BHARATH UNIVERSITY
AUTOMOBILE ENGINEERING DEPARTMENT
M.TECH- AUTOMOBILE ENGINEERING
REGULATIONS - 2015

CURRICULUM I TO IV SEMESTERS (FULL TIME)

SEMESTER I

SL. NO	CATE GORY	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY							
1	PM	MMA102	Advanced Mathematics for Automobile Engineers	3	2	0	4
2	PC	MAM 101	Thermal Engineering	3	2	0	4
3	PC	MAM 102	Automotive Engines and Subsystems	4	0	0	4
4	PC	MAM103	Automotive Chassis	3	0	0	3
5	PC	MAM 104	Automotive Transmission	3	0	0	3
6	PC	MAM 105	Advanced Materials for Automotive Engineers	3	0	0	3
PRACTICAL							
7	PC	MAM 1L1	Automotive Engines Lab	0	0	2	2
			TOTAL	18	4	2	**23**

SEMESTER II

SL. NO	CATE GORY	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY							
1	PC	MAM 201	Automotive Electrical and Electronics	3	0	0	3
2	PC	MAM 202	Vehicle Body Engineering	3	0	0	3
3	PC	MAM 203	Vehicle Dynamics	3	2	0	4
4	PC	MAM 204	Engine Management Systems	3	0	0	3
5	PE	MAM 2E1	Elective-I	3	0	0	3
6	PE	MAM 2E2	Elective -II	3	0	0	3
PRACTICAL							
7	PC	MAM 2L1	Automotive Electrical and Electronics Laboratory	0	0	2	2
			TOTAL	18	2	2	**21**

SEMESTER III

SL. NO	CAT EGO RY	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY							
1	PC	MAM 301	Vehicle Management Systems	3	0	0	3
2	PE	MAM 3E3	Professional Elective-III	3	0	0	3
3	OE	MAM 3E4	Professional Elective – IV	3	0	0	3
PRACTICAL							
4	PC	MAM3L1	Computer Aided Vehicle Design Lab	0	0	2	2
5	PR	MAM3P1	Project Work – Phase I	0	0	6	6
			TOTAL	9	0	8	**17**

SEMESTER IV

SL. NO	CATE GORY	COURSE CODE	COURSE TITLE	L	T	P	C
		PRACTICAL					
1	PC	MAM4P1	Project Work - Phase II (Continuation of Phase I)	0	0	12	12
			TOTAL	0	0	12	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF DEGREE = 73

LIST OF ELECTIVES (Elective I to IV)					
Professional Elective –I					
MAM001	Rubber Technology for Automobiles	3	0	0	3
MAM002	Noise vibration and Harshness	3	0	0	3
MAM003	Transport management and Motor Industry	3	0	0	3
MAM004	Advanced Manufacturing Processes	3	0	0	3
Professional Elective –II					
MAM005	Automotive Air-conditioning systems	3	0	0	3
MAM006	Automotive Aerodynamics	3	0	0	3
MAM007	Tyre Technology	3	0	0	3
MAM008	Simulation of Vehicle Systems	3	0	0	3
Professional Elective –III					
MAM009	Alternative Fuels and Propulsion Systems	3	0	0	3
MAM010	IC Engine Process Modeling	3	0	0	3
MAM011	Vehicle Maintenance	3	0	0	3
MAM012	Computer Aided Design (CAD)	3	0	0	3
Open Elective –IV					
MST070	Research Methodology	3	0	0	3
MAM014	Electric and Hybrid Vehicles	3	0	0	3
MAM015	Instrumentation and Experimental Techniques	3	0	0	3
MAM016	Quality Control and Reliability Engineering	3	0	0	3

MMA 102	ADVANCED MATHEMATICS FOR AUTOMOBILE ENGINEERS	L	T	P	C
	Total Contact Hours: 60	3	2	0	4
	Prerequisite:Engineering Mathematics-I, II & III, Numerical methods				
	Course Designed by :Department of Mathematics				

OBJECTIVES

To train the students to apply advanced mathematical tools in modeling real time problems in Automobile and solve algebraically and numerically.

COURSE OUTCOMES (COs)

CO1	To learn and Compute eigen values and eigen vectors by different methods.
CO2	To Solve different non-linear ordinary and Partial differential equations
CO3	To Solve Problems of variation applicable in Automobile engineering.
CO4	To Find numerical solution for advanced problems in interpolation and integration
CO5	To Solve LPP by different algorithms.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	M	M
	CO2	H	H	M	H	M
	CO3	H	H	H	M	L
	CO4	H	H	H	M	L
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th, 38th& 39thMeeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I MATRIX THEORY 12

Eigen values using QR transformations – generalized eigen vectors – canonical forms – singular value decomposition and applications –pseudo inverse – least square approximations.

UNIT II DIFFERENTIAL EQUATIONS – NONLINEAR ODE & PDE 12

Introduction – Equations with separable variables – Equations reducible to linear form – Bernoulli's equation – Riccati's equation – Special forms of Riccati's equation – Laplace

transform methods for one dimensional wave equation – Displacement in a long string – Longitudinal vibration of an elastic bar.

UNIT III CALCULUS OF VARIATION 12

Introduction – Euler's equation – several dependent variables Lagrange's equations of Dynamics – Integrals involving derivatives higher than the first – Problems with constraints – Direct methods and Eigen value problems.

UNIT IV INTERPOLATION AND INTEGRATION 12

Hermite's Interpolation – Cubic Spline Interpolation – Gaussian Quadrature – Cubature.

UNIT V LINEAR PROGRAMMING PROBLEM 12

Simplex algorithm – Two-phase and Big-M Techniques – Duality theory – Dual simplex method – Integer programming - Gomory's cutting plane method.

REFERENCES

1. Stephenson, G, Radmore, P.M., "Advanced Mathematical Methods for Engineering and Science Students", Cambridge University Press 1999.
2. Richard Bronson, "Matrix Operations", Schaum's Outline Series, 2nd Edn. McGraw Hill, New York, 1989.
3. Kreyszig, E., "Advanced Engineering Mathematics", John Wiley, 8th Edition, 2004.
4. Sastry.S.S, "Introductory Methods of Numerical Analysis", 5th Edn. PHI, New Delhi.2008
5. Gupta, A.S. "Calculus of Variations with Applications", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
6. Sankara Rao.K., "Introduction to Partial Differential Equations", Prentice Hall of India Pvt. Ltd.,New Delhi, 1997.
7. Hamdy A.Taha. "Operations Research-An Introduction". 8th Edn. PHI, New Delhi. 2007.

MAM 101	THERMAL ENGINEERING	L	T	P	C
	Total Contact Hours: 60	3	2	0	4
	Prerequisite: Engineering Thermodynamics, Heat and Mass Transfer, Inte Combustion Engines and Refrigeration And Air Conditioning				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

- To integrate the concepts, laws and methodologies from the first course in thermo dynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems.

COURSE OUTCOMES (COs)

CO1	To Know the basics on Combustion, IC Engines Processes and Thermodynamic reactions
CO2	To Learn the Phenomena of Chemical Reactions and Kinematics of Combustion
CO3	To Learn about various types of Turbines, Steam nozzles and Governors
CO4	To Know about various types of Compressors and Efficiency Parameters
CO5	To Learn about refrigeration cycles and to solve the problems on Psychometry

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	M	M
	CO2	H	H	M	H	M
	CO3	H	H	H	M	L
	CO4	H	H	H	M	L
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th, 38th& 39thMeeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I THERMODYNAMICS OF COMBUSTION 12

Premixed and diffusion combustion process in IC engines and gas turbines. First and Second Law of Thermodynamics applied to combustion- combustion Stoichiometry- chemical equilibrium, spray formation and droplet combustion.

UNIT II CHEMICAL KINETICS OF COMBUSTION 12

Fundamentals of combustion kinetics, rate of reaction, equation of Arrhenius, activation energy. Chemical thermodynamic model for Normal Combustion.

UNIT III STEAM NOZZLES AND TURBINES 12

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow, Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations –Governors.

UNIT IV AIR COMPRESSOR 12

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor

UNIT V REFRIGERATION AND AIR CONDITIONING 12

Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide –water systems (Description only) - Alternate refrigerants – Comparison between vapour compression and absorption systems - Air conditioning system: Types, Working Principles - Psychrometry, Psychometric chart - Cooling Load calculations - Concept of RSHF, GSHF, ESHF -(Use of standard thermodynamic tables, Mollierdiagram, Psychrometric chart and refrigerant property tables are permitted in the examination)

TEXT BOOKS:

1. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007.
2. Kothandaraman.C.P., Domkundwar.S,Domkundwar. A.V., "A course in thermal engineering,"Dhanpat Rai &sons, Fifth edition, 2002.

REFERENCES:

1. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2000.
2. Arora.C.P,"Refrigeration and Air Conditioning," Tata McGraw-Hill Publishers 1994.
3. Ganesan V. ." Internal Combustion Engines", Third Edition, Tata Mcgraw-Hill 2007.
4. Rudramoorthy, R, "Thermal Engineering ", Tata McGraw-Hill, New Delhi, 2003.

MAM 102	AUTOMOTIVE ENGINES AND SUBSYSTEMS	L	T	P	C
	Total Contact Hours: 45	4	0	0	4
	Prerequisite: Thermal Engineering, Internal Combustion Engines				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The main objective of this course is to impart knowledge in automotive engine. The detailed concept, construction and principle of operation of engine and various engine components, combustion, cooling and lubrication systems will be taught to the students. At the end of the course the students will have command over automotive engines and the recent development in the area of engines.

COURSE OUTCOMES (COs)

CO1	To Know the basics on operating cycles of SI and CI engines
CO2	To Study about fuel supply and fuel injection systems in SI and CI engines
CO3	To Learn about various types of cooling and lubrication system in SI and CI engines
CO4	To learn about the stages involved in combustion with utilization of optimized design on combustion chamber
CO5	To Learn about new technological innovations on engine and its management systems with recent development systems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I ENGINE BASIC THEORY 9

Engine types - operating cycles of SI and CI Engines - Engine design and operating parameters - Two and four stroke engines - Typical performance curves for automobile engines- two stroke engine - performance and emissions from SI and CI engines- Standards for Bharath stages and other Standards.

UNIT II FUEL SUPPLY, IGNITION SYSTEM 9

Theory of carburetion and carburetors — Design aspects — Petrol Injection and diesel fuel injection - pumps and injectors, gasoline direct injection system - conventional and electronic ignition systems for SI engine.

