zied , “CAD / CAM: Theory and Practice”, McGraw-Hill publication, 2nd Edition, 2002

Reference Books

1. Hearn E J and Baker M P, “Computer Graphic”, Pearson publication, 4th Edition, 2012
2. Chandrupatla T A and Belegundu A D , “Introduction to Finite Elements in Engineering”, PHI, 5th Edition,2015

Web Resources

1. http://www.nptelvideos.in/2012/12/computer-aided-design.html - Whole Syllabus
2. http://www.adi.pt/docs/innoregio_cad-en.pdf - CAD techniques and implementation
3. https://www.vidyarthiplus.com/vp/attachment.php?aid=36703 – Lecture notes (Whole syllabus)

Subject: **Advanced Automotive Technology (DE-III)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0708			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

The subject will help the students to learn and understand the programming, data acquisition hardware and implementing small automotive related projects in virtual instrumentation.

CONTENTS

UNIT 1

[12 hours]

INTRODUCTION

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

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**,** Sensors and actuators for automobile industries.

UNIT 2

[12 hours]

VEHICLE SAFETY

Anti lock braking systems- Traction Control system- Electro-hydraulic brakes- Occupant safety systems- Airbags, seat belt tightening system, collision warning systems, child Lock – Power windows- Power Sunroof- Seat and steering Column- Biometric systems- Driver-assistance systems- Adaptive cruise control.

DRIVE TRAIN

Modern Engine Technology like DTS- i, DTS – Fi, DTS – Si, VVT, Camless Engine, GDi, CRDI

UNIT 3

[12 hours]

VEHICLE SAFETY AND COMFORT SYSTEM

Vision enhancement, road recognition system, Anti theft technologies, smart card system, number plate coding. Locking system- Central locking system- acoustic signaling devices Active suspension systems, requirement and characteristics, different types, Vehicle Handling and Ride characteristics of road vehicle, pitch, yaw, bounce control, Climate control management system.

UNIT 4

[12 hours]

VEHICLE INFORMATION AND COMUNICATION

Instrumentation- Vehicle Information system- Trip Recorders- Parking systems- Analog and digital signal transmission- Automotive sound systems- Mobile and data radio- Mobile Information services- navigation system- Traffic telematics- Multimedia systems OBD-I Engine diagnostic system- OBD-II Engine Control systems- SAE DTC Standards- Scan Tools- Strategy based diagnosis – Engine and vehicle performance problems.

INTELLIGENT TRANSPORTATION SYSTEM

Traffic routing system - Automated highway systems - Lane warning system – Driver Information System, driver assistance systems - Driver conditioning warning - Route Guidance and Navigation Systems- Hybrid / Electric and Future Cars.

Course Outcomes

After learning the course the students should be able to:

1. Apply knowledge of advanced electrical/electronic systems leading to diagnosis and repair of a vehicle's systems
2. Diagnose, adjust, and repair advanced electrical fuel injection systems, including but not limited to computer controls, fuel exhaust, ignition, and emission systems
3. Demonstrate workplace skills related to the occupation, including but not limited to maintaining a safe and healthy workplace environment, demonstrating workplace skills, ethics, and teamwork

Text books

1. Nadovich, C., "Synthetic Instruments Concepts and Applications". Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., "Labview Advanced programming Techniques", CRC Press, 2nd Edition, 2007.

Reference book

Robert N.Brandy, "Automotive Electronics and Computer Systems", Prentice Hall, 2001.

Web Resources

1. https://drive.google.com/drive/folders/0B_XumSFK-LYNSUVNekpZVlFNME0 - Full Syllabus
2. https://www.slideshare.net/AnkulGupta2/electronic-control-unitecu - ECU in Engines
3. https://www.slideshare.net/kaustubhmarudwar/vehicle-safety-system - Vehicle Safety Systems

4. https://www.oki.com/jp/SSC/ITS/eng/vics.html - Vehicle Information and Communication System
5. https://www.slideshare.net/gauravhtandon1/intelligent-transportation-system-56391402 - Intelligent Transportation System

Subject: **Nano technology (DE-III)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0709			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

To make students understand the use of concept of nanotechnology and nanoscience in the chemical industries and in consumer products. Nanotechnology will mean complete control of the structure of matter, building complex objects with molecular precision. In current scenario, engineers are finding a wide variety of ways to deliberately make materials at the nanoscale to take advantage of their enhanced properties such as higher strength, lighter weight, increased control of light spectrum, and greater chemical reactivity then their larger scale counterparts. So in order to move towards advanced materials and devices students should have the knowledge of nano science.

