ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

REGULATIONS – 2015

CHOICE BASED CREDIT SYSTEM

M.E. AUTOMOBILE ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

I. Students will excel in their professional career in automobile industry and research with highest professional and ethical standards to their activities by acquiring knowledge in basic engineering, mathematics, science and automobile engineering.
II. Students will exhibit professionalism, team work in their chosen profession and adapt to current trends, technologies and industrial scenarios by pursuing lifelong learning.

PROGRAMME OUTCOMES (POs):

1. Graduate will demonstrate strong basics in mathematics, science and Engineering
2. Graduate will demonstrate the ability to design and conduct Experiments, as well as to analyze and interpret data.
3. Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and Safety, manufacturability and sustainability.
4. Graduate will become familiar with modern Engineering tools and analyse the problems within the domains of Automobile Engineering as the members of multidisciplinary teams.
5. Graduate will acquire the capability to identify, formulate and solve complex engineering problems related to Automobile Engineering
6. Graduate will demonstrate and understanding of professional and ethical responsibility with reference to their career in the field of Automobile Engineering
7. Graduate will be able to communicate effectively both in verbal non-verbal forms
8. Graduate will be trained towards developing the impact of development of Automobile engineering on global, economic environment and societal context
9. Graduate will be capable of understanding the value for life-long learning
10. Graduate will demonstrate knowledge of contemporary issues focusing on the necessary to develop new material, design, and engineering practice in the field of Automobile Engineering
11. Graduate will demonstrate the ability to use the techniques, skills and Modern engineering tools necessary for engineering practice in the field of Automobile Engineering
12. Graduate will have a firm scientific, technological and communication base that helps them either to find a desire placement or to become an Entrepreneur and explore their knowledge in their field.
13. Graduate will be capable of doing higher studies and research in inter and multi-disciplinary areas.

CORRELATION BETWEEN POs AND PEOs

Sl. No.	Programme Outcomes (POs)	Programme Educational Objectives	
		PEO I	PEO II
1.	Graduate will demonstrate strong basics in mathematics, science and Engineering	✓	
2.	Graduate will demonstrate the ability to design and conduct Experiments, as well as to analyze and interpret data.	✓	✓
3.	Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and Safety, manufacturability and sustainability.	✓	✓
4.	Graduate will become familiar with modern Engineering tools and analyse the problems within the domains of Automobile Engineering as the members of multidisciplinary teams.	✓	✓
5.	Graduate will acquire the capability to identify, formulate and solve complex engineering problems related to Automobile Engineering	✓	✓
6.	Graduate will demonstrate and understanding of professional and ethical responsibility with reference to their career in the field of Automobile Engineering	✓	
7.	Graduate will be able to communicate effectively both in verbal non-verbal forms		✓
8.	Graduate will be trained towards developing the impact of development of Automobile engineering on global, economic environment and societal context	✓	
9.	Graduate will be capable of understanding the value for life-long learning		✓
10.	Graduate will demonstrate knowledge of contemporary issues focusing on the necessary to develop new material, design, and engineering practice in the field of Automobile Engineering	✓	✓
11.	Graduate will demonstrate the ability to use the techniques , skills and Modern engineering tools necessary for engineering practice in the field of Automobile Engineering	✓	✓
12.	Graduate will have a firm scientific, technological and communication base that helps them either to find a desire placement or to become an Entrepreneur and explore their knowledge in their field.	✓	✓
13.	Graduate will be capable of doing higher studies and research in inter and multi-disciplinary areas.	✓	✓

CORRELATION BETWEEN COURSES AND POs

Year	Semester	Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
1	1	Advanced Numerical Methods	✓	✓			✓			✓	✓	✓	✓	✓	✓
		Automotive Chassis	✓				✓			✓	✓	✓	✓	✓	✓
		Automotive Engines and Subsystems	✓				✓			✓	✓	✓	✓	✓	✓
		Automotive Transmission	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓
		Elective I													
		Elective II													
		Engine and Chassis Laboratory	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓
	2	Automotive Electrical and Electronics	✓	✓	✓	✓	✓			✓		✓			✓
		Automotive Pollution and Control	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓
		Vehicle Body Engineering	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓
		Vehicle Dynamics	✓	✓	✓	✓	✓			✓	✓	✓			✓
		Elective III													
		Elective IV													
		Automotive Electrical, Electronics and Virtual Instrumentation Laboratory	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓
2	3	Engine Management System	✓	✓	✓	✓	✓			✓		✓			✓
		Elective V Elective VI													
		Project Work Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	4	Project Work Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

REGULATIONS – 2015

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI

M.E. AUTOMOBILE ENGINEERING (FT/PT)

SEMESTER I

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AM7101	Automotive Chassis	PC	4	4	0	0	4
2.	AM7102	Automotive Engines and Subsystems	PC	3	3	0	0	3
3.	AM7103	Automotive Transmission	PC	3	3	0	0	3
4.	MA 7154	Advanced Numerical Methods	FC	4	4	0	0	4
5.		Elective I	PE	3	3	0	0	3
6.		Elective II	PE	3	3	0	0	3
PRACTICAL								
7.	AM7111	Engine and Chassis Laboratory	PC	4	0	0	4	2
			TOTAL	**24**	**20**	**0**	**4**	**22**

SEMESTER II

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AM7201	Automotive Electrical and Electronics	PC	3	3	0	0	3
2.	AM7202	Automotive Pollution and Control	PC	3	3	0	0	3
3.	AM7203	Vehicle Body Engineering	PC	3	3	0	0	3
4.	AM7251	Vehicle Dynamics	PC	3	3	0	0	3
5.		Elective III	PE	3	3	0	0	3
6.		Elective IV	PE	3	3	0	0	3
PRACTICAL								
7.	AM7211	Automotive Electrical, Electronics and Virtual Instrumentation Laboratory	PC	4	0	0	4	2
			TOTAL	**22**	**18**	**0**	**4**	**20**

SEMESTER III

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AM7301	Engine Management System	PC	3	3	0	0	3
2.		Elective V	PE	3	3	0	0	3
3.		Elective VI	PE	3	3	0	0	3
PRACTICAL								
4.	AM7311	Computer Aided Engine Component Design Laboratory	PC	4	0	0	4	2
5.	AM7312	Project Work Phase I	EEC	12	0	0	12	6
			TOTAL	**25**	**9**	**0**	**16**	**17**

SEMESTER IV

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1.	AM7411	Project Work Phase II	EEC	24	0	0	24	12
			TOTAL	**24**	**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF DEGREE = 71

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

REGULATIONS – 2015

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI

M.E. AUTOMOBILE ENGINEERING (PART TIME)

SEMESTER I

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA 7154	Advanced Numerical Methods	FC	4	4	0	0	4
2.	AM7101	Automotive Chassis	PC	4	4	0	0	4
3.	AM7102	Automotive Engines and Subsystems	PC	3	3	0	0	3
PRACTICAL								
4.	AM7111	Engine and Chassis Laboratory	PC	4	0	0	4	2
			TOTAL	**15**	**11**	**0**	**4**	**13**

SEMESTER II

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AM7201	Automotive Electrical and Electronics	PC	3	3	0	0	3
2.	AM7202	Automotive Pollution and Control	PC	3	3	0	0	3
3.	AM7251	Vehicle Dynamics	PC	3	3	0	0	3
PRACTICAL								
4.	AM7211	Automotive Electrical, Electronics and Virtual Instrumentation Laboratory	PC	4	0	0	4	2
			TOTAL	**13**	**9**	**0**	**4**	**11**

SEMESTER III

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AM 7103	Automotive Transmission	PC	3	3	0	0	3
2.		Elective I	PE	3	3	0	0	3
3.		Elective II	PE	3	3	0	0	3
PRACTICAL								
4.	AM7311	Computer Aided Engine Component Design Laboratory	PC	4	0	0	4	2
			TOTAL	**13**	**9**	**0**	**4**	**11**

SEMESTER IV

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AM7203	Vehicle Body Engineering	PC	3	3	0	0	3
2.		Elective III	PE	3	3	0	0	3
3.		Elective IV	PE	3	3	0	0	3
			TOTAL	**9**	**9**	**0**	**0**	**9**

SEMESTER V

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AM7301	Engine Management System	PC	3	3	0	0	3
2.		Elective V	PE	3	3	0	0	3
3.		Elective VI	PE	3	3	0	0	3
PRACTICAL								
4.	AM7312	Project Work Phase I	EEC	12	0	0	12	6
			TOTAL	**21**	**9**	**0**	**12**	**15**

SEMESTER VI

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1.	AM 7411	Project Work Phase II	EEC	24	0	0	24	12
			TOTAL	**24**	**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF DEGREE = 71

FOUNDATION COURSES (FC)

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Advanced Numerical Methods	FC	4	4	0	0	4

PROFESSIONAL CORE (PC)

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Automotive Chassis	PC	4	4	0	0	4
2.		Automotive Engines and Subsystems	PC	3	3	0	0	3
3.		Automotive Transmission	PC	3	3	0	0	3
4.		Engine and Chassis Laboratory	PC	4	0	0	4	2
5.		Automotive Electrical and Electronics	PC	3	3	0	0	3
6.		Automotive Pollution and Control	PC	3	3	0	0	3
7.		Vehicle Body Engineering	PC	3	3	0	0	3
8.		Vehicle Dynamics	PC	3	3	0	0	3
9.		Automotive Electrical and Electronics Laboratory	PC	4	0	0	4	2
10.		Engine Management System	PC	3	3	0	0	3
11.		Computer Aided Engine Component Design Laboratory	PC	4	0	0	4	2

PROFESSIONAL ELECTIVES (PE)

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AM7001	Advanced Thermodynamics for Automobile Engineers	PE	3	3	0	0	3
2.	AM7002	Alternative Fuels and Propulsion Systems	PE	3	3	0	0	3
3.	AM7003	Automotive Aerodynamics	PE	3	3	0	0	3
4.	AM7004	Automotive Air Conditioning Systems	PE	3	3	0	0	3
5.	AM7005	Automotive Safety	PE	3	3	0	0	3
6.	AM7006	Electric and Hybrid Vehicles	PE	3	3	0	0	3

7.	AM7007	Engine Combustion Thermodynamics and Engine Heat Transfer	PE	3	3	0	0	3
8.	AM7008	Finite Element Methods in Automobile Engineering	PE	3	3	0	0	3
9.	AM7009	Hydraulic and Pneumatic Systems	PE	3	3	0	0	3
10.	AM7010	IC Engine Process Modeling	PE	3	3	0	0	3
11.	AM7011	Instrumentation and Experimental Techniques	PE	3	3	0	0	3
12.	AM7012	Materials in Automobile Technology	PE	3	3	0	0	3
13.	AM7013	Modeling of vehicle systems	PE	3	3	0	0	3
14.	AM7014	Noise, Vibration and Harshness	PE	3	3	0	0	3
15.	AM7015	Production of Automobile Components	PE	3	3	0	0	3
16.	AM7016	Research Methodology	PE	3	3	0	0	3
17.	AM7017	Special Vehicles	PE	3	3	0	0	3
18.	AM7018	Theory of Fuels and Lubricants	PE	3	3	0	0	3
19.	AM7019	Two and Three Wheelers	PE	3	3	0	0	3
20.	AM7020	Vehicle Control Systems	PE	3	3	0	0	3
21.	AM7021	Vehicle Maintenance	PE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Project Work Phase I	EEC	12	0	0	12	6
2.		Project Work Phase II	EEC	24	0	0	24	12

AM7101 AUTOMOTIVE CHASSIS L T P C
4 0 0 4

OBJECTIVE:

- 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.