UNIT III COOLING AND LUBRICATING SYSTEM 9 Air cooling and water cooling – thermosympon cooling, forced cooling systems. Fins and radiator - design aspects. Theory of lubrication — types of lubrication, splash lubrication system, petroil lubrication system, forced feed lubrication system.

UNIT IV AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 9

Premixed combustion, diffused combustion, laminar and turbulent combustion of fuels in engines. Droplet combustion — combustion in SI and CI engines. - Cylinder pressure data and heat release analysis. Optimized design of combustion chambers.

UNIT V NEW ENGINE TECHNOLOGY 9

Lean Burn engine – Different approaches to lean bum – LHR engine – Surface ignition concept – catalytic ignition – homogenous charge compression ignition in diesel engines – variable valve timing - electronic engine management.

TEXTBOOK

1. J.B.Heywood, 'Internal combustion engine Fundamentals', McGraw Hill Book Co, 1989.
2. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.

REFERENCES:

1. Edward F.Obert, 'Internal combustion engines and air pollution' Harber and Row Publishers, 1973.
2. M.Khovakh, 'Motor Vehicle Engines', Mir Publishers, Mascow,1976
3. W.H.Crouse and A.L.Anglin, 'Automotive Emission control', McGraw Hill Book Co, 1995.
4. G.S.Springer and A.J.Patterson, 'Engine emissions and pollutant formation', plenum press, Newyork, 1985.

MAM 103	AUTOMOTIVE CHASSIS	L	T	P	C
	Total Contact Hours: 60	3	0	0	3
	Prerequisite: Automobile Engineering, Vehicle Body Engineering				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

- Study of the Constructional details and Theory of important drive line, Structural,
- Steering, Braking and Suspension Systems of Automobiles.
- Problem–Solving in Steering Mechanism, Propeller Shaft, Braking and Suspension Systems are to be done.

COURSE OUTCOMES (COs)

CO1	To Know the basics on drive location and frame construction on vehicles
CO2	To Study about Steering geometry, Steering gear box with types and steering conditions
CO3	To Learn about various types of Rear axle , final drive and its mechanism
CO4	To learn about the constructional details and types of braking system and to analyze its braking performance with tests.
CO5	To study on suspension system with its type along with the construction of tyres and wheels

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION 10

Layout with reference to power plant, steering location and drive, frames, constructional details, materials, testing of frames, integral body construction.

UNIT II FRONT AXLE STEERING SYSTEM 12

Front axle type, rigid axle and split axle, Constructional Details, Materials, Front wheel geometry viz., camber, castor, kingpin inclination, toe-in and toe-out. 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 III DRIVE LINE STUDY 12

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 and differential housing.

UNIT IV BRAKING SYSTEM 12

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, Exhaust brakes, power and power assisted brakes. Testing of brakes.

UNIT V SUSPENSION SYSTEMS14

Types of suspension, Factors influencing ride comfort, Types of suspension 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 tube tyres.

TEXT BOOKS:

1. K. Newton, W.Steeds and T.K.Garret, "The Motor Vehicle", 13th Edition, Butterworth Heinemann, India, 2004.
2. P.M.Heldt, "Automotive Chassis", Chilton Co., New York, 1982.
3. W.Steed, "Mechanics of Road Vehicles", Illiffe Books Ltd., London. 1992.

REFERENCES:

1. Harban Singh Rayat, "The Automobile", S. Chand & Co. Ltd, New Delhi, 2000.
2. G.J.Giles, "Steering Suspension and Tyres", Illiffe Books Ltd., London, 1975.
3. Kirpal Singh, "Automobile Engineering", Standard publishers, Distributors, Delhi, 1999.
4. G.B.S.Narang, "Automobile Engineering", Khanna Publishers, Twelfth reprint New Delhi, 2005.
5. R.P.Sharma, "Automobile Engineering", Dhanpat Rai & Sons, New Delhi, 2000.

MAM 104	AUTOMOTIVE TRANSMISSION	L	T	P	C
	Total Contact Hours: 60	3	0	0	3
	Prerequisite: Automobile Engineering, Machine Design, Automotive Chassis				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The main objective of this course is to impart knowledge in automotive transmission. The detailed concept, construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devisees and automatic transmission system will be taught to the students. The design of clutch and gearbox will also be introduce to the students. At the end of the course the students will have command over automotive transmission concepts and application.

COURSE OUTCOMES (COs)

CO1	To Know and to study about Clutch and Gearbox with its type in detail
CO2	To Study on various types of hydrodynamic torque transmission and its performance characteristics
CO3	To Know about Automatic Transmission and its type in detail
CO4	To learn the principle of Hydrostatic and Electric drive system elaborately
CO5	To study on applications of Automatic Transmission with its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I CLUTCH AND GEAR BOX 15

Requirement of Transmission system. Different types of clutches: Principle, construction and operation of friction clutches. Objective of the gear box. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications. Different types of gear boxes.

UNIT II HYDRODYNAMIC DRIVES 13

Principles, performance and limitations of fluid coupling Constructional details of a typical fluid coupling. Reduction of drag torque, Principle, construction and advantages of hydrodynamic torque converters. Performance characteristics, converter couplings. Multi-stage Torque converter and poly phase torque converter.

UNIT III AUTOMATIC TRANSMISSION 11

Ford – T model gear box, Wilson gear box- Cotal electric transmission– Hydraulic control systems of automatic transmission.

UNIT IV HYDROSTATIC DRIVE AND ELECTRIC DRIVE 9

Principle of hydrostatic drive systems. Construction and working of typical drives. Advantages and limitations. Control of hydrostatic transmissions, Principle of electric drive. Early and modified Ward Leonard control systems.

UNIT V AUTOMATIC TRANSMISSION APPLICATIONS 12

Chevrolet "Turbo glide" transmission. Toyota's Automatic transmission with Electronic control system. Continuously Variable Transmission (CVT) – types – Operations.

TEXTBOOK:

1. Heldt P.M, Torque Converters, Chilton Book Co., 1992.
2. K. Newton, W.Steeds and T.K.Garret, "The Motor Vehicle", 13th Edition, Butterworth Heinemann, India, 2004.

REFERENCES:

1. Heinz Heisler, "Advanced Vehicle Technology", second edition, Butterworth – Heinemann, New York, 2002.
2. Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers, Delhi, 2005.

MAM 105	**ADVANCED MATERIALS FOR AUTOMOTIVE ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours: 60	3	0	0	3
	Prerequisite: Nano Technology and its applications, Production Technology , Metallurgy and Manufacturing Process				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The main objective of this course is to impart knowledge in material science with modes of manufacturing process involved in construction of various technologies employed in automobile Industries. Students been focused on basics related to Nano technological developments which sustainably develop their skill in selection of materials for the process of manufacturing.

COURSE OUTCOMES (COs)

CO1	To Know and to study about FRP and its properties with its application in Automotive sector
CO2	To Study about the basics of material properties like ceramics and reinforced materials
CO3	To learn about CMC & PMC Characteristics with its type in detail
CO4	To learn about the utilization of elastomers and plastics in automotive manufacturing process
CO5	To study on Foams, Adhesives, Coatings and Paints in detail

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M

	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I FIBRE REINFORCED PLASTICS (FRP) 12

Definition; Types; General properties and characteristics; Reinforcing materials – particles, fibers, whiskers; Properties of reinforcing materials; Matrix materials; Additives; Properties of FRP materials; Automotive applications

UNIT II ENGINEERING CERAMICS AND METAL MATRIX COMPOSITE 12

Reinforcement materials; Matrix; Characteristics and specialized properties like – weibull modulus, high temperature strengths, wear & frictional property improvements; Selection criteria; Advantages and limitations in use of ceramics & MMCs; Fracture mechanics; Auto applications.

UNIT III CERAMIC & POLYMER METAL COMPOSITES 12

CMC & PMC Characteristics, Various types, Advantages & Limitations, Applications. Role of Mixtures- Reinforcement – Particles – Fibres. Carbon/Carbon Composites- Advantages, Limitations- Sol-Gel techniques – Chemical Vapor Deposits. Composite for automotive applications.

UNIT IV AUTOMOTIVE ELASTOMERS AND PLASTICS POLYMERIC MATERIALS AND MANUFACTURING PROCESSES 12

Polymerization – Thermosets Vs Thermoplastics – Classes and types of polymers; Properties and limitations of plastic material species; Additives; Auto applications – exterior, interior, engine and fuel line, transmission systems, electrical and electronic components. Injection molding, Reaction injection molding (RIM), Transfer molding, Extrusion, compression molding, blow molding, scopes and limitations of various manufacturing processes, mold making, safety in handling of materials, hands on training on processes, selection criteria for auto applications, economics

UNIT V FOAMS, ADHESIVES, COATINGS AND PAINTS 12

PU & Latex foams - Formulations and manufacturing Control of various foam properties – density, modulus of elasticity, compression set, dynamic properties, etc.Adhesives - Condensation polymerization of products like – phenol formaldehyde (Phenolic resins), Amino resins, Polyester resins, Alkyl resins, Epoxy resins, Polyurethane resins, Polyamide resins; Additional polymerization products like – Vinyl resins, Vinyl alcohol resins,

vinylidine resins, Styrene resins and Acrylic resins. Protective coatings and Paints - Organic paints and coatings, metal coatings, ceramic coatings, Linings, primers, varnishes, enamels, galvanizing, anodizing, blackodizing, electro plating, CVD & PVD surface coatings,Other Materials - Seals and Gaskets, Automotive glasses, Refractory materials

TEXT BOOK

1. Haslehurst.S.E., "Manufacturing Technology ", ELBS, London, 1990.
2. Krishnan K. Chawle. "Composite Material: Science and Engineering" Second Edition, Springer, 1998.
3. T.W.Clyne, P.J. Withers, "An Introduction to metal matrix composites", Cambridge University Press, 1993.
4. F.C.Campbell "Structural Composite Materials", Materials Park,ASM International,2010.