CONTENTS

UNIT 1

[12 hours]

NANOTECHNOLOGY

Background, what is nanotechnology, types of nanotechnology and nano-machines, top down and bottom up techniques, Molecular nanotechnology, atomic manipulation-nanodots, self-assembly, Dip pen nanolithography, Simple details of characterization tools- SEM, TEM, STM,AFM

UNIT 2

[12 hours]

NANOMATERIALS

What are Nanomaterials? Preparation of Nanomaterials-Plasma arcing, Chemical Vapor Deposition, Sol-gels techniques, ElectrodepositioN, Ball Milling, Natural Nanomaterials, Applications of Nanomaterials-Insulation materials, Machine tools, Phosphors, Batteries, High power magnets Medical implants

NEW FORMS OF CARBON

Carbon tubes-types of nanotubes, formation of nanotubes,Assemblies, purification of Carbon nanotubes, Properties of nanotubes, applications of nanotubes

UNIT 3

[12 hours]

OPTICS, PHOTONICS AND SOLAR ENERGY

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, Solar cells, Nanoparticles and nanostructures; Optically useful nanostructured polymers, Photonic Crystals.

NANOELECTRONICS

Introduction, Tools of Micro- and Nanofabrication-optical and electron beam lithography, Molecular beam lithography, Quantum electronic devices, Molecular electronics, Simple ideas about quantum computers

UNIT 4

[12 hours]

APPLICATIONS

MEMs, robots, Nanomachines, Nanodevices, New Computing System, Optic-electronic devices, Environmental applications, Nanomedicine, Biological Nano-Technological future.

Course Outcomes

After learning the course the students should be able:

1. Understand bulk and Nanostructured materials.
2. Understand synthesis of nanomaterial with different.
3. Understand the basic principal of various characterization technique.
4. Understand the use of nanoscience and nanotechnology for various applications.
5. Students can understand the difficulties in synthesizing Nano particles and can work in the field of commercialization of Nano materials.

Text Books

Mick Wilson, Kamali Kannangra Geoff Smith, Michelle Simons and Burkhard Raguse Nanotechnology-Basic Science and Emerging Technologies, Overseas Press publication 2nd edition 2002

Reference Books

1. Mark Ratner and Daniel Ratner Nanotechnology-AGentle Introduction to the Next Big Idea, Prentice Hall publication 2nd edition 2003
2. Rebeccal Johnson Nanotechnology Lerner Publications. 2nd edition 2005
3. Charles P. Poole Jr., Chapman Introduction to Nanotechnogy: Hall/CR publication 1st edition 2003

4. Hari Singh Nalwa, “Nanostructured Materials and Nanotechnology”, Academic Press publication 1st edition 2001

Web Resources

1. http://nptel.ac.in/courses/118104008/ - Full syllabus
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-701-introduction-to-nanoelectronics-spring-2010/ - introduction to NanoElectronics
3. https://ocw.mit.edu/courses/materials-science-and-engineering/ - Material Science & Engineering
4. http://www.lib.uts.edu.au/guides/science/physics-nanotechnology/open-courses - physics involved in nanotechnology

Subject: **Noise Vibration & Harshness(DE-III)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0710			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. Understanding the importance of Noise, Vibrations & Harshness related sources and mandatory requirements in Vehicular applications.
2. Parameters affecting design criteria, construction & architecture, as well as operational systems for reduction of NVH.
3. Subjectively evaluate vehicle performance characteristics for functional requirements including mandatory - safety parameters. In order to better prepare today's automotive engineer for this course, to help in understanding fundamental principles and automotive system applications, along with associated improvements implemented in different models of vehicles.

CONTENTS

UNIT 1

[12 hours]

INTRODUCTION TO NOISE VIBRATION & HARSHNESS

Definition of Noise, Vibrations & Harshness in reference to Vehicular application. Study principles of Rolling, Pitch & Yaw velocity and moments.