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM 13

Basic construction of chassis, Types of Chassis layout, with reference to Power Plant location and drive, various, types of frames, Loads acting on vehicle frame, materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry – Castor, Camber, King Pin Inclination and Toe–in, Toe-out. Condition for True Rolling Motion. Ackerman's and Davis Steering Mechanisms, Steering Linkages, Different Types of Steering Gear boxes, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering. Steering of Crawler Tractors.

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 12

Driving Thrust and its effects, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, transfer case, Propeller Shaft, Slip joints, Universal Joints, Constant Velocity Universal Joints, Final drive, types of final drive – Worm and Worm wheel, straight bevel gear, spiral bevel gear, helical gear and hypoid gear final drive. Double reduction and twin speed final drives, Differential principle. Constructional details of differential unit, Differential housings, Non–Slip differential, Differential locks, Final drive of Crawler Tractors.

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 11

Construction of rear axles, Types of Loads acting on rear axles, Full –Floating, Three–Quarter Floating and Semi–Floating Axles, Types, Multi axle vehicles. Constructional Details of Different Types of axle Housings, Wheels and Rims. Tyres – Types and constructional details.

UNIT IV SUSPENSION SYSTEM 12

Requirements of Suspension System, Types of Suspension – Constructional details and characteristics of Single Leaf, Multi–Leaf spring, Coil spring and Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension, Independent Suspension System, Shock Absorbers.

UNIT V BRAKE SYSTEM 12

Need for Brake system, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Leading and Trailing Shoes, Braking Torque, Types and constructional details – Drum Brakes and disc brakes, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders, Anti–Lock Braking System.

TOTAL 60 PERIODS

OUTCOME:

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

- Understand of the Constructional details of chassis Know the important drive line, Structural, Steering, Braking and Suspension Systems of Automobiles.
- Improve the Problem–Solving skill in Steering Mechanism, Propeller Shaft, Braking and Suspension systems.
- Acquire the importance of axle and tyre selection
- Understand the Dynamics of the chassis affecting vehicle characteristics

TEXT BOOKS

1. T. Kenneth Garrett, Kenneth Newton and William Steeds, "The Motor Vehicle" 13th Edition, Butterworth-Heinemann Limited**,** London, 2005.
2. Heinz Heisler, "Vehicle and Engine Technology", Second Edition, SAE, USA, 1999.
3. Kripal Singh, "Automobile Engineering (Volume - 1)", 12th Edition, Standard Publishers Distributors, 2011.

REFERENCES

1. Heldt P.M., “Automotive Chassis” Chilton Co., New York, 1952
2. R.K. Rajput, “A Text Book of Automobile Engineering”, Laxmi Publications Private Limited, 2007
3. N.K. Giri, “Automotive Mechanics” Khanna Publishers, New Delhi, 2005.

AM7102 AUTOMOTIVE ENGINES AND SUBSYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- 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.

UNIT I ENGINE BASIC THEORY 9

Engine types – otto, diesel, dual operating cycles – Fuel air cycle and actual cycles – Engine design and operating parameters - Two and four stroke engines - Typical performance curves for automobile engines - performance and pollution aspects.

UNIT II FUEL SUPPLY AND IGNITION SYSTEMS 9

Theory of carburetion and carburetors — Design aspects — Diesel fuel injection - pumps and injectors, Introduction to Petrol Injection system - conventional ignition systems, advance mechanisms.

UNIT III COOLING AND LUBRICATING SYSTEMS 9

Air cooling and water cooling – thermo syphon 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. Properties of engine lubricants.

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. Supercharger and Turbochargers.

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 – variable valve timing – Multi Port Injection System - Gasoline Direct Injection – Common Rail Direct Injection – Recent Trends.

TOTAL : 45 PERIODS

OUTCOME:

- To students will have the basic knowledge on Automotive Engines and its various sub components along with its functions. At the end of the course the students will have command knowledge over automotive engines and the recent development in the area of internal combustion engines.

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.
5. M. L. Mathur, R. P. Sharma, "Internal combustion engines", Dhanpat Rai Publication, 2005
6. William Crouse, Donald Anglin, "AUTOMOTIVE MECHANICS", Tata McGraw Hill Book Co, 2006

AM7103 AUTOMOTIVE TRANSMISSION L T P C
3 0 0 3

OBJECTIVE:

- 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

UNIT I CLUTCH 9

Requirements of Transmission system. Clutches – Functions, Principle of operation and types – single plate, multi plate, diaphragm and overrunning clutches.

UNIT II GEAR BOX 9

Purpose of gear box. Construction and working principle of sliding, constant and synchromesh gear boxes. 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.

UNIT III HYDRODYNAMIC TRANSMISSION 9

Fluid coupling – principles - Performance characteristics – advantages – limitations – drag torque – reduction of drag torque. Torque converter - principles - Performance characteristics – advantages – limitations – multi and poly stage torque converters.

UNIT IV AUTOMATIC TRANSMISSION 9

Introduction to epicycle gear trains - Ford – T model gear box, Wilson gear box- Cotal electric transmission. Chevrolet "Turboglide" transmission. – Hydraulic control systems of automatic transmission. Continuously Variable Transmission (CVT) – types – Operations.

UNIT V HYDROSTATIC DRIVE AND ELECTRIC DRIVE 9

Hydrostatic drive – various types of hydrostatic transmission – principle - Advantages and limitations. Comparison of hydrostatic transmission with hydrodynamic transmission. Construction and working principle of Janny hydrostatic drive. Electric drive- Principle of Early and modified Ward Leonard control system – advantages and limitations.

TOTAL: 45 PERIODS

OUTCOME:

- At the end of the course the students will have command over automotive transmission concepts and applications like The constructional, working principle of various types of manual and automotive transmission of an automobile.
- The performance characteristics, design of clutch and gear box for different vehicle applications.

- The construction and working principles of hydrostatic drive and electric drives used in the automotive transmission system.

TEXTBOOK:

1. Heldt P.M, Torque Converters, Chilton Book Co., 1992.
2. T. Kenneth Garrett, Kenneth Newton and William Steeds, "The Motor Vehicle" 13th Edition, Butterworth-Heinemann Limited**,** London, 2005.

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
3. James Larminie "Electric Vehicle Technology Explained", John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England

MA7154 ADVANCED NUMERICAL METHODS L T P C
4 0 0 4

OBJECTIVE:

- To impart knowledge on numerical methods that will come in handy to solve numerically the problems that arise in engineering and technology. This will also serve as a precursor for future research.

UNIT I ALGEBRAIC EQUATIONS 12

Systems of linear equations: Gauss Elimination method, pivoting techniques, Thomas algorithm for tridiagonal system – Jacobi, Gauss Seidel, SOR iteration methods - Systems of nonlinear equations: Fixed point iterations, Newton Method, Eigenvalue problems: power method, inverse power method, Faddeev – Leverrier Method.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 12

Runge Kutta Methods for system of IVPs, numerical stability, Adams-Bashforth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

UNIT III FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATION 12

Parabolic equations: explicit and implicit finite difference methods, weighted average approximation - Dirichlet and Neumann conditions – Two dimensional parabolic equations – ADI method; First order hyperbolic equations – method of characteristics, different explicit and implicit methods; numerical stability analysis, method of lines – Wave equation: Explicit scheme-Stability of above schemes.

UNIT IV FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS 12

Laplace and Poisson's equations in a rectangular region: Five point finite difference schemes, Leibmann's iterative methods, Dirichlet and Neumann conditions – Laplace equation in polar coordinates: finite difference schemes – approximation of derivatives near a curved boundary while using a square mesh.

UNIT V FINITE ELEMENT METHOD 12

Partial differential equations – Finite element method - orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

TOTAL: 60 PERIODS

OUTCOME:

- It helps the students to get familiarized with the numerical methods which are necessary to solve numerically the problems that arise in engineering.

BOOK FOR STUDY

1. Saumyen Guha and Rajesh Srivastava, “Numerical methods for Engineering and Science”, Oxford Higher Education, New Delhi, 2010.
2. Gupta S.K., “Numerical Methods for Engineers”, New Age Publishers, 1995.
3. Burden, R.L., and Faires, J.D., “Numerical Analysis – Theory and Applications”, Cengage Learning, India Edition, New Delhi, 2009
4. Jain M. K., Iyengar S. R., Kanchi M. B., Jain , “Computational Methods for Partial Differential Equations”, New Age Publishers, 1993.
5. Morton K.W. and Mayers D.F., “Numerical solution of partial differential equations”, Cambridge University press, Cambridge, 2002.

AM7111	ENGINE AND CHASSIS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

- 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, and Braking system.
- At the end of the course the student will be well versed in the assembling and dismantling of any vehicles.