REFERENCE BOOKS

1. Derek Hull, "An Introduction to composite Materials", Cambridge University Press, 1988.
2. B.T.Astrom, "Manufacturing of polymer composites", Champman & Hall, 1997 S.C.Sharma, "Composite Materials", Narosa Publishing House, 2000.
3. Berins, ISBN 0442010699, "Design with Plastics and Plastic Engineering", Wiley & Sons Inc., 1995.
4. D. Huda, M.A. E1 Baradie and M.S.J. Hashmi, "Metal-matrix composites: Materials aspects- Part II", Journal of Materials Processing Technology, 37 (1993) 521-541.
5. ASM Metals Hand Book, Vol.21, "Composites", ASM International, 2001.
6. Kalyan Sehanobish, "Engineering Plastics and Plastic Composites in Automotive Applications", SAE International, April 2009.
7. Francis Gardiner and Eleanor Garmson "Plastics and the Environment" Smithers Rapra, 2010.
8. Mahendra D Baijal "Plastic Polymer Science and Technology", John Wiley&Sons, 1982.

MAM 1L1	AUTOMOTIVE ENGINES LAB	L	T	P	C
	Total Contact Hours: 45	0	0	2	2
	Prerequisite: Automotive Engines and Emissions, Alternate Fuels, IC Engines				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The main objective of this course is to impart knowledge in the assembling and dismantling and study of different types of an engine and its various systems like steering system, transmission system, electrical system, ignition system, injection system, Braking system. At the end of the course the student will be well versed in the assembling and dismantling of any vehicles with performance study of SI and CI engines.

COURSE OUTCOMES (COs)

CO1	To Know and to study the performance aspects of SI and CI engines
CO2	To Study and to determine the Pressure crank angle
CO3	To learn about CMC & PMC Characteristics with its type in detail
CO4	To learn about Heat Balance Test on IC engines
CO5	To study on Assembling and Dismantling of various SI and CI engines

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Performance Test of SI Engine.
2. Performance Test of CI Engine.
3. Determination of pressure crank angle diagram in IC Engines.
4. Heat balance test on IC engines
5. Performance test on variable compression ratio multi fuel diesel engine.
6. Assembling and dismantling of the following

(i) Fiat engine.
(ii) CI-Ashok Leyland engine
(iii) Single plate, Diaphragm Clutch.
(iv) Constant mesh, Sliding mesh gear box
(v) Transfer case
(vi) Differential
(vii) Front axle, Rear axle
(viii) Brakes system
(ix) Steering system

MAM 201	**AUTOMOTIVE ELECTRICAL AND ELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Basic Electrical and Electronics, Automotive Electrical systems				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, charging System, Ignition System, Lighting System and Dash – Board Instruments, Electronic ignition system, various sensors and the role of ECU.

COURSE OUTCOMES (COs)	
CO1	To Know and to study the basics of Automobile Charging and Starting systems with its characteristics and mechanism
CO2	To Study the basic elements of Charging and Lighting system with its accessories
CO3	To learn about Mechanism of Electronic Ignition and Injection systems
CO4	To study about the various sensors in a vehicle
CO5	To study aboutMicroprocessor and Microcontroller applications in Automobiles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I BATTERIES AND STARTING SYSTEM 9

Different types of Batteries – Principle, Construction and Electrochemical action of Lead – Acid battery, Electrolyte, Efficiency, Rating, Charging, Testing and Maintenance. Starting System, Starter Motors – Characteristics, Capacity requirements. Drive Mechanisms. Starter Switches.

UNIT II CHARGING SYSTEM, LIGHTING SYSTEM AND ACCESSORIES 9

D.C. Generators and Alternators their Characteristics. Control cutout, Electrical, Electro-mechanical and electronic regulators. Regulations for charging. Wiring Requirements, Insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods. Lighting design, Dash board instruments, Horns, wiper, Trafficators, Warning system and safety devices.

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEMS 9

Spark plugs, Advance mechanisms. Different types of electronic ignition systems - variable ignition timing, distributor less ignition. Spark timing control. Electronic fuel injection systems. Engine mapping.

UNIT IV SENSORS IN AUTOMOBILES 9

Basic sensor arrangement. Types of sensors – Oxygen sensor, fuel metering/Vehicle speed sensor, mass air flow sensor, temperature sensor, altitude sensor, pressure sensor and detonation sensor. Various actuators and its application in automobiles.

UNIT V MICROPROCESSOR IN AUTOMOBILES 9

Microprocessor And Microcomputer controlled devices in automobiles such as instrument cluster, Voice warning system, Travel information system, Keyless entry system, Automatic Transmission. Environmental requirements (vibration, Temperature and EMI).

TEXTBOOK:

1. Judge. A.W., Modern Electrical Equipment of Automobiles, Chamman & Hall, London, 1992.
2. William B. Ribbens -Understanding Automotive Electronics, 5th edition- Butter worth Heinemann, 1998
3. Young. A.P. & Griffiths. L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990.

REFERENCES:

1. Vinal. G.W., Storage Batteries, John Wiley & Sons inc., New York, 1985.
2. Crouse.W.H. Automobile Electrical Equipment, McGraw Hill Book Co Inc., New York, 1980.
3. Spreadbury.F.G. Electrical Ignition Equipment, Constable & Co Ltd., London, 1962.
4. Robert N Brady Automotive Computers and Digital Instrumentation, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
5. Kohli P L., "Automotive Electrical Equipment", Tata McGraw Hill Publishing Co., Delhi, 2004

MAM 202	VEHICLE BODY ENGINEERING	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Automotive chassis, Body Building Technology, Automotive Aerodynamics				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamic, concept, paneling of passenger car body trim. At the end of the course the student will be well versed in the design and construction of external body of the vehicles.

COURSE OUTCOMES (COs)

CO1	To Know and to visualize the Car body details with its design and construction
CO2	To Know and to visualize the Bus body details with its design and construction
CO3	To study about the vehicle design on basis to aerodynamic aspects and aesthetic features with safety concerns.
CO4	To Know and to visualize the Commercial vehicle details with its design and construction
CO5	To study about the procedures involved in designing Commercial vehicle pertaining to aerodynamic aspects

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e

2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I CAR BODY DETAILS 9

Types of car bodies - visibility: regulation, driver's visibility, methods of improving visibility- safety: safety design, safety aspects. Constructional details of a passenger car.

UNIT II BUS BODY DETAILS 9

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. Construction of Conventional and integral type bus.

UNIT III CAR AERODYNAMICS 9

Objects — Vehicle types of drag. Various types of forces and moments. Effects of forces and moments. Various body optimization techniques for minimum drag. Principle of wind tunnel technology. Flow visualization techniques. Test with scale models.

UNIT IV COMMERCIAL VEHICLE DETAILS 9

Classification of commercial vehicle bodies. Construction of Tanker body and Tipper body. Dimensions of driver'sseat in relation to controls. Driver's cab design. Compactness of Driver's cab. Segmental construction of driver's cab.

UNIT V COMMERCIAL VEHICLE AERODYNAMICS 9

Effects of rounding sharp front body edges. Effects of different cab to trailer body Fore body pressure distribution. Effects of a cab to trailer body roof height. Commercial vehicle drag reducing devices. Modern painting process of a commercial vehicle.

TEXTBOOK:

1. Powloski, J., 'Vehicle Body Engineering', Business Books Ltd, 1970
2. J.G. Giles, 'Body Construction and Design', Butterworth and Co., 1975

REFERENCES:

1. John Fenton 'Vehicle Body layout and analysis', Mechanical Engineering Publication Ltd., 1984
2. Heinz Heisler, "Advanced Vehicle Technology", second edition, Butterworth – Heinemann, New York, 2002

MAM 203	VEHICLE DYNAMICS	L	T	P	C
	Total Contact Hours: 60	3	2	0	4
	Prerequisite: Automotive chassis, Automotive Aerodynamics				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

When the vehicle is at dynamic condition more vibration will be produced. It is essential to study about vibrations and how to reduce the vibration under different loads, speed and road conditions in order to improve the comfort for the passengers and life of the various components of the vehicle. In this subject these aspects have been given.

COURSE OUTCOMES (COs)

CO1	To Know about basics of Vibration and Mechanical vibrating systems
CO2	To Know the classifications of tyres with its properties and distribution of moments and forces acting on them
CO3	To study about thePerformance Characteristics of a Vehicle
CO4	To study about the Handling Characteristics of a Vehicle
CO5	To study and to learn about the dynamics of suspension system with its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	H	H	M
	CO2	H	H	L	M	H
	CO3	H	M	H	M	L
	CO4	M	H	L	H	H
	CO5	H	M	L	H	H
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I BASIC OF VIBRATION 12

Classification of vibration, definitions, mechanical vibrating systems, mechanical vibration and human comfort. Modeling and simulation studies. Single degree of freedom, free, forced and damped vibrations. Magnification factor and transmissibility. Vibration absorber. Vibration measuring instruments. Two degree of freedom system, Modal analysis.

UNIT II TYRES 12

Tire forces and moments, rolling resistance of tires, relationship between tractive effort and longitudinal slip of tyres, cornering properties of tyres, ride properties of tyre.

UNIT III PERFORMANCE CHARACTERISTICS OF VEHICLE 12

Equation of motion and maximum tractive effort. Aerodynamics forces and moments. Power plant and transmission characteristics. Prediction of vehicle performance. Braking performance.

UNIT IV HANDLING CHARACTERISTICS OF VEHICLES 12

Steering geometry. Steady state handling characteristics. Steady state response to steering input. Transient response characteristics. Directional stability of vehicle.

UNIT V DYNAMICS OF SUSPENSION SYSTEM 12

Requirements of suspension system. Spring mass frequency, wheel hop, Wheel wobble, wheel shimmy, choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft, Hydraulic dampers and choice of damping characteristics. Compensated suspension systems. Human response to vibration, vehicle ride model. Load distribution. Stability on a curved track, banked road and on a slope.

TEXTBOOK:

1. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., 2002.
2. J.Y.Wong,' Theory of ground vehicles', John Wiley and Sons Inc., Newyork, 1978
3. Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers, Delhi, 2005

REFERENCES:

1. Groover, "Mechanical Vibration", 7th Edition, Nem Chand &Bros, Roorkee, India, 2003.
2. W.Steeds, 'Mechanics of road vehicle' Illiffe Books Ltd, London 1992
3. JG.Giles, 'Steering, Suspension tyres', Illife Books Lid London 1975
4. P.M.Heldt, 'Automotive chassis', Chilton Co ., Newyork, 1982
5. J. R. Ellis, 'Vehicle Dynamics', Business Books, London, 1969.

MAM 204	ENGINE MANAGEMENT SYSTEMS	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Automotive Engines and Emissions, IC engines and Alternative Fuels, Automotive Electronics				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To explain the principle of engines electronic management system and different sensors used in the systems.