FUNDAMENTALS OF NOISE AND VIBRATIONS

Basic Concepts of Vibrations: Simple Harmonic Motion, Frequency of Vibrations, Period, Natural Frequency, Resonant Frequency, Amplitude of vibrations. Un-Damped & Damped Vibrations. Types of Vibrations: Free & Forced Vibrations induced for Single degree of freedom & Multi degrees of freedom. Basic Concepts of Noise: Fundamentals of Acoustics. General Types of sound wave propagations- wave equation, specific acoustic impedance, Plane wave & Spherical waves. Structure borne sound and air borne sound. Interior noise sources and levels of noise. Anatomy of human ear and mechanism of hearing. Sound intensity, summation of pure tones (decibel addition), subtraction & averaging. Octave and Octave bands.

UNIT 2

[12 hours]

CHARACTERISTICS & SOURCES OF VIBRATIONS

Power Train: Engine, Clutch, Transmission, Propeller shaft, Differential, Drive shaft, Trans axle. Power train mounts. Suspension: Different types of suspensions, Dampers, Rubber & Rubber

embedded Metallic bushes. Passive and Active suspensions. Road roughness & irregularities, Tyres & Wheels. Low frequency vibrations: due to body structure, Seat mounting, seat materials and Steering assembly components.

VIBRATIONS MEASUREMENT TECHNICS AND CONTROL

Vibration measuring Instruments: Vibration pick-up, Types of Transducers, Vibrometer etc. for measurement of Frequency of vibrations, Period, Amplitude, Velocity and acceleration parameters. Methods of Control and vibrations isolation: Different Types of Dampers, Vibrations absorber / isolator (including viscous damping, sandwich construction).

UNIT 3

[12 hours]

SOURCES OF NOISE, NOISE MEASUREMENT TECHNICS AND CONTROL

Noise specifications and mandatory standards regulations. Brake Squeal noise, Pass-by Noise, wind noise, squeak noise and rattle, interior noise (including noise emitted by running of accessories, indicators and all buzzers). Power train, Engine Air Intake & Exhaust noise, Engine accessories, cooling system and vehicle body protrusion noise, under body protrusion noise. Noise due to Tyre-Road friction and slip characteristics. Noise Measuring Instruments: Microphone, Sound intensity probes. Noise Control: Damping treatment methods, Control through isolations and noise absorbing materials and structure. Active and semi-active control of noise. Study of anechoic chamber.

HARSHNESS

Definition. Its effect and acceptable degree of Harshness. Perception of Ride comfort i.e. psychological effects of Noise & Vibrations. Study of NVH - Legislations applicable for vehicles in India.

UNIT 4

[12 hours]

SAFETY

Passive safety Active safety. Study of Safety Regulations for vehicular application. Introduction to software applications (Capabilities & Limitations of different software's) for analysis of NVH.

Course Outcomes

1. Students will become familiar with the basic terminologies of Noise, Vibration & Harshness – NVH, which is a major focus for high end luxury vehicles manufacturers, in the current times.
2. Students will acquire Comprehensive, theory based understanding of natural and physical sciences along with engineering fundamentals related to Sources of Vibration and Noise applicable to the automobile engineering discipline and possibility of modifications and improvements.
3. Student will understand Application of engineering techniques, tools, for measurement methods in order to learn to control and solve complex Vehicle vibrations behavior /as well as performance problems.

4. Student will learn Application of systematic engineering synthesis and design processes for eliminating or reducing the Vibration, Noise to reduce irritation to occupants and achieve improvement in perception of ride comfort.

Text Books

1. Gang Sheng Chen, "Vehicle Noise, Vibration, and Sound Quality", SAE International Publications,2012.
2. Norton M.P ,"Fundamentals of Noise and Vibration", Cambrige University Press,2ND Editition,2003.
3. Dr. Sadhu Singh, "Mechanical Vibrations & Noise Control", Khanna Publishers, 2ND Editition,2006.
4. G.K.Grover, "Mechanical Vibrations", Nem Chand & Bros, Roorkee, India,2009.

Reference Books

1. S.S.Rao "Mechanical Vibrations", Pearson Education Centre, 2011 .
2. W.T.Thomson & M.D.Dahleh ,"Theory of Vibration with Applications", Pearson Education, 4th Edision,2013.
3. Borris and Kornev, "Dynamic Vibration Absorbers", John Wiley Publications,1993.