LIST OF EXPERIMENTS

1. Performance and emission Test of SI Engine.
2. Performance and emission Test of CI Engine.
3. Heat balance test on IC engines
4. Performance test on variable compression ratio multi fuel diesel engine.
5. Determination of in-cylinder pressure vs crank angle.
6. Study of chassis system, Chassis dynamometer.
7. Study of Wheel Alignment System
8. Assembling and dismantling of the following
    i. SI engine.
    ii. CI engine
    iii. V engine
    iv. Single plate, Diaphragm Clutch.
    v. Constant mesh, Sliding mesh gear box
    vi. Transfer case
    vii. Differential
    viii. Front axle, Rear axle
    ix. Brake system
    x. Steering system

TOTAL: 60 PERIODS

OUTCOME

- Be familiar with of the Performance and emission Test of SI & CI Engine, Heat balance test on IC engines
- To develop the trouble shoot skill in chassis system, Chassis dynamometer, and Wheel Alignment System.

AM7201 AUTOMOTIVE ELECTRICALS AND ELECTRONICS L T P C
3 0 0 3

OBJECTIVE:

- 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.

UNIT I BATTERY AND STARTING SYSTEMS 9

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 AND LIGHTING SYSTEMS 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.

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEMS 9

Types of electronic ignition systems - variable ignition timing, distributor less ignition. Spark timing control. TBI, MPFI, GDI Systems. Engine mapping.

UNIT IV ELECTRICAL SYSTEMS 9

Warning and alarm instruments : Brake actuation warning system, traficators, flash system, oil pressure warning system, engine over heat warning system, air pressure warning system, speed warning system, door lock indicators, neutral gear indicator, horn design, permanent magnet horn, air & music horns. Wind shield wiper. window washer, instrument wiring system and electromagnetic interference suppression, wiring circuits for instruments, electronic instruments, dash board illumination.

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. Environmental requirements (vibration, Temperature and EMI).

TOTAL : 45 PERIODS

OUTCOME:

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

- Understand about Batteries, Starting System
- Understand the functioning of charging System and Ignition System in Tandem
- Understand the Lighting System and Dash – Board Instruments of vehicle.
- Know the Functions of electrical accessories onboard the vehicle.

TEXTBOOK:

1. Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & 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

AM7202 AUTOMOTIVE POLLUTION AND CONTROL L T P C
3 0 0 3

OBJECTIVE:

- The main objective of this course is to impart knowledge in automotive pollution control. The detailed concept of formation and control techniques of pollutants like UBHC, CO, NO_x, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

UNIT I EMISSION FROM AUTOMOBILES 05

Sources of Pollution. Various emissions from Automobiles — Formation — Effects of pollutants on environment human beings. Emission control techniques – Emission standards.

UNIT II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL 12

Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon, NO_x, Smoke — Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters — Charcoal Canister — Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion.

UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL 12

Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, EGR, HCCI, Particulate Traps, SCR — Cetane number Effect.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES 08

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design.

UNIT V TEST PROCEDURES AND EMISSION MEASUREMENTS 08

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dyno - Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems — Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

TOTAL : 45 PERIODS

OUTCOME:

By the end of this course, students will be able to

- Understand the various emissions formed in IC engines
- Understand the effects of pollution on human health and environment
- Understand the control techniques
- Understand the emission norms

TEXTBOOK:

1. G.P.Springer and D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York, 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.

REFERENCES

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987

AM7203 VEHICLE BODY ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamic, concept, panelling 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.

UNIT I CAR BODY 8

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

UNIT II BUS BODY 9

Types of bus body: based on capacity, distance traveled and based on construction.– Layout for various types of Bus body, Types of metal sections used – Regulations – Constructional details: Conventional and integral. Driver seat design.

UNIT III COMMERCIAL VEHICLE BODY 9

Types of commercial vehicle bodies – LCV, HCV. Construction details of - Flat platform body and Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design – segmental design, compaction of driver's cab.

UNIT IV VEHICLE AERODYNAMICS 10

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

UNIT V BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR 9

Types of materials used in body construction-Steel sheet, wood, aluminum, plastics, composites, properties of materials. Body trim items-body mechanisms. Hand tools - power tools -panel repair-repairing sheet metal-repairing plastics-body – corrosion: Anticorrosion methods, Modern painting process procedure-paint problems

TOTAL : 45 PERIODS

OUTCOME:

Upon completion of the course, students will

- Know about different aspects of car body and bus body, types, commercial vehicle.
- Role of various aerodynamic forces and moments, measuring instruments.
- Know about the material used in body building, tools used, body repairs.

TEXTBOOK:

1. Powloski, J., Vehicle Body Engineering, Business Books Ltd., 1998.
2. James E Duffy, Body Repair Technology for 4-Wheelers,Cengage Learning,2009.

REFERENCES:

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

AM7251 VEHICLE DYNAMICS L T P C

3 0 0 3

OBJECTIVE:

- Road vehicles are classified into various types based on application. The design of vehicle control system, traction and brake, ride and handling dynamics for each vehicle are presented. Students will learn about the fundamental theory of vehicle dynamics, vehicle performance as well as related tests. It is also an important goal to instruct them in the application of the dynamic modeling and analysis approach in vehicle design. The objective of this course is to train the students as specialists in the vehicle engineering domain, to develop their capacities of analysis, evaluation and design based on their acquisition of skills in modeling dynamic equation and performance analysis.

UNIT I BASIS OF VIBRATION 9

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed. Modal analysis

UNIT II TYRES 9

Tyre forces and moments, Tyre structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tyre. Performance of tyre on wet surface. Ride property of tyres. Magic formulae tyre model, Estimation of tyre road friction. Test on Various road surfaces. Tyre vibration.

UNIT III VERTICAL DYNAMICS 9

Human response to vibration, Sources of Vibration. Design, analysis and computer simulation of Passive, Semi-active and Active suspension using Quarter car, half car and full car model. Influence of suspension stiffness, suspension damping, and tyre stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL 9

Aerodynamic forces and moments. Equation of motion. Tyre forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control. Case Studies.

UNIT V LATERAL DYNAMICS 9

Steady state handling characteristics. Steady state response to steering input. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Stability of vehicle on banked road and during turn. Effect of suspension on cornering.

TOTAL : 45 PERIODS

OUTCOME:

- At the end of the course, the students will be introduced to the fundamentals of vehicle dynamics and the performance indices and evaluation criteria of vehicles, to analyze the influence of vehicle configuration and design parameters on vehicle performance, to discuss the approach for predicting vehicle performance and to simulate and analyze vehicle performance as well.

TEXT BOOKS:

1. Singiresu S. Rao, Mechanical Vibrations (5^{th} Edition), Prentice Hall, 2010
2. J. Y. Wong, Theory of Ground Vehicles, 3^{rd} Edition, Wiley-Interscience, 2001
3. Rajesh Rajamani, Vehicle Dynamics and Control, 1^{st} edition, Springer, 2005
4. Thomas D. Gillespie, Fundamentals of Vehicle Dynamics, Society of Automotive Engineers Inc, 1992

REFERENCES:

1. Dean Karnopp, Vehicle Stability, 1st edition, Marcel Dekker, 2004
2. G. Nakhaie Jazar, Vehicle Dynamics: Theory and Application, 1st edition, Springer, 2008
3. Michael Blundell & Damian Harty, The Multibody Systems Approach to Vehicle Dynamics, Elsevier Limited, 2004
4. Hans B Pacejka, Tyre and Vehicle Dynamics, 2nd edition, SAE International, 2005
5. John C. Dixon, Tyres, Suspension, and Handling, 2nd Edition, Society of Automotive Engineers Inc, 1996
6. Jan Zuijdijk, Vehicle dynamics and damping, AuthorHouse, 2009

AM7211 AUTOMOTIVE ELECTRICAL AND ELECTRONICS AND VIRTUAL INSTRUMENTATION LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVE:

- To import the knowledge in the area of automotive electrical system and electronic system associated in modern vehicles.

LIST OF EXPERIMENTS:

1. Testing of
    a. battery
    b. starting systems
    c. charging systems
    d. ignition systems
    e. body controller systems
2. Study of
    a. automotive lighting system and adjustment of head lights beam
    b. major electrical components used in modern vehicles
    c. diagnostic tool used in vehicle
3. Dismantling, testing and assembling of Starter system components
4. Dismantling, testing and assembling of Charging system components

5. Basic Analog Experiments like
    a. Logic gates, Adders, Flip flops
    b. Amplifier, filter,
    c. Multiplexer and De-multiplexer
6. Interfacing seven segment displays
7. Microprocessor and microcontroller programming
    a. Arithmetic and Logic operation,
    b. Code conversion,
    c. Waveform generation,
    d. Look up table
8. Interfacing ADC and DAC for Data Acquisition and Control Application
9. Interfacing Sensors for Measurements of position, displacement, velocity, force, temperature, proximity/range etc
10. Display, Keyboard, Stepper Motor and DC Motor interface using microcontroller.
11. Study of
    a. Virtual Instrumentation
    b. Controller Area Network
    c. Multiplexing System
    d. Electronic Control Unit
    e. Engine Sensors and Actuators
    f. Chassis Sensors and Actuators
    g. Development of Embedded Systems
12. Mini Project

TOTAL: 45 PERIODS

OUTCOME:

At the end of the course the students will be able to have the knowledge in

- Automotive electrical systems and electrical accessories
- Basic microprocessor / microcontroller programming
- Automotive sensor, transducer, actuator, virtual instrumentation, data acquisition
- Development of embedded systems for automobiles

AM7301	ENGINE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The course will focus on engine management systems viz fuel injection, ignition system. emission control and engine management. This course will provide opportunities to discuss the fundamentals of engine control, sensors, actuators, electronics systems, diagnostics system.

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. Switches, active resistors, Transistors, Current mirrors/amplifiers, Voltage and current references, Comparator, Multiplier. Amplifier, filters, A/D and D/A converters.

UNIT II SENSORS AND ACTUATORS 9

Inductive, Hall Effect, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine speed sensor, exhaust oxygen level (two step, linear lambda and wideband), knock, manifold temperature and pressure sensors. Solenoid, relay(four and five pin), stepper motor

UNIT III SI ENGINE MANAGEMENT 9

Layout and working of SI engine management systems. Group and sequential injection techniques. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless (BREAKERLESS) 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. Electronically controlled Unit Injection system. 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 and closed loop control – Integrated engine control system, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

TOTAL : 45 PERIODS

OUTCOME:

At the end of the course, the student should able to

- Explain the fundamentals, operation, function of various sensors and actuators in engine management systems.
- Explain the fundamentals, operation, function of various fuel injection systems pertain to SI and CI Engine.
- Explain the control algorithm during various engine operating conditions.