COURSE OUTCOMES (COs)

CO1	To Know the basics of Automotive Electronics with its description on various systems
CO2	To Know about the various functions of Sensors and Actuators present in the vehicle
CO3	To study about the SI Engine management systems with its techniques
CO4	To study about the CI Engine management systems with its techniques
CO5	To study about the Digital engine control systems with their applications

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines.

UNIT II SENSORS AND ACTUATORS 9

Inductive, Hall Effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, c Engine and vehicle design data rash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

UNIT III SI ENGINE MANAGEMENT 9

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch Monojetronic, L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control.

UNIT IV CI ENGINE MANAGEMENT 9

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valve.

UNIT V DIGITAL ENGINE CONTROL SYSTEM 9

Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control – Integrated engine control system, Exhaust emission control

engineering, and Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

TEXT BOOKS:

1. Understanding Automotive Electronics William B Ribbens, SAE 1998
2. Automobile Electronics by Eric Chowanietz SAE

REFERENCES:

1. Diesel Engine Management by Robert Bosch, SAE Publications, 3rd Edition, 2004
2. Gasoline Engine Management by Robert Bosch, SAE Publications, 2nd Edition, 2004

MAM 2L1	AUTOMOTIVE ELECTRICAL & ELECTRONICS LAB	L	T	P	C
	Total Contact Hours: 45	0	0	2	2
	Prerequisite: Basic Electrical and Electronics, Automotive Electrical and Electronics				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To provide hands on training on automotive electrical and electronic systems and to provide knowledge on interfacing of different sensors and actuators used in the automobile systems.

COURSE OUTCOMES (COs)

CO1	To Know the basics of Automotive Electronics
CO2	To Know about the Electrical and Electronics Systems with their Characteristics
CO3	To study and to visualizethe characteristics of Load cells, thermocouple and Strain gauges
CO4	To study about the Thermometers and Transducers
CO5	To study on the basic programming of Microprocessor and Microcontroller with interfacin techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS:

Study of electrical systems such as

1. Battery
2. Lighting system
3. Electric horn system
4. Windscreen wiper system
5. Starting motor and drive system
6. Charging system
7. Ignition system

Experiments on

1. Basic Digital circuits
2. Timer
3. Seven segment displays
4. Characteristics of load cells
5. Characteristics of thermocouples
6. Characteristics of resistance thermometers
7. Characteristics of piezoelectric pressure transducers
8. Characteristics of LVDT
9. Characteristics of Strain gauges
10. Programming of microprocessor.
11. Programming of microcontroller.
12. Interfacing of microprocessors,
13. Interfacing of micro controllers.
14. Mini project

MAM 301	**VEHICLE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Basic Electrical and Electronics, Automotive chassis and Control and Computer Control of Vehicle Systems				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To explain the principle of chassis management system and different sensors used in the systems. Students be knowledge on interfacing of different sensors and actuators used in the automobile systems.

COURSE OUTCOMES (COs)

CO1	To Know the basics onComponents of chassis management system
CO2	To Know about the role of Sensors and Actuators in Driveline Control system
CO3	To study and to know about the Safety and Security Systems installed in the vehicle.
CO4	To study and to know about the comfort systems present in a vehicle with electronic management systems
CO5	To study on the Intelligent transportation systems with Data communication modes

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L

	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION 9

Components of chassis management system – role of various sensors and actuators pertain to chassis system – construction – working principle.

UNIT II DRIVELINE CONTROL SYSTEM 9

Speed control – cylinder cut - off technology, Gear shifting control – Traction / braking control, brake by wire – Adaptive cruise control, throttle by wire. Steering - power steering, collapsible and tiltable steering column – steer by wire.

UNIT III SAFETY AND SECURITY SYSTEM 9

Airbags, seat belt tightening system, collision warning systems, child Lock, Anti-lock braking systems, Vision enhancement, road recognition system, Anti-theft technologies, smart card system, number plate coding, central locking system.

UNIT IV COMFORT SYSTEM 9

Active suspension systems, requirement and characteristics, different types, Vehicle Handling and Ride characteristics of road vehicle, pitch, yaw, bounce control, power windows, thermal management system, adaptive noise control.

UNIT V INTELLIGENT TRANSPORTATION SYSTEM 9

Traffic routing system - Automated highway systems - Lane warning system – Driver Information System, driver assistance systems - Data communication within the car, Driver conditioning warning - Route Guidance and Navigation Systems – vision enhancement system - In-Vehicle Computing – Vehicle Diagnostics system – Hybrid / Electric and Future Cars – Case studies.

TEXT BOOKS:

1. U. Kiencke, and L. Nielsen, Automotive Control Systems, SAE and Springer-Verlag, 2000.
2. Ljubo Vlacic, Michel Parent, Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann publications, Oxford, 2001.

REFERENCES:

1. Crouse, W.H. & Anglin, D.L., "Automotive Mechanics", Intl. Student edition, 9th edition, TMH, New Delhi, 2002.

2. William B.Ribbens -Understanding Automotive Electronics, 5th edition, Butter worth Heinemann Woburn, 1998.
3. Bosch, "Automotive Handbook", 6th edition, SAE, 2004.
4. Internet References

MAM 3L1	COMPUTER AIDED VEHICLE DESIGN LABORATORY	L	T	P	C
	Total Contact Hours: 45	0	0	2	2
	Prerequisite: Vehicle Design, Design of Machine Components				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The main objective of this course is to impart knowledge in the designing and evaluating the automobile engine components such as Piston, Connecting rod, Crankshaft, Journal bearings, Camshaft and Automobile chassis components such as Vehicle Chassis, Leaf Spring and Rear axle systems with calculation and model analysis.

COURSE OUTCOMES (COs)

CO1	To Know and to study the Design and Analysis part of Automobile Components
CO2	To Design and to analyze the Engine components with design calculation and Model Analysis
CO3	To Design and to analyze the Chassis components with design calculation and Model Analysis
CO4	To Design and Analyze the Front and Rear axle systems
CO5	To Design and Analyze the various types of gearboxes

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

Design calculation, model and analyze the following automobile components

1. Piston, piston pin and piston rings
2. Connecting rod.
3. Automobile valves

4. Crank shaft
5. Cam shaft
6. Vehicle Chassis
7. Leaf spring, coil spring and torsion bar.
8. Front axle system of a typical 4 Wheeled vehicle
9. Rear axle system of a typical 4 wheeled vehicle
10. Three speed and four speed gear boxes of a heavy vehicle

REFERENCES:

1. Dean Averns, "Automobile Chassis Design ", Illiffe Books Ltd, 1992.
2. Richard Stone, "Introduction to Internal Combustion Engines", McMillan. London, 1985.
3. Bosch, "Automotive Handbook" 6th edition, SAE, 2004.
4. Heldt.P.M. "Automotive Chassis ", Chilton Co., New York, 1992.
5. Steeds'. "Mechanics of Road vehicles ", Illiffe Books Ltd., London, 1990.
6. Giles.J.G. Steering, "Suspension and tyres ", Illiffe Books Ltd., London, 1988.
7. K. Newton, W.Steeds and T.K.Garret, "The Motor Vehicle", 13th Edition, Butterworth Heinemann, India, 2004.
8. Heldt.P.M. "Torque converter ", Chilton Book Co., New York, 1982.
9. Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers, Delhi, 2005
10. ACAD, CATIA and ANSYS software guide / manual

MAM 3P1	PROJECT WORK – PHASE I	L	T	P	C
	Total Contact Hours: 45	0	0	6	6
	Prerequisite: Technical Seminar, Project Review and Report generation				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The objective of project work is to enable the student, a project involving some design and analysis work or theoretical and experimental studies related to the respective engineering discipline.

COURSE OUTCOMES (COs)

CO1	To Know and to State the area of the project irrespective of all classifications
CO2	To Study and to utilize the best method on basis of Cost, Material and Work Feasibility criteria
CO3	To understand and to rejenuvate the skills of thinking, leadership team effort and Knowlec sharing
CO4	To involve and to gather literature reviews on research activities with the aid of modern technological developments
CO5	To Create and to analyze the Model with Classified design with Fabricated Material Properties

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M

	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

The objective of project work is to enable the student, a project involving some design and analysis work or theoretical and experimental studies related to the respective engineering discipline. Every project work shall have a Guide who is a member of the faculty of the University. Three periods per week shall be allotted in the Time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the project.

Student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines. The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

MAM 4P1	**PROJECT WORK – PHASE II**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	0	0	12	12
	Prerequisite: Technical Seminar, Project Review and Report generation				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The objective of project work is to enable the student, a project involving some design and analysis work or theoretical and experimental studies related to the respective engineering discipline.

COURSE OUTCOMES (COs)

CO1	To Know and to State the area of the project irrespective of all classifications

CO2	To Study and to utilize the best method on basis of Cost, Material and Work Feasibility criteria
CO3	To understand and to rejenuvate the skills of thinking, leadership team effort and Knowlec sharing
CO4	To involve and to gather literature reviews on research activities with the aid of modern technological developments
CO5	To Create and to analyze the Model with Classified design with Fabricated Material Properties

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

The objective of project work is to enable the student, a project involving some design and analysis work or theoretical and experimental studies related to the respective engineering discipline. Every project work shall have a Guide who is a member of the faculty of the University. Three periods per week shall be allotted in the Time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the project.

Student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

LIST OF ELECTIVES

PROFESSIONAL ELECTIVE-I

MAM 001	RUBBER TECHNOLOGY FOR AUTOMOBILES	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Nanotechnology, Mechanics of Materials and Automotive Chassis				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

At the end, the student will have good exposure to role of various Rubber components in Automobiles.

COURSE OUTCOMES (COs)

CO1	To know and to Identify the utilization of plastics and rubber components in automobile systems
CO2	To know and to understand the Structure with their properties in relationship to rubber
CO3	To study about the properties of the spring in accordance with their characteristics
CO4	To study about the flexible sealings, hoses and couplings employed in automobiles
CO5	To study about the various couplings and their usage in automobiles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION 6

Identification of plastics / rubber components in automobiles – function – selection criteria.

UNIT II STRUCTURE-PROPERTY RELATIONSHIP OF RUBBER 10

Resilience, creep, hysteresis and damping, stability, set and stress relaxation, behavior in dynamic applications.

UNIT III VIBRATION AND RUBBER SPRING 10

Principle of vibration isolation – rubber mounts – spring design – comparison with metallic springs – shape factor and its effect – forced and free vibrations with damping – typical mounts, compounding and manufacture.