Web Resources

1. https://www.youtube.com/watch?v=AJ_v9b6nqUI- Vehicle Noise & Vibration
2. https://www.youtube.com/watch?v=DMlLEZMXOmc- Theory of Vibration
3. https://www.youtube.com/watch?v=RodJalzXGvw- Front Suspension Types and adjustments
4. https://www.youtube.com/watch?v=4JC8Xjv7tPk- How Car Suspension Works
5. https://www.youtube.com/watch?v=5bod7H3fzrs- Powertrain Of Automobile Explained
6. https://www.youtube.com/watch?v=uwJ-4Htdgbs- [Vehicle Control 10] Passive, Semi-Active and Active Suspension Control
7. https://www.youtube.com/watch?v=3Xc8tgx1D9Q- Noise Measuring Instruments
8. https://www.youtube.com/watch?v=KMgR-zjLQkE- Noise, vibration, and harshness
9. https://www.youtube.com/watch?v=Bles5cjEHKM- Active and Passive Car Safety
10. https://www.youtube.com/watch?v=o-KCx0fwbac- Integration of Active and Passive Safety Technologies

Subject: **Automotive Instrumentation and Testing (DE-III)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0711			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. This subject explores the types of measuring systems and their characteristics. The thorough knowledge in Automobile measuring instruments develops the ability to design and judge the use of particular instruments in their industrial exposure.
2. Knowledge in Various experimental techniques develops the design skills of students. Students can understand the I.S. code for engine testing which will be useful for them in practical field in automotive industries.

CONTENTS

UNIT 1

[12 hours]

INSTRUMENTATION
Introduction, characteristics and calibration.

VEHICLE WIND TUNNEL TEST
Test requirements –ground boundary simulation-wind tunnel selection and Reynolds number capability, model requirements, model details, model mounting, test procedure.

UNIT 2

[12 hours]

VEHICLES RIDE VIBRATION AND BODY TEST
Vibration measurement instrument – accelerometer and signal conditioning, graphical presentation. Dynamic simulation sled testing, methodology, vehicle acceleration measurement and documentation. Dolly roll over test, dolly role over fixture, photographic / video coverage, instrumentation. Vehicle roof strength test – test procedure and test measurements. Door system crush test –procedure and measurements.

FUEL CONSUMPTION TEST
Type I & II, test route selection, vehicle test speeds, cargo weights, driver selection, test data form, calculations. Test on rough terrain, pot holes with laden and unladen conditions.

UNIT 3

[12 hours]

VEHICLE SUSPENSION AND STABILITY FOR DIRECTIONAL CONTROL

Measurement of dimensional and geometric characteristics, measurement of centre of gravity position, measurement of moments and products of inertia, measurement of suspension kinematic characteristics, measurement of suspension elastic and coulomb friction characteristics, measurement of shock absorber characteristics.

STEERING CONTROL SYSTEM DIRECTIONAL CONTROL TEST

Analysis of constant radius test, constant steer angle test, constant speed variable radius test, constant speed variable steer angle test, response gain test.

UNIT 4

[12 hours]

WHEELS AND BRAKING PERFORMANCE TEST

Dynamic cornering fatigue, dynamic radial fatigue tests – procedure, bending moment and radial load calculations. Impact test – road hazard impact test for wheel and tyre assemblies, test procedures, failure criteria and performance criteria. Bumpers - types of tests, pendulum test, fixed collision barrier test, procedure, performance criteria. Air and hydraulic brake test, air brake actuator, valves test, performance requirements. Parking brake – drawbar pull test, grade holding test.

ENERGY CONSUMPTION TEST

Engine cooling fan, air conditioning and brake compressors, hydraulic pumps power consumption. Antilock brake systems energy consumption.

Course Outcomes

After successful completion of the course, student will be able to:

1. Know type of measuring systems and their characteristics.
2. Know the I.S. code for engine testing
3. Study the mechanical and electromechanical measuring instruments.
4. Study the engine and vehicle experiment technique.

Text Books

1. W.H.Crouse & D.L.Anglin, “Automotive Mechanics”’ Tata McGraw Hill Publishing Company, 2004.
2. Rangan, Mani and Sharma, “Instruementation”, Tata McGraw Hill Publishers, New Delhi, 2004.
3. SAE Hand book, vol. 3, SAE Publications, 2000.
4. Stockel M. W, “Auto Mechanics Fudamentals”, Good Heart-Wilcox Co., Inc., 2000.

5. Jain.R.K., “Mechanical and Industrial Measurements”, Khanna Publishers, Delhi, 1999.

Reference Books

1. Tim Gilles, “Automotive Service”’ Delmar Publishers, 1998.
2. Beckwith.T.G. and Buck.N.L., “Mechanical Measurements”, Addition Wesley Publishing Company Limited, 1995.