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

AM7311	COMPUTER AIDED ENGINE COMPONENT DESIGN LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

- Import the knowledge in the area of design and analysis of automotive engine components

LIST OF EXPERIMENTS:

Design, model and (Structural / Thermal) analysis of the following components

1. Engine Cylinder
2. Piston
3. Connecting rod Assembly.
4. Valve train components
5. Crank shaft.
6. Cam shaft.

TOTAL: 60 PERIODS

OUTCOME:

- At the end of the course the students will be able to have a complete knowledge in design and analysis of automotive engine components

REFERENCES:

1. Dean Averns, " Automobile Chassis Design ", Illiffe Books Ltd, 1992.

2. Bosch, “Automotive HandBook” 6th edition, SAE, 2004.
3. Heldt.P.M., " Automotive Chassis ", Chilton Co., New York, 1992.
4. Steeds.W., " Mechanics of Road vehicles ", Illiffe Books Ltd., London, 1990.
5. Giles.J.G., Steering, " Suspension and tyres ", Illiffe Books Ltd., London, 1988.
6. T. Kenneth Garrett, Kenneth Newton and William Steeds, “The Motor Vehicle” 13th Edition, Butterworth-Heinemann Limited, London, 2005.
7. Heldt.P.M., " Torque converter ", Chilton Book Co., New York, 1982.
8. Dr. N. K. Giri, “Automobile Mechanics”, Seventh reprint, Khanna Publishers, Delhi, 2005
9. ACAD, CATIA and ANSYS software guide / manual

AM7001 ADVANCED THERMODYNAMICS FOR AUTOMOBILE ENGINEERS

L	T	P	C
3	0	0	3

OBJECTIVE:

- The objectives of this course are to make the students understand the advanced concepts of thermodynamics applied to I.C. engines. To impart knowledge on entropy and its significance in engine combustion. To provide complete knowledge on chemical kinetics involved in pollution formation.

UNIT I BASIC CONCEPTS **9**

Systems, property, state, path and process- quasi static process, work, modes of work. Review of laws of thermodynamics – first and second law of thermodynamics – Application of the energy equation to the engine combustion process. Application to closed and open systems of automobile. internal energy, specific heat capacities, enthalpy, and steady flow process.

UNIT II ENTROPY **9**

Absolute Zero and the Third Law of Thermodynamics. Entropy – Mathematical Definition, Characteristics. Relation between ds, dq and T during an Irreversible Process. Entropy Change in Internally Reversible Processes. Isentropic Processes. Absolute Entropies. Helmholtz and Gibbs Free Energies. Entropy of Mixing of Ideal Gases.

UNIT III COMBUSTION OF HYDROCARBON FUELS **9**

Combustion processes. Combustion of simple hydrocarbon fuels. Enthalpy of formation. Bond energies. Chemical Reactions and Combustion. Air – Fuel ratio calculation, Equivalence Ratio, problems.

UNIT IV CHEMICAL KINETICS OF COMBUSTION **9**

Chemical Kinetics – Rate of reaction, equation of Arrhenius, activation energy. Chemical thermodynamic model for normal combustion. Chemical kinetics of pollutants formation in I.C. Engines.

UNIT V CHEMICAL EQUILIBRIUM AND DISSOCIATION **10**

Chemical equilibrium. Criterion for reaction equilibrium. Equilibrium constant for gaseous mixtures - evaluation of equilibrium composition. The Vant Hoff relationship between equilibrium constant and heat of reaction. Calculation of chemical equilibrium and the law of mass action. Dissociation. Effect of pressure and temperature on dissociation. Problems.

TOTAL: 45 PERIODS

OUTCOME:

- Students will possess extended knowledge in thermodynamics such as entropy and its significance.
- Students will possess a comprehensive understanding of importance of chemical kinetics and dissociation involved in combustion and pollution formation in IC engines.

REFERENCES :

1. Kenneth Wark Jr., Advanced Thermodynamics for Engineers, McGraw-Hill Inc., 1995.
2. Bejan, A., Advanced Engineering Thermodynamics, John Wiley and Sons, 1988.
3. Desmond E Winterbone, Advanced Thermodynamics for Engineers. John Wiley & Sons, Inc., 1997.
4. Holman,J.P., Thermodynamics, Fourth Edition, McGraw-Hill Inc., 1988.
5. Sonntag, R.E., and Van Wylen, G, Introduction to Thermodynamics, Classical and Statistical, Third Edition, John Wiley and Sons, 1991.

AM7002 ALTERNATIVE FUELS AND PROPULSION SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- At the end of the course, the student will be able to acquire knowledge of alternate fuels and the changes in the engine design for handling them and understand various propulsion systems for use in the automobiles.

UNIT I ALCOHOLS AS FUELS 9

Alternative fuels. Availability of different alternative fuels for engines. Alcohols – Properties, Production methods and usage in engines. Blending, dual fuel operation, surface ignition, spark ignition and oxygenated additives. Performance, combustion and emission Characteristics in engines. Issues & limitation in alcohols

UNIT II VEGETABLE OILS AS FUELS 9

Vegetable oils and their important properties. Fuel properties characterization. Methods of using vegetable oils – Blending, preheating, Transesterification and emulsification – Performance, combustion and emission Characteristics in diesel engines. Third generation biofuels - Biofuels from micro algae. Issues & limitation of using vegetable oils in IC engines.

UNIT III HYDROGEN AS ENGINE FUEL 9

Hydrogen – Properties, problems, Production methods, storage and safety aspects. Issues & limitation in Hydrogen. Methods of using hydrogen in engines. Performance, combustion and emission Characteristics in engines.

UNIT IV BIOGAS, NATURAL GAS AND LPG AS FUELS 9

Biogas, Natural gas and LPG – Properties and production methods. CO_2 and H_2S scrubbing in Biogas, Modifications required for use in Engines- Performance, combustion and emission Characteristics in engines. Issues & limitation in Gaseous fuels.

UNIT V HYBRID AND ELECTRIC VEHICLES 9

Hybrid and Electric vehicle – Layout, Merits, demerits and components, Electronic control system – Different configurations of Hybrid vehicles. Power split device. Energy regeneration. High energy and power density batteries – Introduction to PEM Fuel cell.

TOTAL :45 PERIODS

OUTCOME:

By the end of this course, students will be able to

- Student will possess a comprehensive understanding of available alternative fuels for IC engines. They will posses complete knowledge on producing different biofuels, modifying them and using them in IC engines
- Students will acquire the skills in developing new technologies for alternative fuels efficiently in IC engines.
- Students will demonstrate the importance of using alternative fuels for sustainable energy supply and for emission control in IC engines.

REFERENCES

1. Ayhan Demirbas, ' Biodiesel A Realistic Fuel Alternative for Diesel Engines', Springer-Verlag London Limited 2008,ISBN-13: 9781846289941
2. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS Press Champaign, Illinois 2005.
3. Richard L Bechtold P.E., Alternative Fuels Guide book, Society of Automotive Engineers, 1997 ISBN 0-76-80-0052-1.
4. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).
5. Science direct Journals (Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy, etc.) on biofuels.

AM7003 AUTOMOTIVE AERODYNAMICS L T P C
3 0 0 3

OBJECTIVE:

- At the end of the course, the students will be able to apply basic principles of aerodynamics to improve fuel efficiency of road vehicles.

UNIT I INTRODUCTION TO FLUID PROPERTIES 9

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

UNIT II SCOPE AND ANALYSIS OF PASSNGER CAR 9

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 OPTIMIZATION TECHNIQUES OF PASSENGER CAR 9

Front end 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 SCOPE AND ANALYSIS OF COMMERCIAL VEHICLES 9

Force and moments – Origin, calculation, effects and characteristics. Cross wind problems of commercial vehicle. Vehicle stability under side winds – Add-ons used in commercial vehicles for drag reduction - Drag potential and fuel efficiency.

UNIT V WIND TUNNEL TESTING OF ROAD VEHICLES 9

Principles of wind tunnel technology – problems with scale models – full scale wind tunnels – instrumentation techniques – Real time testing methods.

TOTAL: 45 PERIODS

OUTCOME:

On completion of the course the student will have

- an ability to apply concepts of fluid dynamics on vehicle motion
- an ability to interpret the influence of vehicle design on fuel economy
- an exposure on drag reduction enhancing vehicle performance
- an ability to develop programs and interpret test data through computational fluid dynamics

TEXTBOOK:

1. Hucho, W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 4th Edition, SAE 1998.

REFERENCES:

1. Pope, A, Wind Tunnel Testing, John Wiley & Sons, 2nd Edn., New York, 1994.
2. Automotive Aerodynamics: Update SP-706, S
3. Vehicle Aerodynamics, SP-1145, SAE, 1996.

AM7004	AUTOMOTIVE AIR CONDITIONING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- At the end of the course, the students will be able to understand the Psychometric concepts, refrigerant characteristics, components of the automotive air-conditioning and their functions, and the latest developments in the field of vehicle air conditioning.

UNIT I FUNDAMENTALS 9

Terminology, design factors and concepts related to air conditioning system - Construction and Working principles of Thermostatic Expansion valve and Orifice tube based system- Heating system types -detailed study of HVAC components like compressor, evaporator, condenser, TXV, orifice tube, Receiver-drier, heater core etc. Location of air conditioning components in a vehicle.

UNIT II REFRIGERANTS & AIR MANAGEMENT SYSTEMS 9

Refrigerants:

Temperature and pressure relation, Properties of R-12 and R134a- refrigerant oil. Simple problems -Containers - Handling refrigerants - Tapping into the refrigerant container - Ozone Layer Depletion.

Air management system:

Air routing for manual, semi and automatic system- cases and ducts- Air distribution, control head and doors- Defrost system

UNIT III AUTOMATIC CLIMATE CONTROL SYSTEM 9

Block diagram - types of Sensors and Actuators, - Control Logic Electrical wiring diagram of manual and automatic system - multiplexing between BCM and PCM- control of compressor clutch, blower motor etc.- diagnostics tools and features.