UNIT IV FLUID SEALINGS AND FLEXIBLE COUPLINGS AND HOSES 10

Seals for static and dynamic applications – effect of heat / oil ageing – frictional behavior – fundamental of seal ability.

UNIT V COMPOUNDING AND MANUFACTURE 9

Types of couplings – specification and selection – torque vs. deflection relationships – brake fluid / hydraulic hoses, materials and manufacture.

TEXTBOOK:

1. Freakley, P.K., and Payne, A.R., Theory and Practice of Engineering with Rubber, Applied Science Publishers Ltd.

REFERENCES:

1. Hobel, E.F., Rubber Springs Design.
2. Blow, C.M. and Hepburn, C., Rubber Technology and Manufacture.

MAM 002	**NOISE VIBRATION AND HARSHNESS**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Nanotechnology, Mechanics of Materials and Automotive Chassis				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To Know about the Noise, Vibration and Harshness (NVH) and its role in automotive design and development. Physiological effects of noise and vibration, sources of vibration and noise in automobiles.

COURSE OUTCOMES (COs)

CO1	To know and to study thebasics of vibration analysis
CO2	To know and to understand thevibration control techniques
CO3	To study about the basics of noise and its control methods
CO4	To study about the NVH measurements taken care in automotive systems
CO5	To study about the automotive noise sources and their control techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I - BASICS OF VIBRATION ANALYSIS **9**

Basic concepts, mathematical models, formulating the equations of motion linear and torsional system characteristics and response – damped and undamped single & two degree of freedom systems under harmonic force, coordinate coupling, generalized coordinates and modal analysis.

UNIT II - VIBRATION CONTROL TECHNIQUES **9**

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, Applications: isolation of the engine from vehicle structure and control of torsional oscillation amplitudes in engine crankshaft.

UNIT III - NOISE FUNDAMENTALS **9**

Fundamentals of acoustics – general sound propagation – structure borne sound & air borne sound, Plane wave propagation - wave equation, specific acoustic impedance, acoustic intensity, Spherical wave propagation – acoustic near and far fields, Reference quantities, The decibel scale, relationship among sound power, sound intensity and sound pressure level, summation of pure tones, Decibel addition, subtraction and averaging, Effects of reflecting surfaces on sound propagation, octave band analysis, Anatomy of Human Ear, Mechanism of hearing, loudness, weighting networks, equivalent sound level.

UNIT IV - NVH MEASUREMENTS **9**

Vibration and Noise Standards – Pass/Drive by noise, noise from stationary vehicles, interior noise in vehicles, NVH measurement tools and techniques, Modal parameter (natural frequency, mode shape and damping) estimation techniques, signal and system analysis.

UNIT V-AUTOMOTIVE NOISE SOURCES AND CONTROL TECHNIQUES **9**

Methods for control of engine noise, Transmission Noise, Intake and Exhaust Noise, Aerodynamic Noise, Tyre Noise, Brake noise. Noise control strategy, noise control at source – along the path – isolation, damping, balancing, resonators, absorption, barriers and enclosures.

TEXT BOOK:

1. Matthew Harrison, "Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles", Elsevier, 2004.

REFERENCES:

1. Bell, L. H. and Bell, D. H., "Industrial Noise Control – Fundamentals and Applications", Marcel Dekker Inc, New York, 1994.
2. Xu Wang, "Vehicle Noise and Vibration Refinement", CRC Press, 2010
3. Ambekar, A. G., "Mechanical Vibrations and Noise Engineering", Prentice Hall of India,

New Delhi, 2006.
4. Beranek, L. L. and Ver, I, L., "Noise and Vibration Control Engineering –Principles and Application", John Wiley & Sons, Inc, 1 992.
5. Wilson, C. E., "Noise Control – Measurement, Analysis, and Control of Sound and Vibration" Harper & Row Publishers, New York, 1989.
6. Thomson, W. T., "Theory of Vibrations with Applications", CBS Publishers Delhi

MAM 003	TRANSPORT MANAGEMENT AND MOTOR INDUSTRY	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Motor Vehicle Act and traffic Regulations				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To Learn and to enrich the knowledge on managing transport systems and to follow the rules and regulations of Motor Industry. Students might able to know the fundamentals and activities of transport systems

COURSE OUTCOMES (COs)

CO1	To know the basics of Transport systems on basis of types, elements and modes
CO2	To know and to understand the transport organization structure and its operations
CO3	To study about geographical conditions, economic factors and operations of transport organization
CO4	To study about the rules and regulations involved in Motor vehicle Act
CO5	To study about the laws and safety precautions developed in order to prevent accidents by vehicle

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION ON TRANSPORTATION MODES 9

Elements of Mass Transportation, History of transport, modes of transport, types of transport systems

UNIT II TRANSPORT ORGANIZATION AND DEVELOPMENT 9

Transport organization structure, operations, General set up, transport industry, government / (STU) State Government Undertakings and private Bus transport organizations. Bus depot organization structure. Truck fleet operators organization. Economics of Road Transport: Theory of fares and cost of services, fare charging, costing and statistics of operating cost

UNIT III PLANNING FOR NEW TRANSPORT ORGANIZATION 9

Geographical considerations, economic factors, vehicles used, planning of trips. Concept of BRTS operations. Organization of Transport Services: Records and fleet management, vehicles schedule, booking and reservation, statistical records and shipment center, recording of goods transport

UNIT IV MOTOR VEHICLE ACT 9

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. 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.

UNIT V ACCIDENT & PREVENTION 9

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

TEXT BOOK:

1. Motor Vehicles Acts, Law Publishers
2. Myer Kutz, "Handbook of Transportation Engineering", Volume 1: Systems and Operations,Second Edition, Tata McGraw Hill Edition, 2011.
3.Coleman O'Flaherty, "Transport Planning and Traffic Engineering", 4th Edition, Butterworth Heinemann Publications, 2010.
4. Roger P. Roess and Elena S. Prassas, "Traffic Engineering", 4th Edition.

REFERENCES:

1. Schumer, Economics of transport, TMH
2. Fair and Williams, “Economics of transportation”, East West Press.
3. Hudson, “Motor transportation”, TMH.
4. M.V. Act 1988-RTO rules and regulation manual
5. Fuel Economy of Motor Vehicle, Allied Publishers

MAM 004	ADVANCED MANUFACTURING PROCESS	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Manufacturing Process, Production Technology, Manufacturing of Automotive Components and Nano technological applications				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To Learn and to enrich the knowledge on studying the various methods of processes involved in production of Automotive Components. The students can able to visualize the mode of

production techniques, Physical characteristics of a material and Methods implemented for production.						
COURSE OUTCOMES (COs)						
CO1	To know the various Casting methods and process of rapid solidification technique					
CO2	To know and to understand theadvanced metal forming techniques and powder metallurgy process					
CO3	To study about the fabrication of microelectronic devices					
CO4	To study about the processes involved inmanufacturing of composites					
CO5	To study about the rapid prototyping technique					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I - ADVANCES IN CASTING **9**

Newer casting techniques - Expendable pattern casting - Plaster mold and ceramic mold casting – Vacuum casting - Squeeze casting - Rapid solidification for amorphous alloys – Casting techniques for single crystal components.

UNIT II -ADVANCED FORMING AND POWDER METALLURGY PROCESSES 9

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

UNIT III - FABRICATION OF MICRO ELECTRONIC DEVICES 9

Semiconductors and silicon - Crystal growing and wafer preparation - Film deposition, Oxidation, Lithography, Etching, Diffusion and ion implantation, Metallization and testing - Bonding and packing.

UNIT IV - MANUFACTURING OF COMPOSITES 9

Introduction- Fibre reinforced, Metal matrix, Ceramics matrix composites, Nanocomposites - structure, Properties, manufacturing processes and applications.

UNIT V - RAPID PROTOTYPING **9**

Rapid prototyping- overview, Techniques-Stereo lithography, Laminated object manufacturing, Selective laser sintering, fused deposition modeling, solid ground curing, 3D ink jet printing-Applications of rapid prototyping-Rapid tooling-Rapid manufacturing-Future development-Virtual prototyping.

TEXT BOOKS

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

REFERENCES

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

LIST OF ELECTIVES-II

PROFESSIONAL ELECTIVE-II

MAM 005	AUTOMOTIVE AIR-CONDITIONING SYSTEMS	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Refrigeration and Air-conditioning, Thermodynamics				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To Learn and to enrich the knowledge on studying the various methods of processes involved inAutomotive Air-Conditioning Systems. The students can able to understand the concepts involved in various cycles of refrigeration and heating.

COURSE OUTCOMES (COs)

CO1	To know the basics of Air Conditioning system and description of its components
CO2	To know and to understand therefrigerant and its classification with diagnosis
CO3	To study about the air conditioner and heating system with its description
CO4	To study about the processes involved in air routing and temperature control systems
CO5	To study about the heater – air conditioner trouble shooting and service procedures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e

2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS 10

Basic air conditioning system – Components – types of Compressor, Condenser, Expansion devices and Evaporators. Location of air conditioning components in a car – Schematic layout of a air conditioning system. Compressor components – Thermostatic expansion valve & orifice tube – Expansion valve calibration – Evaporator temperature controls for TXV & CCOT systems.

UNIT – II REFRIGERANT 9

Requirements for refrigerants – Classification of refrigerants- Refrigerant selection-Storage of refrigerants – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT – III AIR CONDITIONER – HEATING SYSTEM 10

Manually controlled air conditioner – Heater system – Ford automatically controlled air conditioner – heater systems – Chrysler automatically controlled air conditioner – Heater system, General Motors automatically controlled air conditioner – Heater system – Flushing & Evacuating.

UNIT – IV AIR ROUTING & TEMPERATURE CONTROL 10

Objectives – Evaporator case air flow through the Dash recirculating unit – Automatic temperature control – Ducting system in Passenger car and Bus– Controlling flow – Vacuum reserve – Testing the air control and handling systems- Load calculations - Psychrometry

UNIT – V HEATER – AIR CONDITIONER TROUBLE SHOOTING & SERVICE 6

Air conditioner maintenance and service – Servicing heater system. Removing and replacing components. Trouble shooting of air conditioner – heating system – Compressor service.

TEXT BOOK:

1. William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc., 1990.

REFERENCES:

1. Paul Weisler, Automotive Air Conditioing, Reston Publishing Co. Inc., 1990.
2. McDonald,K.L., Automotive Air Conditioning, Theodore Audel series, 1978.
3. Goings,L.F., Automotive Air Conditioning, American Technical services, 1974.