Web Resources

1. https://www.youtube.com/watch?v=E9ZSAX56m0E - Car Aerodynamics in a Wind Tunnel
2. https://www.youtube.com/watch?v=jxukyhuhLjs - Vibration Sensor using Piezoelectric on Arduino
3. http://standards.sae.org/j2481_200911/ - Dynamic Simulation Sled Testing
4. https://www.youtube.com/watch?v=fiIPA1v8Cas - 1998 Ford Explorer dolly rollover test
5. http://www.ijsrp.org/research-paper- 0213/ijsrp-p1424.pdf - Uniform Driver Evaluation in India
6. http://papers.sae.org/2004-01- 1076/ - Measurement & Calculation of Vehicle Center of Gravity Using Portable Wheel Scales
7. http://inpressco.com/wp-content/uploads/2014/09/Paper363282- 32851.pdf - Experimental Testing of Transient and Steady State Handling Characteristics of Passenger Vehicle
8. http://www.tsw.com/explore/wheels-radial- fatigue-test.php - What is a Wheel Radial Fatigue Test?
9. http://unitedvalve.com/engineering-valve- testing/type-testing/ - Type Testing of Valves - Standards & Specificiations
10. https://www.youtube.com/watch?v=Le2dxOpHAd0 - Drawbar Pull Test

Subject:**Tribology (DE-III)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0712			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. To teach the students about the friction and wear phenomena, different types of bearings and lubrication,
2. To get knowledge about tribo-testing and standards
3. To sensitize the student on the inevitability of tribological considerations in the design of automotive components, which are invariably subjected to extreme conditions

CONTENTS

UNIT 1

[12 hours]

INTRODUCTION

Introduction of Tribology, Tribological components,Tribo testing, matching and Selection tribometry and standards

FRICTION AND WEAR

Nature of metal surfaces, Surface properties, Surface parameters and measurements. Friction, Sliding friction, Rolling friction characteristics of common metals and non-metals, Friction under extreme environments. Engine friction, Losses and engine design parameters. Economic role of wear, type of wear, wear mechanism, Factors affecting wear, Selection of materials for different wear situations, Measurement of wear, Tribometers and Tribometry. Engine wear, mechanisms, wear resistance material and coatings and failure mode analysis.

UNIT 2

[12 hours]

HYDRO DYNAMIC BEARINGS AND LUBRICATION

Theory of hydrodynamic lubrication, Generalized Reynolds Equation, slider bearings, Fixed and pivoted shoe bearings, Hydrodynamic journals bearings, short and finite bearing, Thrust bearings, Sintered bearing, Non- Circular bearings and multi side surface bearings.

UNIT 3

[12 hours]

LUBRICANTS AND MONITORING

Lubricants, Type of lubricants, Properties and testing, service classification of lubricants, Additives,Lubrication of tribological components, Lubrication systems, Lubricant monitoring, SOAP, Ferrography and other rapid testing methods for lubricants contamination.

HYDROSTATIC (EXTERNALLY – PRESSURIZED) BEARINGS & LUBRICATION: Hydrostatic bearing, basic concepts Bearing pad coefficients. Restrictors, Capillary, orifice and flow control valve, bearing characteristic number and performance coefficients, flat, Conical and spherical pad thrust bearing, Multirecess journal and thrust bearings, Air and gas lubricated bearings.

UNIT 4

[12 hours]

ELASTO HYDRO DYNAMICS AND GREASE LUBRICATION (RHEOLOGY): Lubrication of Ball and roller bearings, cams and gears, selection and life estimation, fatigue and diagnostics. Non- Newtonian fluids, characteristics, Thixotopic, materials and Bingham solids, grease lubrication and stability. Trilogy in Extreme environments Tribology of components in extreme environments like vacuum, Pressure and Temperature

Course Outcomes

After learning the course the students should be able to:

1. Understand the fundamentals of tribology and associated parameters.
2. Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.

Text Books

1. Bowden, F.P. & Tabor, D., “Friction and Lubrication of solids”, Oxford University press., 1986.
2. Ernest Rabinowiez, :“Friction and wear of materials” Inter science Publishers, 1995.
3. Neale, M.J., Tribology – :Hand Book”, Butterworth, 1995.

Reference Books

1. Fuller D.D., : “Theory and practice of Lubrication for engineers”, John Wiley sons, 1984.
2. Gross, W.A.,: “Gas film lubrication”, Wiley, 1980.