UNIT IV DESIGN OF AIR-CONDITIONING COMPONENTS 9

Modeling of Fixed and variable Displacement type compressor, evaporator modeling - heat transfer correlations for the fluids inside the evaporator, analysis of evaporator frosting- condenser modeling - improvement of refrigerant flow control method.

UNIT V AIR CONDITIONING DIAGNOSIS AND SERVICES 9

AC system diagnosis based on temperature and pressure measurements, sight glass, sound etc. - refrigerant leak detection- Trouble shooting and Servicing of compressor, evaporator, condenser, heater core etc. – HVAC equipment , recovery and charging. Air routing system service.

TOTAL: 45 PERIODS

OUTCOME:

- To students will have the basic knowledge on psychometric terminologies and simple problem pertaining to psychometric and refrigerant system. At the end of the course the students will have through knowledge over different component and their function related to different type of vehicle air conditioning system.

TEXTBOOK:

1. Tom Birch, “Automotive Heating and Air Conditioning” Pearson Education Inc., 2003.
2. Boyce H. Dwiggins, Jack Erjavec., “Automotive Heating and Air-Conditioning”, Delmer publisher.,2001.

3. William H Crouse and Donald L Anglin, “Automotive air conditioning”, McGraw - Hill Inc., 1990
4. Steven Daly “Automotive Air Conditioning and Climate Control System”, Butterworth-Heinemann., 2006

REFERENCES

1. Paul Weiser, “Automotive air conditioning”, Reston Publishing Co Inc., 1990.
2. MacDonald, K.L., “Automotive air conditioning”, Theodore Audel series, 1978.
3. James D. Halderman, “Automotive Heating, Ventilation, and Air Conditioning Systems”, Pearson Education Inc., 2004.
4. SAE paper No: 931121,900084, 850040,931137,870029 etc.
5. Vehicle service manuals.

AM7005 AUTOMOTIVE SAFETY L T P C
3 0 0 3

OBJECTIVE:

The course should enable the students to:

- Know about the basics about the vehicle.
- Understand the safety aspects in the vehicle.
- Know and understand the various safety aspects.
- To get the knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle.
- To know about the comfort and convenience system.

UNIT I INTRODUCTION 9

Automotive safety: Introduction, Types. Active safety: driving safety, conditional safety, perceptibility safety, operating safety. Passive safety: exterior safety, interior safety.

UNIT II PASSIVE SAFETY CONCEPTS 9

Design of body for safety, deceleration of vehicle, passenger. Concept of crumble zone, Safety Cage. Optimum crash pulse, deceleration on impact with stationary and movable obstacles. Deformation behavior of vehicle body. Deformation behavior of Light weight materials.

UNIT III PASSIVE SAFETY EQUIPMENTS AND CONVENIENCE SYSTEM 9

Seat belt, Seat belt tightener system and importance , collapsible steering column. Air bags and its activation . Designing aspcets of automotive bumpers and materials for bumpers. Steering and mirror adjustment, central locking system, Tire pressure control system, rain sensor system, automated wiper system.

UNIT IV ACTIVE SAFETY 9

Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection system.

UNIT V VEHICLE INTEGRATION AND NAVIGATION SYSTEM 9

Looking out sensors and Looking in senors, Intelligent vision system, Vehicle Integration system. Global Positioning System. Vehicle Navigation System. Road Network,

TOTAL: 45 PERIODS

OUTCOME:

The students should be able to:

- Know about the design of the bumper for safety.
- Know about the concept of crumble zone, and also the effect of acceleration and deceleration of the vehicle in the compartment of the vehicle.
- Know the various types of safety aspects such as active and passive safety, the active safety components and the working passive safety components such as air bags, seat belts
- Know the working of the compartment while moving of the vehicle, about the collapsible steering and tiltable steering column, about the collision avoidance system, front and rear object detection.
- Know about the rear vehicle detection system, and the braking system, the comfort and convenience system for the vehicle such as central locking system, garage door opening system and about the environment information system.

TEXT BOOK:

1. Ljubo Vlacic, Michel Parent, Fumio Harashima – "Intelligent Vehicle Technologies Theory and Applications" -Butterworth-Heinemann, 2001
2. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori - "Sensors for Automotive Applications " - WILEY-VCH Verlag GmbH & Co. 2003
3. Robert Bosch GmbH - "Safety, Comfort and Convenience Systems"- Wiley; 3rd edition , 2007

REFERENCES:

1. Bosch, "Automotive HandBook", 6th edition, SAE, 2004.
2. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.
3. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.
4. ARAI Safety standards

AM7006 ELECTRIC AND HYBRID VEHICLES L T P C
3 0 0 3

OBJECTIVE:

- This course will introduce general aspects of advanced Hybrid Electric Vehicles (HEV), including architectures, modeling, sizing, sub-system design and hybrid vehicle control. It will cover vehicle dynamics, energy storage sources, electric propulsion systems, power electronics design, and HEV control and communication.

UNIT I NEED FOR ALTERNATIVE SYSTEM 9

Need of electric vehicles hybrid vehicles – comparative study of diesel, petrol, pure electric and hybrid Vehicles. Limitations of electric vehicles. Specification of some electric and hybrid vehicles

UNIT II VEHICLE DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES 6

Various Resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Power steering- Tire choice- Wing Mirror, Aerials and Luggage racks

UNIT III ENERGY SOURCES: BATTERIES AND FUEL CELLS 9

Battery Parameters-Power requirement of electric vehicles- Different types of batteries - Lead acid- Nickel based-Sodium based-Lithium based- Metal Air based. Battery charging- Charger design- Quick Charging devices, Equivalent circuits, Battery Modeling. Fuel Cell- Fuel cell characteristics- Fuel cell types-Half reactions of fuel cell- Thermal Management of the PEM fuel cell

UNIT IV PROPULSION MOTORS AND CONTROLLERS 12

Characteristic of DC motors. AC single phase and 3-phase motor, PR motors, Switched reluctance machines, speed controllers, Inverters, DC/DC converters.

UNIT V HYBRID VEHICLES 9

Types of Hybrid power train- Series, parallel, split – parallel, series - parallel - Advantages and Disadvantages. Power split device – Energy Management System - Design consideration - Economy of hybrid Vehicles

TOTAL: 45 PERIODS

OUTCOME:

The student should be able to

- Explain how a hybrid vehicle works and describe its main components and their function.
- Describe the different hybrid topologies with respect to their functional blocks and their characteristics.
- Design and implement both simple and advanced models of the vehicles.
- Analyze the performance of a hybrid vehicle.
- Build efficiency models of important components.
- Evaluate the environmental impact of road vehicles.
- Calculate basic electrical and thermal properties for power electronic converters.
- Describe the operating principle and properties for the most common types of electrical motors in hybrid technology.
- Describe the operating principle for fuel cells and energy storage elements and calculate basic performance of them.
- Describe the fuel alternatives for hybrid vehicles.

TEXT BOOKS:

1. James Larminie and John Lowry, “Electric Vehicle Technology Explained “ John Wiley & Sons,2003
2. Iqbal Husain, “ Electric and Hybrid Vehicles-Design Fundamentals”, CRC Press,2003
3. Mehrdad Ehsani, “ Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, CRC Press,2005

REFERENCES:

1. Ron HodKinson, “Light Weight Electric/ Hybrid Vehicle Design”, Butterworth Heinemann Publication,2005
2. Lino Guzzella, “ Vehicle Propulsion System” Springer Publications,2005

AM7007 ENGINE COMBUSTION THERMODYNAMICS AND ENGINE HEAT TRANSFER

L	T	P	C
3	0	0	3

OBJECTIVE:

- The objective of this course is to make the students to understand the principle of internal combustion engine combustion process and to introduce the various heat transfer models. The students will also understand various engine measurement techniques such as surface temperature, cylinder pressure, flow velocity and their significance in engine combustion.

UNIT I BASIC CONCEPTS OF COMBUSTION AND FLAMES 10

Introduction to combustion. Fuels and oxidizers. Flames and structures- Laminar premixed and diffusion flames. Flame speed – Definition, theories on laminar flame speed. Factors affecting flame speed. Stability of flames- Quenching and flammability limit, mixture flow rate on stability.

Turbulent flames – Structure, Regimes, significance of Reynolds and Damkohler number on turbulent flames.

UNIT II THERMODYNAMICS OF ENGINE COMBUSTION 8

First and Second Law of Thermodynamics applied to engine combustion- Combustion Stoichiometry. Premixed and diffusion combustion process in I.C. engines using heat release rate and pressure crank angle diagrams. Photographic studies on I.C. engine combustion.

UNIT III SPRAY COMBUSTION AND IGNITION DELAY 9

Diesel spray – Spray characteristics, formation, atomization, penetration and evaporation process. Ignition delay – Significance of ignition delay in engine combustion, definition, calculation from experimental data. Models for ignition delay. Factors affecting ignition delay.

UNIT IV HEAT TRANSFER IN IC ENGINES 9

Engine Heat transfer and heat Balance. Measurement of Instantaneous heat transfer rate. Models for engine heat transfer. Development of engine convective heat transfer coefficient. Radiative heat transfer. Temperature measurement in Piston, Cylinder, Cylinder Head, Liner and valves.

UNIT V INSTRUMENTATION 9

Pressure sensors, crank angle encoder. Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines. In-cylinder pressure measurement. Calculation of combustion parameters from engine pressure crank angle diagrams. Heat release rate – significance, derivation. Tutorial problems. Significance of cumulative heat release.

TOTAL : 45 PERIODS

OUTCOME:

- Student will possess a comprehensive understanding of thermodynamics involved in combustion process of I.C. Engines.
- Students will demonstrate the importance of engine heat transfer in designing modern engine combustion systems.
- Students will posses complete knowledge in engine pressure data acquisition and analysis for combustion parameters.

REFERENCES

1. Spalding.D.B., "Some fundamentals of Combustion", Butterworth Science Publications, London, 1985.
2. Irvin Glasman, “Combustion” Academic Press, London, 1987, ISBN 0-12-285851-4.
3. Taylor.E.F. “The Internal Combustion Engines", International Text Book Co., Pennsylvania, 1982.
4. Ashley Campbel, “Thermodynamic analysis of combustion engine”, John book company, Newyork,1979.
5. J.I.Ramos, “Modeling of Internal Combustion Engine”, Mcgraw hill book company New york 1990
6. John. B. Heywood,’ “Internal Combustion Engines", Tata McGraw Hill Co., Newyork, 1988.
7. Ganesan.V. "Computer Simulation of Spark Ignition Engine Process ", Wiley eastern India ltd, 1996.