MAM 006	AUTOMOTIVE AERODYNAMICS	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Vehicle Design, Vehicle Dynamics, Vehicle Body Building Technology				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

When the vehicle is at dynamic condition more vibration will be produced. It is essential to study about vibrations and how to reduce the vibration under different loads, speed and road conditions in order to improve the comfort for the passengers and life of the various components of the vehicle. In this subject these aspects have been given.

COURSE OUTCOMES (COs)

CO1	To know the basics of Aerodynamics, phenomenon and its performance on vehicles
CO2	To know and to understand theforces acting on a car with its aerodynamic profile development
CO3	To study about the aerodynamic shape development of a car with optimization techniques
CO4	To study about the vehicle handling aspects with characteristics of forces and moments
CO5	To study and to visualize the experimentation on wind tunnels for automotive aerodynamics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I INTRODUCTION 10

Scope – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles – External & Internal flow problems – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.

UNIT – II AERODYNAMIC DRAG OF CABS 8

Car as a bluff body – Flow field around car – drag force – types of drag force – analysis of aerodynamic drag – drag coefficient of cars – strategies for aerodynamic development – low drag profiles.

UNIT – III SHAPE OPTIMIZATION OF CABS 7

Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.

UNIT – IV VEHICLE HANDLING 10

The origin of force and moments on a vehicle – side wind problems – methods to calculate forces and moments – vehicle dynamics Under side winds – the effects of forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles.

UNIT – V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS 10

Introduction – Principles of wind tunnel technology – Limitation of simulation – Stress with scale models – full scale wind tunnels – measurement techniques – Equipment and transducers – road testing methods – Numerical methods.

TEXTBOOK:

1. Hucho, W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 1997.

REFERENCES:

1. Pope, A, Wind Tunnel Testing, John Wiley & Sons, 2nd Edn., New York, 1994.
2. Automotive Aerodynamics: Update SP-706, SAE, 1987.
3. Houghton, Aerodynamics

MAM 007	**TYRE TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Vehicle Design, Vehicle Dynamics, Vehicle Body Building Technology				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

.

COURSE OUTCOMES (COs)

CO1	To Study the basis on Tyre classification and its properties
CO2	To Know the various process involved in the manufacturing of tyre and its fabric preparation
CO3	To Know the process of calendaring, skimming and bead formation with detailed description on process
CO4	To Study the process involved in thread extrusion and bead construction and to know tyre building techniques
CO5	To learn the basics involved in green tyre preparation and curing

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

INTRODUCTION TO BASICS OF TYRES **5**

Types of tyres, tyre components and its role, tread patterns, outline of production of tires, Requirements and function of tyres - Major departments of a Tyre Industry – An explanation of their function and relation to other departments. Factors influencing the performance of tyre: Compound design, degree of mixing: (open mill & internal mixing), parameters (temperature, time, speed), degree of vulcanization - Testing and dispatch of mixes, Basic quality control and mill room control Laboratory.

UNIT I - FABRIC PREPARATION **8**

Fabrics of the Tyre Industry: Cotton, Rayon, Nylon & steel cords – manufacture, construction – styles and presentations. Bonding methods – Fabric bonding necessities of stronger fabrics leading to bonding methods developments. Wet & dry bonding systems – dip and hot stretch process for Nylon. REL-VP latex systems – and parameters for dip & hot stretch process for Nylon. Modified surface treatment needed for polyesters & glass fabric - Metal coating for steel cord. Recent developments in Radical Tyre fabrics – Aromatic Nylon (Kevlar) and other special fabric reinforcement systems and their use - Testing of dipped fabrics 'U', 'H' and other tests. Dip pick up and the relation to adhesion etc.

UNIT II - CALENDERING **8**

Calendering process: 3 and 4 roll calenders. Skimming & frictioning process preparation of bead wrapper and chaffer-on fabrics on 3 roll calenders. Topping process on calendar - Limitation of 3 roll calenders and advantages of 4 roll calenders-process control aspects – economics - Relation between ends per inch and calendering process. Inner, outer and breaker fabrics. Compound fabric ratios and compound design consideration for different styles of fabrics - Defects of calendered fabrics and their remedies. Parameters for scrap control in fabric processes in the tyre industry requirement of total quality control involving fabric supplier's dipping, calendering and bias cutting operations. Economics of fabric usage.

UNIT III - THREAD EXTRUSION AND BEAD CONSTRUCTION 8

Basic concepts of Extrusion. Die swell & shrinkage phenomenon – effect of compounding parameters on these phenomenon. Die design and theoretical calculation of tread weight. Effect of viscosity & temperature on extrusion. Dimensions and weight control extusion operation parameters like feeding rate, screw speed, take off conveyor speed on tread extrusion. Extruded tread profile – critical dimensions. Duel extruder – Cap & base concept relation to tyre wear parameters like tread wear heat buildup etc. Cross head extruder wire coating process - Bias cutting and pocket making: Bias angle specification and the significance Horizontal and vertical laying of coated wore. Apex preparation on extruder and profile calender Bead wrapping and flipping operations. Single and double bead concept and preliminary calculation of bead safety factors. Width and angle adjustments splicing and identification. Bias plies pocket 3-3-2 4-4-2 ply constructions Defects of pockets wrong identification over splicing wrinkles, parallel plies etc.

UNIT IV - TYRE BUILDING 8

Tyre building inputs: Inner liners, plies, beads, tread, side wall and gum strips – their inspection Drum inspection for drumset, drum circumference Significance of parameters for tyre building. Size making on finished tyre and the relation to building specifications. Tyre building specifications sequence of building. Intermitant consolidation use of various cements and gum strips.Importance of the state of the Art Technology. Appraisal of Tyre building as most crucial operation correlation of some of the cured tyre & service returned tyres to the lack of building skill. Green tyre inspection procedures weight tolerance techno-commercial importance of green tyre weight. Green tyre storage considerations.

UNIT V - GREEN TYRE PREPARATION & CURING 8

Internal and External painting – Awling – Bagging in case of Air bag cure Bag-omatic and Air bag curing – mold lubrication- Bladder assembly bead curing rings – Dimension criticality Services to the Bag-o-matic presses Curing cycle – shaping – HPS, and hot water circulation. Dome steam cold water & vacuum cycles. Determination of optimum cure of tyres by thermocouple built tyres. Economics of curing post cure inflation of Nylon tyres cured tyre inspection. Defects of tyres – Tyre classification for defects – causes and discussions - Examination of: (i) Returned tyres (ii) Tyres for retreading - Norm of tyre adjustments for fastwear, poor retreading Bead/casing failures. Hot and cold process retreading concept of total price/km run increasing competition and future trends in the industry and open house discussion.

TEXT BOOK:

1. Tom French, Tyre technology, The University of Michigan, 1989.

REFERENCES:

1. Blow. C. M, Rubber Technology and Manufacture, Butterworth- Heinemann, London, 1982.
2. Maurice Morton, “Rubber Technology”, Springer, 3rd edition, 1987.
3. Claude Hepburn, “Rubber Technology and Manufacture”, Third Edition, 2005.
4. Kovac. F. J, “Tyre Technology”, Good Year Tire & Rubber Company, 1973.
5. Different tyre manufacturer’s websites.

MAM 008	SIMULATION OF VEHICLE SYSTEMS	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Automotive chassis, Automotive Aerodynamics				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The objective of this course is to introduce the essential principles of simulation of various vehicle systems like longitudinal, lateral dynamics, modeling of suspension and tire system etc.

COURSE OUTCOMES (COs)

CO1	To Know about basics of Vehicle systems and Driveline dynamics
CO2	To Know about the Lateral dynamics and Electronic Stability control
CO3	To study about the concept involved in themodelling of passive automotive suspensions
CO4	To study about the concept involved in themodeling of semi active and active automotivesuspensions
CO5	To study and to learn about the lateral and longitudinal tire forces acting on a vehicle

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	H	H	M
	CO2	H	H	L	M	H
	CO3	H	M	H	M	L
	CO4	M	H	L	H	H
	CO5	H	M	L	H	H
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I LONGITUDINAL DYNAMICS AND CONTROL 9

Aerodynamic drag force - Longitudinal tire force - Rolling resistance - Calculation of normal tire forces - Calculation of effective tire radius - Driveline Dynamics - Torque converter - Transmission dynamics - Engine dynamics - Wheel dynamics - Cruise Control - Anti-Lock Brake Systems - Automated Highway Systems - Longitudinal Control Architecture.

UNIT II LATERAL DYNAMICS AND ELECTRONIC STABILITY CONTROL9

Lateral Systems - Kinematic Model - Bicycle Model. Motion of Particle Relative to a rotating Frame. Dynamic Model in Terms of Error with Respect to Road, Yaw Rate and Slip Angle. Road Model. Differential Braking Systems - Steer-By-Wire Systems - Independent All Wheel Drive Torque Distribution

UNIT III MODELING OF PASSIVE AUTOMOTIVE SUSPENSIONS 9

Introduction - Modal Decoupling - Performance Variables - Natural Frequencies and Mode Shapes - Approximate Transfer Functions - Analysis of Vibrations in the Sprung Mass Mode and Unsprung Mass Mode - Verification Using Quarter Model. Half-Car and Full-Car Suspension Models.

UNIT IV MODELING OF SEMIACTIVE AND ACTIVE AUTOMOTIVE SUSPENSIONS 9

Semi-Active Suspension Model - Optimal Semi-Active Control Law - Calculation of Transfer Function Plots - Performance of Semi-Active Suspension Systems. Active Automotive Suspensions - Trade-offs and Limitations - Invariant Points and Their Influence - Hydraulic Actuators for Active Suspensions

UNIT V LATERAL AND LONGITUDINAL TIRE FORCES 9

Tire Forces - Tire Structure - Longitudinal Tire Force at Small Slip Ratios - Lateral Tire Force at Small Slip Angles - Magic Formula Tire Model - Dugoff's Tire Model - Dynamic Tire Model - Development of Lateral Tire Model for Uniform Normal Force Distribution and Parabolic Normal Pressure Distribution - Combined Lateral and Longitudinal Tire Force Generation.

TEXT BOOK

1) Rajesh Rajamani, "Vehicle Dynamics and Control", Springer, 2006.