Web Resources

1. http://allaboutmetallurgy.com/wp/wp-content/uploads/2016/12/Introduction- to-Tribology.pdf - Introduction to Tribology

2. https://www.bruker.com/fileadmin/user_upload/8-PDF-Docs/SurfaceAnalysis/TMT/Webinars / Tribology-TriboAuto- webinar-COE - 27032014_Final.pdf - Tribo-testing Applications in Automotive and Effective Characterization of the Tribo-tests
3. https://prezi.com/tk8tawqca-c_/friction- in-extreme- conditions/ - Friction in Extreme Conditions
4. http://www.tribology-abc.com/abc/sinter.htm - Sintered bearings
5. http://www.substech.com/dokuwiki/doku.php?id=classification_of_lubricants - Classification of lubricants
6. https://www.youtube.com/watch?v=RZXxlZ5SWpQ - Hydrostatic Bearing (Working Animation)
7. http://www.specialtycomponents.com/Resources/Technical-Articles/Introduction- to-Air-Bearings/ - Introduction to Air Bearings
8. http://thermal-lube.com/wp- content/uploads/2014/02/Trib-in- extreme-environments-Beijing- STLE.pdf - Tribology and Lubrication in Extreme Environments

Subject: **Production Technology (DE-III)**								
Program: **B.Tech. Automobile Engineering**				Subject Code: AU0714			Semester: **VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	24/60	0	16/40	0	100

Course Objectives

1. Students will be able to apply basics of metal machining processes very well. They can have enough knowledge of different forces acting while cutting with tool life and wear. They can interpret and utilize the economics of machining.
2. Learning of the technology of Gear and threads manufacturing which is grassroots knowledge of any manufacturing industries. They are able understand the usefulness of Jig & Fixtures, Presses & Press work, Types of Dies and various forces acting during cutting. They also understand non conventional machining processes its importance, application advantages and economy aspect in production technology.

CONTENTS

UNIT 1

[12 hours]

THEORY OF METAL CUTTING

Principles of metal machining, cutting tools and
tool materials, tool signature, mechanics of chip removal, cutting forces and parameters effecting it, cutting fluids, tool wear, tool life, economics of machining. Multi point cutting tools, temperature measurement at tool-work interface and its effects

UNIT 2

[12 hours]

GEAR AND THREADS MANUFACTURING

Different types of Threads manufacturing methods, and tools involved, Different gear forming and generating methods with their special features, Gears finishing processes.

JIGS & FIXTURES

Definition, its usefulness in mass production, design principles,
locating systems and types of locators & clamps, jig bushes, design of jigs and fixturesfor various machining operations.

UNIT 3

[12 hours]

PRESSES AND PRESS WORK

Classification Of Presses, Classification Of Dies,Cutting Actions In Dies, Clearance, Cutting Forces, Center Of Pressure Design Of PressTools, Methods Of Mounting Of Punches, Scrap Reduction, Strip Layout.

CONTROLS IN MACHINE TOOLS

Machine tool drives, Machine tool structures, Machinetool spindles, Special purpose machines , Capstan and turret lathes, single spindle andmulti spindle automats, bar type and chucking type machines, Design of cam forsingle spindle automat Transfer Machines.

UNIT 4

[12 hours]

NON-CONVENTIONAL MACHINING

EDM, IBM, ECM, ECG, CM, AJM, wire cut EDM, ,USM, LBM process principle, process parameters and their applications

Course Outcomes

1. Students will be able to apply basics of metal machining processes very well with the detailed signature of tools.
2. Students able to understand different forces acting while metal cutting and can draw merchant circle diagram and also able to apply knowledge to economic metal cutting.
3. Students can able to grasp distinctive knowledge of gear forming and its generating methods.
4. Students are able to clutch its usefulness and design of such locating and fixing devises.
5. Learn in depth about press and press work
6. Gained elementary knowledge in Non-conventional machining and its application in industries.