AM7008	FINITE ELEMENT METHODS IN AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To equip the students with the Finite Element Analysis fundamentals.
- To enable the students to formulate the design problems into FEA.

- To introduce basic aspects of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
- Understand how to use finite element analysis in engineering problems and application areas including stress, heat transfer, and vibration analysis

UNIT I INTRODUCTION 9

Engineering design analysis-meaning and purpose, steady state, propagation and transient problems. Concepts of FDM, FEM, FVM. Steps involved in FEM. Applicability of FEM to structural analysis, heat transfer and fluid flow problems. Advantages and limitations of FEM. Test for convergence. Element choice. Commercial finite element packages. Solution of Boundary value problem - Integral formulation for numerical solution - Variational methods - Minimum total potential energy formulation.

UNIT II 1D ELEMENTS 9

Use of bar and beam elements in structural analysis. Bar Element – Stiffness matrix formulation by direct and polynomial methods. Boundary condition and assemblage concepts. Beam element characteristics matrix. Global, local, natural coordinates.

UNIT III 2D ELEMENTS 9

Rectangular elements - Quadratic quadrilateral elements - Linear Triangular elements - 2D elements applications for plane stress, plane strain and axi-symmetric problems. Treatment of boundary condition. Mesh generation techniques. Numerical integration schemes. Iso Parametric elements. Introduction to 3D Elements.

UNIT IV STRUCTURAL AND DYNAMIC ANALYSIS 9

1D & 2D problems in Solid mechanics. Dynamics problems representation in FE. Free vibration problem formulation. Torsion of non circular shaft - axisymmetric problem. Case Studies like Structural analysis of Chassis Frame, Whirling speed of propeller shaft, contact analysis of gears, modal analysis of suspension system, impact, crash worthiness etc.

UNIT V HEAT TRANSFER ANALYSIS AND FLOW ANALYSIS 9

1D & 2D problems in fluid mechanics and heat transfer by conduction and convection. Transient thermal analysis. Case Studies like Heat transfer analysis of piston, fins.

TOTAL : 45 PERIODS

OUTCOME:

Upon completing this course, the students will be able to:

- Identify mathematical model for solution of common engineering problems.
- Formulate simple problems into finite elements.
- Solve structural, thermal, fluid flow problems.
- Use professional-level finite element software to solve engineering problems in Solid mechanics, fluid mechanics and heat transfer.
- Derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts

TEXT BOOK:

1. Segerlind,L.J., Applied Finite Element Analysis, Second Edition, John Wiley and Sons Inc., New York, 1984
2. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and applications of finite element analysis”, 4th edition, John Wiley & Sons, 2007.

REFERENCES

1. Krishnamurthy,C.S., Finite Element Analysis, Tata McGraw Hill, 1987.
2. Ramamurthi,V., Computer Aided Design in Mechanical Engineering, Tata McGraw Hill, 1987.

3. Bathe,K.J. and Wilson,E.L., Numerical methods in finite element analysis, Prentice Hall of India Ltd., 1983.
4. J. N. Reddy, "Finite Element Methods", 2nd Edition, 6th Reprint, Tata McGraw Hill, 2005.
5. Singiresu S. Rao, "The Finite Elements Methods in Engineering", 4th Edition, USA, 2005.

AM7009 HYDRAULIC AND PNEUMATIC SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- The main objective of this course is to impart knowledge in hydraulic and pneumatic system. The detailed concept on construction and principle of operation of various component of hydraulic and pneumatic system will be taught to the students.

UNIT I INTRODUCTION 9

Properties - hydraulic fluids and air. Hydraulic fluids, types, factors affecting oil performance, governing principles and laws- distribution of fluid power- selection, power unit. Selection of pipe / tubing, couplings. Packing and seals, packing standards. Comparison between pneumatic and hydraulic system. energy losses in hydraulic systems- Symbols of pneumatic and hydraulic elements.

UNIT II PNEUMATIC SYSTEMS 9

Basic requirement. Elements of pneumatics, preparation of compressed air. cooling and drying of compressed air. conditioning and distribution of compressed air. pneumatics actuators constructional details of air compressors, types, Air motors, control valves, actuators and mountings, filter, lubricator, regulator. General approach of system design, travel step diagram. Types – sequence control, cascade, step counter method. K.V.Mapping for minimization of logic equation. Simple circuits.

UNIT III HYDRAULIC SYSTEMS 9

Cylinder, Pumps and motors - types, characteristics., construction details. Valves for control of direction, flow and pressure – types and construction details. Power pack– elements and design. Pipes- material, pipe fittings. seals and packing. accessories used in fluid power systems- Maintenance of hydraulic systems. Selection criteria for cylinders, valves, pipes.

UNIT IV SERVO AND PLC SYSTEMS 9

Electro pneumatics, ladder diagram. Servo and Proportional valves - types, operation, application. Hydro-Mechanical servo systems. PLC-construction, types, operation, programming.

UNIT V AUTOMOTIVE APPLICATIONS 9

Hydraulic tipping mechanism, power steering, fort lift hydraulic gear, hydro-pneumatic suspension, air brake. Maintenance and trouble shooting. Design and analysis of a hydraulic / Pneumatic system-Case Study

TOTAL : 45 PERIODS

OUTCOME:

- To students will have the basic knowledge on various laws and simple problem pertaining to hydraulic and pneumatic system. At the end of the course the students will have through knowledge over different component and their function related to hydraulic and pneumatic system and how it is used for automotive applications.

TEXT BOOKS:

1. Anthony Espisito, " Fluid Power with Application", Pearson Education (Singapore) Pte.Ltd, Delhi,India, Fifth Edition, First Indian Reprint, 2003
2. Werner Deppert and Kurt Stoll, "Pneumatic Controls : An introduction to principles", Vogel-Druck Wurzburg, Germany, 1975
3. Pippenger, J.J, "Industrial Hydraulic & Pneumatics", McGraw Hill, 2002.

REFERENCES:

1. Majumdar, S.R., "Oil Hydraulic Systems: Principles and Maintenance", Tata McGraw- Hill Publishing Company Ltd., New Delhi, Fourth Reprint, 2003.
2. Peter Rohner, "Fluid Power Logic Circuit Design – Analysis, Design Method and Worked Examples", The Macmillan Press Ltd., UK, 1979.
3. Festo KG, "Pneumatic Tips", Festo, Germany, 1987.
4. Andrew Parr, "Hydraulic and Pneumatics", Jaico publishing house, 1999.

AM7010 IC ENGINE PROCESS MODELING L T P C
3 0 0 3

OBJECTIVE:

- The main objective of this course is to impart knowledge in computer simulation of IC engine process. The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine will be taught to the students. The simulation of two stroke SI engine will also be introduced to the students. At the end of the course the students will have command over simulation of IC engine process.

UNIT I INTRODUCTION TO MODELLING 9

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, excess air and stoichiometric air required for combustion. Conversion of volumetric analysis to mass analysis. 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.

UNIT III COMPUTER SIMULATION OF SI ENGINE WITH FUEL AIR CYCLE 9

SI Engine simulation with air as working medium, deviation between actual and ideal cycle. Fuel air cycle analysis - 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 IV COMPUTER SIMULATION OF SI ENGINE 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.

UNIT V COMPUTER SIMULATION OF CI ENGINE 9

Zero, one and multizone models for diesel engine combustion. Double Wiebe's Law analysis for diesel combustion. Heat release model and different heat transfer models. Equilibrium calculations. Parametric studies on simulated engine performance.

TOTAL: 45 PERIODS

OUTCOME:

- Student will possess a comprehensive understanding of all the processes involved in engine cycles. They will acquire the skills in developing the complete theoretical model of combustion of an internal combustion engine.
- Students will demonstrate the importance of intake and exhaust processes in developing a theoretical model of a complete engine.
- Students will posses complete knowledge on adiabatic flame temperature, heat transfer and their importance in engine modeling.

TEXTBOOK:

1. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.

REFERENCES

1. John. B. Heywood, 'Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.
2. Benson.R.S., Whitehouse.N.D., "Internal Combustion Engines", Pergamon Press, oxford, 1979
3. Ramoss.A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co.,1992.
4. Ashley Campbel, "Thermodynamic analysis of combustion engines", John Wiley & Sons, New York, 1986.

AM7011 INSTRUMENTATION AND EXPERIMENTAL TECHNIQUES L T P C
3 0 0 3

OBJECTIVE:

- Study of the theory, construction and operation of different measurement technology, instruments transducers and their application in automotive industry.

UNIT I LINEAR AND ANGULAR MEASUREMENTS 8

Errors in measurement & calibration – uncertainty in measurements. Length standards - Length measuring instruments - Vernier, micrometers,dial guages, comparators, Limits, fits, tolerances. Gauges and their types - Angular measuring instruments -bevel protractor, spirit level, sine bar - measurement of straightness anf flatness - Measurement of surface finish.

UNIT II PRESSURE & FLOW MEASUREMENT 11

Diaphragm - various elastic elements - Transduction methods - Potentiometric strain gauge, variable reluctance and capacitive device, piezo electric transducers and its application to high speed engine.Farnboro Engine indicator. Low pressure measurement - McLeod gauge, pirani gauge, thermocouple typeconductivity gauge.

Classification of flow meters - Orifice plate, venturimeter, flow nozzles, pitot tubes, rotameter, electromagnetic flow meters, anemometers, ultrasonic and magnetic flow meters, alcolck viscous flow meter.

UNIT III TEMPERATURE MEASUREMENT 8

Temperature scales - Mechanical temperature sensors - liquid in glass, vapour pressure, bimetal - resistance typetemperature sensors and their measuring circuits - Thermistors, thermocouples, laws, types, construction,circuits - Radiation methods - Optical pyrometer.

UNIT IV LOAD AND TORQUE MEASUREMENT 8

Force measuring devices, balances, platform scale weigh bridges, load cells. Torque measurement, prony brake,rope brake. Dynamometers. Electric cradle dynamometer, Eddy current dynamometers. Hydraulicdynamometer, Transmission and chasis dynamometer.