LIST OF ELECTIVES-III

PROFESSIONAL ELECTIVE-III

MAM 009	ALTERNATE FUELS AND PROPULSION SYSTEMS	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Automotive engines and Emissions, Engineering Chemistry, Automotive Pollution and its control, Fuels and Combustion.				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To Understand the basic concept and to involve in replenishing the world through utilization of alternative fuels to meet over the current demand on energy scenario. The students can able to know the various alternative sources of energy other than fossil fuels and their significance.

COURSE OUTCOMES (COs)

CO1	To Study the current energy scenario and its demand on fossil fuels
CO2	To Study the general properties of alcohol with its source, performance and emission characteristics
CO3	To Study the general properties of natural gas, LPG, hydrogen and biogaswith its source, performance and emission characteristics
CO4	To Study the general properties of vegetable oilswith its source, performance and emiss characteristics
CO5	To Learn the basics involved inelectric and solar powered vehicles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M

	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I INTRODUCTION 6

Estimation of petroleum reserve "World Energy Scenerio, Energy Survey of India" – Need for alternate fuel – Availability of alternate fuels- Other alternate energy sources

UNIT – II ALCOHOLS 9

Properties as engine fuels, alcohols and gasoline blends, Performance in SI engine. Methanol and gasoline blends - Performance combustion and emission characteristics.

UNIT – III NATURAL GAS, LPG, HYDROGEN AND BIOGAS 9

Availability of CNG, properties, modification required to use in engines – performance and emission characteristics of CNG and LPG in SI & CI engines. Performance and emission for LPG – Hydrogen – Storage and handling, performance and safety aspects.

UNIT – IV VEGETABLE OILS 10

Various vegetable oils for engines – Transesterification – Performance in engines – Performance and emission characteristics.

UNIT – V ELECTRIC AND SOLAR POWERED VEHICLES 11

Layout of an electric vehicle – advantage and limitations – Specifications – System component, Electronic control system – High energy and power density batteries – Hybrid vehicle – Solar powered vehicles. Fuel cell vehicles.

TEXTBOOKS:

1. Ramalingam. K.K., Internal combustion engine, scitech publications, Chennai, 2003.
2. Bechtold,R.L., Alternative Fuels Guide Book, SAE, 1997.

REFERENCES:

1. Nagpal, Power Plant Engineering, Khanna Publishers, 1991.
2. Alcohols and motor fuels progress in technology, Series No.19, SAE Publication USA 1980.

MAM 010	IC ENGINES PROCESS MODELING	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: IC Engines, Engine Management Systems, Automotive Engines				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

The objective of this course is to introduce the essential principles of simulation of various vehicle systems like longitudinal, lateral dynamics, modeling of suspension and tire system etc.

COURSE OUTCOMES (COs)

CO1	To Know about basics of Vehicle systems and Driveline dynamics
CO2	To Know about the Lateral dynamics and Electronic Stability control
CO3	To study about the concept involved in themodelling of passive automotive suspensions
CO4	To study about the concept involved in themodeling of semi active and active automotivesuspensions
CO5	To study and to learn about the lateral and longitudinal tire forces acting on a vehicle

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	H	H	M
	CO2	H	H	L	M	H
	CO3	H	M	H	M	L
	CO4	M	H	L	H	H
	CO5	H	M	L	H	H
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I INTRODUCTION 9

Introduction to simulation, advantages of computer simulation, classification of engine models. Intake and exhaust flow models, quasi steady flow, filling and emptying, gas dynamic models. Thermodynamic based in cylinder models. Step by step approach in SI engine simulation.

UNIT – II COMBUSTION AND STOICHIOMETERY 9

Reactive processes, heat of reaction, measurement of URP, measurement of HRP. Introduction combustion equation for hydrocarbon fuels. Calculation of minimum air required for combustion, excess air supplied and stoichiometric air required for complete combustion. Conversion of volumetric analysis to mass analysis.

UNIT – III ADIABATIC FLAME TEMPERATURE 9

Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state. SI engine simulation with air as working medium, deviation between actual and ideal cycle.

UNIT – IV SI ENGINE SIMULATION WITH ADIABATIC COMBUSTION 9

Introduction, engine details, temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation, SI engines simulation with progressive combustion. Wiebe's law combustion analysis.

UNIT – V SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS 9

Introduction, gas exchange process, heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.

TEXTBOOKS:

1. Ramalingam. K.K., Internal combustion engine, scitech publications, Chennai, 2003.
2. Bechtold,R.L., Alternative Fuels Guide Book, SAE, 1997.

REFERENCES:

1. Ganesan. V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.
2. John. B. Heywood, "Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.
3. Benson.R.S., Whitehouse.N.D., "Internal Combustion Engines", Pergamon Press, oxford, 1979
4. Ramoss. A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co., 1992.
5. Ashley Campbel, "Thermodynamic analysis of combustion engines", John Wiley & Sons, New York, 1986.

MAM 011	VEHICLE MAINTENANCE	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Automotive engines. Automotive chassis, Automotive Electrical systems				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

At the end of the course, the students will be able to have a complete knowledge of the vehicle maintenance procedures and acquire skills in handling situations where the vehicle is likely to fail.

COURSE OUTCOMES (COs)

CO1	To know about the various maintenance tools, shops, scheduling and maintaining records
CO2	To Study the general maintenance procedure carried out in power plant through repairing and overhauling
CO3	To Study the general maintenance procedure carried out in cassis through repairing and overhauling
CO4	To Study the general maintenance procedure carried out in vehicle body

CO5	To Study the general maintenance procedure carried out in electrical system and accessories of a vehicle through repairing and replacement					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS 8

Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheel alignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re boring machine, fuel injection calibration machine. Importance of maintenance. Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Reports. Log books. Trip sheet. Lay out and requirements of maintenance shop.

UNIT II POWER PLANT REPAIR AND OVERHAULING 12

Dismantling of power plant and its components. Cleaning methods. Inspection and checking. Repair and reconditioning methods for all engine components. Maintenance of ignition system, fuel injection system, cooling system, - lubrication system. Power plant trouble shooting chart.

UNIT III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS 12

Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems. Tyre maintenance.

UNIT IV MAINTENANCE AND REPAIR OF VEHICLE BODY 6

Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste.

UNIT V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS 7

Care, maintenance, testing and trouble shooting of battery, starter motor, dynamo, alternator and regulator. Transistorized regulator problems.

TEXTBOOK:

1. A.W.Judge, Motor Vehicle Servicing, 3rd Edition, Pitman Paperpack, London, 1969.

2. W.Crouse, Everyday Automobile repair, Intl.student edition, TMH, New Delhi, 1986.
3. Ernest Venk., Edward spicer, Automotive maintenance and trouble shooting, D.B. Taraporevala Sons, Bombay, 1963

REFERENCES:

1. Stator Abbey, Automotive steering, braking and suspension overhaul, pitman publishing, London, 1971.
2. Frazee, fledell, Spicer,-Automobile collision Work, American technical publications, Chicago, 1953.
3. John Dolce, Fleet maintenance, McGraw Hill, Newyork, 1984
4. A,W.Judge, Maintenance of high speed diesel engines, Chamman Hall Ltd., London, 1956.
5. V.L.Maleev, Diesel Engine operation and maintenance, McGraw Hill Book CO., Newyork, 1995.
6. Vehicle servicing manuals.
7. Ernest Venk., Edward spicer, Automotive maintenance and trouble shooting, D.B. Taraporevala Sons, Bombay, 1963.

MAM 012	**COMPUTER AIDED DESIGN (CAD)**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: CAD/CAM, Computer Integrated Manufacturing, Computer aided process planning and development				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

At the end of the course, the students will be able to have a complete knowledge CAD procedures and acquire skills in designing and development of a product.

COURSE OUTCOMES (COs)

CO1	To know about the CAD/CAED/CAE with its concepts and engineering applications
CO2	To Study the Graphics and Geometric transformations involved in 2D and 3D design
CO3	To Understand the properties of curve design, nature and its representation
CO4	To Study the tree dimensional designing and its procedures
CO5	To Study and to analyze the3D models in FEM techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT-I - INTRODUCTION **9**

Introduction to CAD/CAED/CAE, Elements of CAD, Essential requirements of CAD, Concepts of integrated CAD/CAM, Necessity & its importance, Engineering Applications

Computer Graphics-I

CAD/CAM systems, Graphics Input devices-cursor control Devices, Digitizers, Keyboard terminals, Image scanner, Speech control devices and Touch, panels, Graphics display devices-Cathode Ray Tube, Random & Raster scan display, Colour CRT monitors, Direct View Storage Tubes, Flat Panel display, Hard copy printers and plotters

UNIT-II- COMPUTER GRAPHICS-II **9**

Graphics standards, Graphics Software, Software Configuration, Graphics Functions, Output primitives- Bresenham's line drawing algorithm and Bresenham's circle generating algorithm

Geometric Transformations:

World/device Coordinate Representation, Windowing and clipping, 2 D Geometric transformations-Translation, Scaling, Shearing, Rotation & Reflection Matrix representation, Composite transformation, 3 D transformations, multiple transformation.

UNIT-III- CURVES **9**

Curves representation, Properties of curve design and representation, Interpolation vs approximation, Parametric representation of analytic curves, Parametric continuity conditions, Parametric representation of synthetic curves-Hermite cubic splines-Blending function formulation and its properties, Bezier curves-Blending function formulation and its properties, Composite Bezier curves, B-spline curves and its properties, Periodic and non-periodic B-spline curves

UNIT-IV- 3D GRAPHICS **9**

Polygon surfaces-Polygon mesh representations, Quadric and Superquadric surfaces and blobby objects; Solid modeling-Solid entities, Fundamentals of Solid modeling-Set theory, regularized set operations; Half spaces, Boundary representation, Constructive solid geometry, Sweep representation, Color models Application commands for AutoCAD & ProE software

UNIT-V- NUMERICAL METHODS9

Introduction, Errors in numbers, Binary representation of numbers, Root finding- Bisection method, Newton Raphson method, Curve fitting-Least square method, Numerical differentiation-Newton's interpolation, Numerical Integration-Trapezoidal and Simpson method

Finite Element Method:

Introduction, Principles of Finite elements modeling, Stiffness matrix/displacement matrix, Stiffness matrix for spring system, bar & beam elements, bar elements in 2D space (truss element)

REFERENCES

1. Chris McMohan and Jimmi Browne, "CAD/CAM Principles, Practice and Manufacturing Management", Pearson Education Asia,Ltd., 2000.