Text Books

1. Boothroyd Fundamentals of machining and machine tools, by -CRC publication 2nd edition 1990
2. M C Shaw Metal Cutting principles, by, Oxford University press 2nd editin 2004

Reference Books

1. Donaldson Tool Design, Tata McGraw Hill Publication 4th edition 2012
2. Trent Metal cutting Principles McGraw Hill Publication.4th edition 2000

Web Resources

1. http://nptel.ac.in/downloads/112105127/ - Metal Cutting
2. http://nptel.ac.in/courses/112105126/33 - Gear and Threads Manufacturing
3. http://nptel.ac.in/courses/112105126/34 - Jigs & Fixtures
4. http://nptel.ac.in/courses/112107144/8 - Presses And Press Work
5. http://nptel.ac.in/courses/112104028/ - Non-Conventional Machining

Subject: **Disaster Management**								
Program: **B.Tech. Civil Engineering**				Subject Code:CV0712			Semester: **VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	-	0	0	24/60	0	16/40	0	100

Course Objectives:

1. To explain students the conceptual applications and principles of management to mitigate various disasters.

COURSE CONTENTS:

UNIT-I **[03 hours]**

Introduction

Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention,mitigation

UNIT-II **[04 hours]**

Disasters classification

Natural disasters (floods, drought, cyclones, volcanoes, earthquakes,tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrialpollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard andvulnerability profile of India, mountain and coastal areas, ecological fragility

UNIT-III **[06 hours]**

Disaster Impacts:

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health,psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; globaland national disaster trends; climate-change and urban disasters. Disaster Risk Reduction

Disaster management cycle:

Phases; prevention, mitigation, preparedness, relief andrecovery; structural and non-structural measures; risk analysis, vulnerability and capacityassessment; early warning systems, Post-

disaster environmental response (water, sanitation,food safety, waste management, disease control); Roles and responsibilities ofgovernment,community, local institutions, NGOs and otherstakeholders; Policies and legislation for disasterrisk reduction, DRR programmes in India and the activities of National DisasterManagementAuthority.

UNIT-IV **[02 hours]**

Applications of Science and Technology for Disaster Management and Mitigation
Geo-informatics in Disaster Management (RS, GIS and GPS), Disaster Communication System (Early Warning and Its Dissemination), Land use planning and development regulations, Disaster safe designs and Development Regulations, Disaster safe designs and Construction structural and Non structural Mitigation of Disasters. Science and Technology Institutions for Disaster Management in India.

Text Books:

1. Ghosh G.K., 2006, Disaster management, APH Publishing Corporation.

Reference Books:

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Singh B. K., 2008, Handbook of Disaster Management: techniques and guidelines, Rajat Publications

Course Outcomes:

1. Understand disasters, disaster preparedness and mitigation measures.
2. Understand role of IT, remote sensing, GIS in risk reduction.
3. Understand disaster management acts and guidelines along with the role of various stack-holders during disasters.

Web resources:

1. http://nidm.gov.in/PDF/Disaster_about.pdf
2. https://www.slideshare.net/Jyothi19587/disaster-ppt
3. https://www.slideshare.net/SayefAmin1/natural-disaster-its-causes-effects
4. https://www.slideshare.net/rahulp4/man-made-disasters-23947076
5. https://www.slideshare.net/urveshprajapati3990/disaster-management-in-india-56546805
6. www.ndmindia.nic.in/presentation/Presentation%20by%20JS%20(DM)%20(1).ppt
7. https://www.geospatialworld.net/article/information-technology-and-natural-disaster-management-in-india/
8. http://www.bvicam.ac.in/news/NRSC%202007/pdfs/papers/st_230_03_02_07.pdf
9. http://eagri.tnau.ac.in/eagri50/ENVS302/pdf/lec13.pdf

10. http://nptel.ac.in/courses/105105104/pdf/m16l39.pdf
11. https://www.unisdr.org/we/inform/events/50220

MOOCs:

1. https://www.mooc-list.com/tags/disaster-management

8TH SEMESTER

Approved Vide Agenda Item No. 03 of Minutes of Meeting of Academic Council held on 11 July 17

B-TECH AUTOMOBILE ENGINEERING, SEMESTER –VIII TEACHING & EXAMINATION SCHEME WITH EFFECT FROM JULY 2017														
SR NO	CODE	SUBJECTS	TEACHING SCHEME			CREDITS	HOURS	EXAMINATION SCHEME						
								THEORY			PRACT		TOTAL
								CIE		ESE	CIE	ESE	
			L	T	P			MID	IE				
1	AU0801	Project	00	00	40	20	40	00	00	00	40	60	100
TOTAL			**00**	**00**	**40**	**20**	**40**	00	00	00	40	60	**100**

Subject: **Project**								
Program: **B.Tech. Automobile Engineering**				Subject Code:AU0801			Semester: **VIII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
00	00	40	20	00	60	00	40	100