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES 10

Laboratory tests- test tracks - Endurance Tests- crash tests- wind tunnel tests- Dynamic cornering fatigue, dynamic radial fatigue tests – procedure, bending moment and radial load calculations. Impact test – road hazard impact test for wheel and tyre assemblies, test procedures, failure criteria and performance criteria. Bumpers - types of tests, pendulum test, fixed collision barrier test, procedure, performance criteria. Air and hydraulic brake test, air brake actuator, valves test, performance requirements.

TOTAL: 45 PERIODS

OUTCOME:

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

- Understand the components of the automotive instruments and their functions and the latest developments in this field
- Understand transducers, modifiers and terminating devices
- Understand mechanical measurement
- Grasp the basics of engine experimental techniques
- Grasp the basics of vehicle experimental techniques

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
3. Rangan.C.S., Sarma.G.E. and Mani.V.S.V., " Instrumentation Devices and Systems " Tata McGraw Hill Publishing Co., New Delhi, 1990.

REFERENCES

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 Co, New Delhi, 1990.

AM7012 MATERIALS IN AUTOMOTIVE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To make the students to understand the requirements related to materials used in various automotive parts
- To make the students to identify materials for specific parts based on the usage
- To make the students to identify materials for aesthetic and functional coatings

UNIT I INTRODUCTION 9

Elasticity-forms - Stress and strain relationship in engineering materials - Deformation mechanism - Strengthening material - Strain hardening, alloying, polyphase mixture, martensitic precipitation, dispersion, fibre and texture strengthening - iron carbon diagram.

UNIT II METALLIC MATERIALS 9

Cast irons - types, properties, structures, compositions and applications, plain carbon steels, low alloy steels and effects of alloying elements, high alloy steels, stainless steel types, castability, formability, machinability, hardenability and weldability of the material, high temperature steels and

super alloys. Decorative and functional coating materials for automotive parts - Electro less Nickel, Hard Chrome, and, Zirconium Phosphate, Zinc flake, Metal oxides.

UNIT III COMPOSITES 9

Mechanics, Manufacturing and Design. Types of composites. Fiber reinforced plastics (FRP), engineering ceramics, metal matrix composites, silicon carbide, graphite, fibres of zirconia, alumina and boron nitride - metal filaments - boron filaments - glass fibres applications, nano-composites. Piezoelectric composites.

UNIT IV ELECTRICAL AND MAGNETIC MATERIALS 9

Semiconductors materials, single crystals, soft and hard magnets, superconductors, MEMS materials, nano materials, smart materials, shape memory alloys. Piezoelectric Materials., piezoceramic materials, polyvinyldenefluoride, Magnetostrictive Materials. Metglasmaterials.

UNIT V RUBBER AND PLASTICS MATERIALS 9

Plastics / rubber components in automobiles – function – selection criteria. Structure – property relationship of rubber. Rubber mounts – spring design – comparison with metallic springs – shape factor and its effect. Typical mounts, compounding and manufacture. Seals for static and dynamic applications. Brake fluid / hydraulic hoses, materials and manufacture.

TOTAL : 45 PERIODS

OUTCOME:

- The students will be able identify the materials used in specific parts
- The students will be able find the materials for a part
- The students will be able explain the requirements of functional coatings

TEXT BOOK:

1. Michael F. Ashby, “Materials Selection in Mechanical Design”, Butterworth Heinemann, 2005.
2. Daniel Yesudian C., “Materials Science and Metallurgy”, Scitech Publications (India), 2004.

REFERENCES

1. Polmear I.J., “Light Alloys”, Arnold Publishers, 1995.
2. Swarup D. and Saxena M.N., "Elements of Metallurgy", Rastogi Publishers, Meerut, 1994.
3. Srinivasan N.K. and Ramakrishnan S.S., "The Science of Engineering Materials", Oxford and IBH Pub. Co., New Delhi, 1993.
4. Van Vlack L.H., "Elements of Materials Science and Engineering", Addison Wesley, New York, 1991.
5. Guy A.G," Elements of Physical Metallurgy", Oxford & IBH Pub. Co., 1990.

AM7013 MODELING OF VEHICLE SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- 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 tyre system etc.

UNIT I LONGITUDINAL DYNAMICS AND CONTROL 9

Aerodynamic drag force - Longitudinal tyre force - Rolling resistance - Calculation of normal tyre forces - Calculation of effective tyre 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 CONTROL 9

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 - 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 – Tradeoffs and Limitations - Invariant Points and Their Influence - Hydraulic Actuators for Active Suspensions

UNIT V LATERAL AND LONGITUDINAL TYRE FORCES 9

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

TOTAL : 45 PERIODS

OUTCOME:

- To students will have the basic knowledge on mathematical model of various sub components like passive and active suspension along with its functions. At the end of the course the students will have command knowledge over longitudinal dynamics and control, lateral dynamics and control, recent development in the area of modern vehicle technologies.

TEXT BOOK

1. Rajesh Rajamani, “Vehicle Dynamics and Control”, Springer, 2006.
2. Reza N.Jazar, “Vehicle Dynamics: Theory and Applications”, Springer, 2008.

AM7014 NOISE, VIBRATION AND HARSHNESS L T P C
3 0 0 3

OBJECTIVE:

The course should enable the students to:

- Understand the various types of vibration with damping and without damping.
- Understand the Various types of noise and its measurement and analysis techniques.
- Understand the various sources of noise from automobiles.
- Understand the various noise controlling techniques.
- Understand the various noise from mechanical components and it's suppressing techniques.

UNIT I FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION 8

Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the Atmosphere, Sound Radiation from Structures and Their Response to Sound, General Introduction to Vibration, Vibration of Simple Discrete and Continuous Systems, Random Vibration, Response of Systems to Shock, Passive Damping

UNIT II EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE 7

General Introduction to Noise and Vibration Effects on People and Hearing Conservation, Sleep Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of

Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on People, Effects of Mechanical Shock on People, Rating Measures, Descriptors, Criteria, and Procedures for Determining Human Response to Noise.

UNIT III ENGINE NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL 9

Introduction to ENGINE Noise and Vibration Sources, Internal Combustion Engine Noise Prediction and Control—Diesel, Exhaust and Intake Noise and Acoustical Design of Mufflers,.

UNIT IV TRANSPORTATION NOISE AND VIBRATION SOURCES-PREDICTION AND CONTROL 9

Introduction to Transportation Noise and Vibration Sources, Tire/Road Noise—Generation, Aerodynamic Sound Sources in Vehicles—Prediction and Control, Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.

UNIT V NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES 12

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration Data Analysis, Calibration of Measurement Microphones, Calibration of Shock and Vibration Transducers, Metrology and Traceability of Vibration and Shock Measurements.

TOTAL : 45 PERIODS

OUTCOME:

The students should be able to know:

- Classification of vibration of free, forced, undamped , damped, linear , nonlinear Vibration Response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, Determination of natural frequencies.
- Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise engine radiated noise, intake and exhaust noise, Assessment of mechanical noise, accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.
- Vibration isolation by tuned absorbers, untuned viscous dampers. Damping treatments, application dynamic forces generated by IC engines, engine isolation, Crank shaft damping, Modal analysis of the mass elastic model shock absorbers.
- Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis. Noise Suppressing Techniques like palliative treatments and enclosures, automotive noise control principles. Sound in enclosures, sound energy absorption, sound transmission through barrier.

REFERENCES:

1. Allan G. Piersol ,Thomas L. Paez “Harris’ shock and vibration hand book” , McGraw-Hill , New Delhi, 2010
2. Clarence W. de Silva , “Vibration Monitoring, Testing, and Instrumentation “,CRC Press, 2007
3. David A.Bies and Colin H.Hansen “Engineering Noise Control: Theory and Practice “ Spon Press , London . *2009*
4. Colin H Hansen “Understanding Active Noise Cancellation “ , Spon Press , London .2003
5. Matthew Harrison “Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles “, Elsevier Butterworth-Heinemann, Burlington, 2004

AM7015 PRODUCTION OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

OBJECTIVE:

- The objective of this course is to make the students to know and understand the production methods of various engine components like piston, connecting rod, crankshaft etc and various chassis components like friction lining materials, propeller shaft, steering column, gears etc.

UNIT I CASTING 10

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburetor other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines. Melting practice of alloys.

UNIT II MACHINING 10

Special consideration of machining of various componenets such as flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston

UNIT III FORGING AND EXTRUSION PROCESS 10

Forging materials - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, steering column. Extrusions: Basic process steps, extrusion of transmission shaft, housing spindle, steering worm blanks, piston pin and valve tappets. Hydro forming - Process, hydro forming of manifold and comparison with conventional methods- Hydro forming of tail lamp housing – forming of wheel disc and rims. Stretch forming - Process, stretch forming of auto body panels –Super plastic alloys for auto body panels.

UNIT IV POWDER METALLURGY AND PROCESSING OF PLASTICS 6

Powder metallurgy process, process variables, Manufacture of friction lining materials for clutches and brakes – plastics-raw material –automobile components – molding – injection, compression and blow – PU foam molding - Machining of plastics.

UNIT V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS 10

Powder injection molding - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming –Squeeze Casting of pistons - aluminum composite brake rotors. Sinter diffusion bonded idler sprocket – gas injection molding of window channel – cast con process for auto parts.

TOTAL : 45 PERIODS

OUTCOME:

By the end of this course, students will be able to

- Understand the methods to manufacture the vehicle components
- Understand the requirements of each component and material
- Understand the step by step procedure for manufacturing vehicle components
- Understand the advanced techniques used for manufacturing Automobile components

TEXT BOOK

1. Heldt. P.M., " High Speed Combustion Engines ", Oxford Publishing Co., New York, 1990.

REFERENCES

1. Haslehurst.S.E., " Manufacturing Technology ", ELBS, London, 1990.
2. Rusinoff, " Forging and Forming of metals ", D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.
3. Sabroff.A.M. & Others, "Forging Materials & Processes ", Reinhold Book Corporation, New York, 1988.
4. Upton, "Pressure Die Casting ", Pergamon Press, 1985.
5. High Velocity "Forming of Metals ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990 HMT handbook

AM7016	RESEARCH METHODOLOGY	L T P C
		3 0 0 3

OBJECTIVE:

- To impart the knowledge on research design
- To know about the data processing, report writing and Intellectual property rights

UNIT I INTRODUCTION TO RESEARCH 7

Research – Objective – Significance – Types – approaches; Research and scientific research – The hall marks of scientific research; Research process – steps involved; Current literature survey methods – abstraction of research papers

UNIT II RESEARCH DESIGN AND SAMPLE DESIGN 10

Research Design – Need for Research Design – steps involved - features of Good Design – Important concepts relating to Research Design – Different Research designs – Basic Principles of Experimental Designs – Sample Design – steps involved – sampling techniques – Hypothesis testing to determine optimal sample size.