2. Donald Hearn and Pauline Baker M. "Computer Graphics", Prentice Hall, Inc., 1992.

3. Ibrahim Zeid "CAD/Cam Theory and Practice", McGraw Hill, International Edition, 1998.

4. Khandare S.S., "Computer Aided Design", Charotar Publishing House, India, 2001.

5. Newman, William M., & Sproull, Robert F., "Principles of Interactive Computer Graphics", 2nd Ed., McGraw Hill, 1981.

6. Harington, Stevan, "Computer Graphics: A Programming Approach", McGraw Hill, 1983.

7. Plastock, Roy A., & Kally, "Theory and Problems of Computer Graphics", McGraw Hill, 1986.

8. Rogers. D.F., "Procedural Elements for Computer Graphics", McGraw Hill, 1985.

9. Foley, J.D. & Van dam, A., "Fundamentals of Interactive Computer Graphics", Addison – Wesley, 1982.

10. Vosinet, Donald., "Computer Aided Drafting and Design: Concepts & Applications", McGraw Hill, 1986.

LIST OF ELECTIVES-IV

PROFESSIONAL ELECTIVE-IV

MST070	**RESEARCH METHODOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Operation Research, Human Resource management, Professional Ethics and Industrial Management				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To Know the conceptual design of research process and its methodology with usage of statistical tools and sampling techniques. The students should able to know the process of report writing and usage of Statistical tools in their research.

COURSE OUTCOMES (COs)

CO1	To Understand the concept and design of research process and its methodology
CO2	To Study and to know about the sampling methods and the measurement techniques
CO3	To Understand the method of data collection and experimentation techniques
CO4	To Study and to learn the parametric and non-parametric tests
CO5	To learn report writing along with execution of statistical techniques and evolve research methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I RESEARCH PROCESS AND DESIGN 9

Scientific thinking; Reasoning and Scientific attitude. What is Research? Research Process; Research need, formulating the problem, designing, sampling, Pilot testing, data collection, analysis and interpretation and report. Research design: Exploratory, Descriptive, Causal, Formulation of hypothesis – Types.

UNIT II SAMPLING METHODS AND MEASUREMENT TECHNIQUES 9

Measurement: Nature, Scales, Sources and Characteristics of Sound measurement tool. Scaling : Nature, methods and Scale construction techniques. Sampling: Nature, Simple, Probability and complex probability; Non-probability samples.

UNIT III DATA COLLECTION AND EXPERIMENTATION 9

Sources and collection of data; Primary and secondary sources, survey observation, experimentation – details and evaluation. Analysis and presentation: Coding, data entry, tabulation & cross tabulation. Hypothesis testing Statistical significance, statistical testing procedure. Tests of significance: Types and selection of tests.

UNIT IV PARAMETRIC AND NON PARAMETRIC TESTS 9

Measures of Parametric and Non-parametric tests, Assumptions, Computation and testing of product moment correlation – Mean difference tests, Non-parametric tests: X2 tests, Rank order correlation, U test, Sign test.

UNIT V REPORT WRITING AND STATISTICAL METHODOLOGY 9

Presenting results: Written and oral reports, The written research report, preparatory items, Introduction, methodology, finding and conclusions. Writing the report: Pre-writing concerns, writing the draft to presentation, Consideration. Presentation of statistics, Text, semi tabular, Tabular graphic, presentation, oral presentation: Preparation, delivery and audiovisuals.

TEXTBOOK:

1) Business Research methods By Dr. T.N. Srivastava and Mrs. Shailaja Rego – Tata Mcgraw Hill. Co Chennai – Email: mark_pani@mcgraw.hill. Com

2) Business Research methods, Alan Bryman and Emmabell – Oxford University press. Chennai. Email: v.anand@oup

3) Research methodology, By R. Panneer Selvam, phi learning India PVT Ltd. New Delhi. Email: phi@phindia.com

4) Academic writing, A guide for management students and Researchers, By Mathukutty M. Monippally and Badrinarayanan Shankar Pawar www.sagepublications.com

5) Research methods Indian Edition By Donald H. Mcburney and Theresa – Cengage learning. Email: sriram.b@cengage.com

.

MAM 014	**ELECTRIC AND HYBRID VEHICLES**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Automotive Transmission. Automotive chassis, Automotive Electrical systems and Alternative fuels				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To understand working of different configurations of electric vehicles, and its components, hybrid vehicle configuration and performance analysis.

COURSE OUTCOMES (COs)

CO1	To know about the various types of electric vehicles with its design
CO2	To Study the concept of battery with its construction and properties
CO3	To Learn about AC and DC electrical machines
CO4	To Study the configuration and features of electric vehicle drive
CO5	To Study theconfiguration and features of hybrid electric vehicles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			

4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016

UNIT I ELECTRIC VEHICLES **6**

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNITII BATTERY **7**

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT III DC & AC ELECTRICAL MACHINES **8**

Motor and Engine rating, Requirements, DC machines , Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines.

UNIT IV ELECTRIC VEHICLE DRIVE TRAIN **12**

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

UNIT V HYBRID ELECTRIC VEHICLES **12**

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components

REFERENCES :

1. Iqbal Hussain, Electric & Hybrid Vechicles – Design Fundamentals, CRC Press.
2. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles.

MAM 015	**INSTRUMENTATION AND EXPERIMENTAL TECHNIQUES**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Basic Electrical and Electronics, Microprocessor Applications Automotive Electrical systems and Electronics and Instrumentation				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To understand the concepts involved in electronics and Instrumentation with its application on automobile systems. The students should be more capable to learn the modern technological improvements in instrumentation which directly favors the development of Automotive systems

COURSE OUTCOMES (COs)

CO1	To know about the various types of measurement systems
CO2	To Study the concept of transducers, modifiers and terminating devices
CO3	To Learn about the instruments used for mechanical measurement
CO4	To study the engine experimental techniques and electronic measuring devices
CO5	To Study and to conduct vehicle experimental techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M

	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I MEASUREMENT SYSTEMS 6

Static and Dynamic Measurement systems- Requirement and characterisitics- Analysis of experimental detail, Error analysis.

UNIT – II TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES 8

Transducers for Automotive Applications- Amplifiers- Filters- Data Acquisition- Indicators, Printers and Displays- Signal Analyzing.

UNIT – III MECHANICAL MEASUREMENT 10

Instrumentation for Measuring weight, Force, Torque, Pressure Power, Temperature, Fluid flow, Vibration, Rotational speed, Velocity, Acceleration and Angular motion.

UNIT – IV ENGINE EXPERIMENTAL TECHNIQUES 12

I S Code for Engine testing- Instrumentation for Performance testing of engine- Instrumentation for Research and Development, Instrumentation for noise, vibration, in cylinder gas flow, Flame temperature dynamic cylinder pressure measurements.

UNIT – V VEHICLE EXPERIMENTAL TECHNIQUES 9

Laboratory tests- Tests tracks-Endurance tests-Crash tests- Wind tunnel tests-Brake tests.

TEXTBOOK:

1. J.G. Giles, "Engine and Vehicle Testing", Illiffe books Ltd., London,1968.
2. T.G. Beckwith and Buck, "Mechanical Measurements", Oxford and IBH Publishing House, New Delhi,1995

REFERENCE:

1. A.W. Judge, "Engineering Precision Measurement", Chapman and Hall Ltd, Essex Street W.C., 1951.
2. D.Patambis. "Principle of Industrial Instrumentation", Tata McGraw Hill Publishing Company, New Delhi, 1990.
3. Rangan, Sharma and Mani, "Instrumentation Devices and Systems ", Tata McGraw Hill Publishing Company, New Delhi, 1990.

MAM 016	QUALITY CONTROL AND RELIABILITY	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Industrial Engineering, Operation Research and Total Quality management				
	Course Designed by : Department of Automobile Engineering				

OBJECTIVES

To understand the concept of Statistical techniques involved in the controlling quality and maintain reliability with analyzing failures. Students can able to know the purpose of employing Statistical techniques to maintain reliability aspects with enhanced quality of a product

COURSE OUTCOMES (COs)

CO1	To know about the basicSQC tools and Charts
CO2	To Study the concept of acceptance sampling methods and standards
CO3	To Learn about reliability engineering
CO4	To understand and to check the reasons for failure through analyzing the data
CO5	To Study about the concept of reliability prediction and management

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	H	M
	CO2	H	H	H	H	M
	CO3	H	H	H	M	L
	CO4	H	H	L	H	H
	CO5	H	M	L	M	L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I - STATISTICAL QUALITY CONTROL **9**

Methods and Philosophy of Statistical Process Control - Control Charts for Variables and Attributes –Cumulative sum and Exponentially weighted moving average control charts -Other SPC Techniques – Process - Capability Analysis Six sigma concept.

UNIT II - ACCEPTANCE SAMPLING **9**

Acceptance Sampling Problem - Single sampling plans for attributes – double sampling -multiple sampling - sequential sampling - Military standards - The Dodge Roming sampling plans – Random

sampling.

UNIT III - RELIABILITY ENGINEERING **9**

Definition of reliability – Performance and reliability - Reliability requirements – System life cycle – Mean time between failures – Mean time to failure - Mortality Curve -Availability – Maintainability.

UNIT IV - FAILURE DATA ANALYSIS **9**

Statistical failures of components – failure distributions – Bath tub curve – Negative exponential distribution – Normal distribution - log normal distribution – Gamma distribution - Weibull distribution Life distribution measurements – Accelerated life tests -Data requirements for reliability.

UNIT V - RELIABILITY PREDICTION AND MANAGEMENT **9**

Failure rate estimates - Effect of environment and stress - Series and Parallel systems -RDB analysis – Standby Systems - Complex Systems - Reliability demonstration testing- Reliability growth testing - Duane curve - Risk assessment – FMEA and Fault tree analysis.

TEXT BOOKS:

1. Khanna O.P, "Statistical Quality Control", Dhanpat Rai Publications (P) Ltd., 2001.
2. Lewis E.E, "Introduction to Reliability Engineering", John Wiley and Sons, 1987.

REFERENCES:

1. Mohamed Zairi, "Total Quality Management for Engineers", Woodhead Publishing Limited 1991.
2. Harvid Noori and Russel, "Production and Operations Management – Total Quality and Responsiveness", McGraw-Hill Inc, 1995.
3. Douglus C. Montgomery, "Introduction to Statistical Quality Control", 2nd Edition, John Wiley and Sons, 1991.