UNIT III ANALYSIS OF DATA 9

Statistics in Research – Measures of Central Tendency – Measures of Dispersion – Measures of Asymmetry (Skewness) – Measures of Relationship – Simple Regression Analysis – Multiple Correlation and Regression Partial Correlation – Association in case of attributes – Other Measures – Summary chart concerning Analysis of Data.

UNIT IV INTERPRETATION AND REPORT WRITING 9

Interpretation – need for interpretation - Technique of interpretation – precaution in interpretation – Report writing - Significance of Report writing – Different steps in report writing – Layout of the Research report – Types of reports – Oral presentation – Mechanics of writing Research Reports.

UNIT V INTELLECTUAL PROPERTY RIGHTS 10

An overview of Intellectual property (IP) – Importance – Protection of IPR – Patents – Patentable and Non-Patentable inventions – Procedure for filing of patents – acquisition of patent rights – patents offices in India and jurisdiction – Modification of granted patents – protection against unfair competition – Enforcement of IPR.

TOTAL : 45 PERIODS

OUTCOME:

By the end of this course, students will be able to

- Understand the concepts of various approaches of research, literature survey methods, data analysis, report preparation and significance of Intellectual property Rights

REFERENCES

1. C.R.Kothari, “Research Methodology”, Wishwa Prakashan Publishers, India, 2001.
2. Murray R.Spigel, “Theory and problems of Statistics”, Schaum Publishing Co., New York, 2000.
3. R. Panner selvam, “Research Methodology”, Prentice hall of India, New Delhi, 2004.
4. P. Narayanan, “Intellectual Property Rights”, Eastern law House, Third Edition, 2002.
5. G. P. Reddy, “Intellectual Property Rights & Other Law”, Gogia law agency, 2004.
6. Prof. A. Chandrasekaran, “Intellectual Property Law”, C.Sitaraman & Co.,Pvt.Ltd., 2004.

AM7017	SPECIAL VEHICLES	L T P C
		3 0 0 3

OBJECTIVE:

- The main objective of this course is to introduce the concept and principle of operation of special vehicles such as Bulldozers, Ditchers, Bucket excavators, farm equipments, military vehicles etc. At the end of the course, the students can have a better understanding of the application of the special types of vehicles in the excavation of earth.

UNIT I EARTH MOVING AND CONSTRUCTIONAL EQUIPMENTS 10

Construction details, capacity and applications of earthmovers for dumpers, front-end loaders, bulldozers, excavators, backhoe loaders, scrappers, motor graders etc. criteria for selection of prime mover for dumpers and front end loaders based on vehicle performance characteristics.

UNIT II POWER TRAIN CONCEPTS 7

Engine – converter match curves. Epicyclic type transmissions. Selection criteria for universal joints. Constructional details of steerable and drive axles of dumper.

UNIT III VEHICLE SYSTEMS AND FEATURES 14

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects oF dumper body, loader bucket and water tank of sprinkler. Articulated vehicles, double decker. Fire fighting equipment.

UNIT IV SPECIAL PURPOSE VEHICLES FOR INDUSTRIAL APPLICATIONS 5

Constructional features, capacity and stability of jib cranes. Vibratory compactors. Stackers, borewell machines, concrete mixtures.

UNIT V FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 9

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of tankers, gun carriers and transport vehicles. Harvesting vehicles.

TOTAL : 45 PERIODS

OUTCOME:

At the end of this course the student should

- Know the concept and principle of operation of special vehicles such as bull dozers ditchers bucket excavators far equipments military vehicles etc
- Have better understanding of the application of the special types of vehicles in the excavation.
- Understand earth moving and constructional equipments
- Learn the basics of power train concepts for special vehicles
- Grasp the maintenance of farm equipments, military and combat vehicles

REFERENCES

1. Pipenger, ‘Industrial Hydraulics’, Mcgraw Hill, Tokoyo, 1979.
2. Astakhov, ‘Truck cranes’, MIR Publishers, Moscow, 1971.
3. Bart H Vanderveen, ‘Tanks and Transport Vehicles’, Frederic Warne and co. Ltd., London, 1974.
4. K. Abrosimov, A. Bromberg and F. Katayer, ‘Road making machineries’, MIR Publisher, Moscow,1975.
5. SAE Handbook – Vol III, 1995.

AM7018 THEORY OF FUELS AND LUBRICANTS L T P C
3 0 0 3

OBJECTIVE:

- To import the knowledge on the properties of fuels, lubricants and testing methods for the design and operation of the I.C engines.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS 9

Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT II THEORY OF LUBRICATION 9

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNIT III PROPERTIES AND TESTING OF LUBRICANTS 9

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

UNIT IV PROPERTIES AND TESTING OF FUELS 9

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc.

UNIT V ADDITIVES FOR LUBRICANTS AND FUELS 9

Additive - mechanism, requirements of additive, petrol fuel additives, diesel fuel additives – Additives and additive mechanism, for lubricants. Introduction to Nano fluids

TOTAL : 45 PERIODS

OUTCOME:

- At the end of the course, the students will be able to have a complete knowledge on the various properties of fuels, lubricants and testing methods.

TEXT BOOKS:

1. Ganesan.V., “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L. Mathur, R.P.Sharma “A course in internal combustion engines”, Dhanpatrai publication, 2003.
3. Obert.E.F “Internal Combustion Engineering and Air Pollution”, International book Co., 1988.

REFERENCES

1. Brame, J.S.S. and King, J.G. – Fuels – Solids, Liquids, Gaseous.
2. Francis, W – Fuels and Fuel Technology, Vol. I & II
3. Hobson, G.D. & Pohl.W- Modern Petroleum Technology
4. A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press – 1982.
5. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.

AM7019 **TWO AND THREE WHEELERS** **L T P C**
3 0 0 3

OBJECTIVE:

- The objective of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of various Two and Three wheelers.

UNIT I INTRODUCTION **7**

Classifications- design considerations –weight and dimension limitations –requirements, stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS **12**

2 stoke and 4 stoke engines. Design criteria for engines – design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburettor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical systems.

UNIT III CLUTCHES AND TRANSMISSION **10**

Types of clutches. Design of clutch system. Gears for two and three wheelers. Design of gear box and gear change mechanism. Belt, chain and shaft drive. Free wheeling devices, starting systems.

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES **8**

Types of frames. Wheel frames- construction design of frames for fatigue strength, torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

UNIT V THREE WHEELERS **8**

Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission, wheel types, wheel mountings attachment, tyre types. Brake systems.

TOTAL : 45 PERIODS

OUTCOME:

- To students will have the basic knowledge on various two wheelers and its technology along with its functions. At the end of the course the students will have through knowledge over different frames, suspension system and transmission unit used on various two and three wheeler vehicles.

TEXTBOOK:

1. Irving P.E., “Motor Cycle Engineering”, Temple Press Book, London, 1964.
2. Marshal Cavandedish, ‘Encyclopedia of Motor cycling’, New York, 1989
3. Srinivasan.S., ‘Motor cycle, Scooter, Mopeds’, New century book house, 1988.

REFERENCES:

1. M.M.Griffin., ‘Motor cycles from inside and outside’, Prentice Hall Inc, New Jersey, 1978.
2. Johns.B.A., ‘Motorcycles’, Good Heartwill, 1984.
3. ‘Cycle Motor Manual’, Templeton Press Ltd., London, 1992.
4. Servicing Manuals- various motor cycles, Scooters, Mopeds and three wheelers.

AM7020 **VEHICLE CONTROL SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVE:

- The objective of this course is to make the students to know and understand the concept of control system and apply it to automotive system.

UNIT I INTRODUCTION 9

Components of chassis management system – role of various sensors and actuators pertaining to chassis system – construction – working principle of wheel speed sensor, steering position, tyre pressure, brake pressure, steering torque, fuel level, Engine and vehicle design data.

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.

TOTAL: 45 PERIODS

OUTCOME:

- To students will have the basic knowledge on mathematical modeling of various automotive system, time domain specification. At the end of the course the students will have through knowledge over safety and security system, comfort system and intelligent vehicle system.

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, NewDelhi, 2002.
2. William B.Ribbens -Understanding Automotive Electronics, 5th edition, Butter worth Heinemann Woburn, 1998.
3. Bosch, “Automotive HandBook”, 6th edition, SAE, 2004.

AM7021 VEHICLE MAINTENANCE L T P C
3 0 0 3

OBJECTIVE:

To import the knowledge in the area of vehicle maintenance like

- Introduction about layout of maintenance shop, tools and instruments
- Maintenance procedure of power plant and sub systems
- Maintenance procedure of chassis, vehicle body and electrical and electronic systems

UNIT I MAINTENANCE RECORDS,BASIC TOOLS AND INSTRUMENTS 9

Importance of maintenance. Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Log books. Trip sheet. Lay out and requirements of maintenance shop. Standard tool set, torque wrenches, compression and vacuum gauges, OBD Tool, gauges for engine tune up.

UNIT II POWER PLANT REPAIR AND OVERHAULING 9

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 9

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

UNIT IV MAINTENANCE AND REPAIR OF VEHICLE BODY 9

Body panel tools for repairing. Tinkering and painting. Minor and major repairs. Door lock and window glass actuating system maintenance.

UNIT V MAINTENANCE AND REPAIR OF ELECTRICAL AND ELECTRONIC SYSTEMS 9

Maintenance, testing and trouble shooting of battery, starter motor, dynamo, alternator, regulator, lighting system, horn and dash board instruments. Introduction to OBD.

TOTAL : 45 PERIODS

OUTCOME:

- 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.

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, Chapman 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
8. S. Abbey, Automotive Transmission servicing and overhaul, Sir Issac Pitman, London, 1971.