

ACADEMIC CURRICULUM

(REGULATIONS 2019)

FOR

UNDER GRADUATE PROGRAMMES

CHOICE BASED CREDIT SYSTEM

(Applicable to the students admitted from the Academic Year 2019-20 onwards)

B.E. – AUTOMOBILE ENGINEERING



EASWARI ENGINEERING COLLEGE

(AUTONOMOUS INSTITUTION)

Bharathi Salai, Ramapuram, Chennai – 600 089

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SEMESTER I								
S.No	Course Code	Course Title	Category	L	T	P	R	C
THEORY								
1.	191LEH101T	Technical English	HS	3	0	0	-	3
2.	191MAB101T	Engineering Mathematics I	BS	3	2	0	-	4
3.	191PYB101T	Engineering Physics	BS	3	0	0	-	3
4.	191CYB101T	Engineering Chemistry	BS	3	0	0	-	3
5.	191GES101T	Engineering Graphics	ES	3	0	2	-	4
6.	191GES102T	Problem Solving and Python Programming	ES	3	0	0	-	3
LABORATORY								
7.	191GEB111L	Physics and Chemistry Laboratory	BS	0	0	4	-	2
8.	191GES111L	Python Programming Laboratory	ES	0	0	3	1	2
MANDATORY COURSE								
9.	191GEM101L	Induction Training	MC	-	-	2	-	1 ^{##}
TOTAL CREDITS								24

^{##} Mandatory to attend Induction training programme to earn one credit.

SEMESTER II								
S.No	Course Code	Course Title	Category	L	T	P	R	C
THEORY								
1.	191LEH201T	Professional Communication / BEC Certification	HS	3	0	0	-	3
2.	191MAB201T	Engineering Mathematics - II	BS	3	2	0	-	4
3.	191PYB203T	Material Science	BS	3	0	0	-	3
4.	191GES201T	Basic Electrical and Electronics Engineering	ES	3	0	0	-	3
5.	191GES202T	Engineering Mechanics	ES	3	2	0	-	4
LABORATORY								
6.	191GES211L	Engineering Practices Laboratory	ES	0	0	4	-	2
7.	191GES212L	Basic Electrical and Electronics Engineering Lab	ES	0	0	3	1	2
MANDATORY COURSE								
8.	191CYM201T	Environmental Science ^{\$\$}	MC	3	-	-	-	3 ^{\$\$}
9.	191GEM211L	NSS / NCC / YRC (Phase I)*	MC	-	-	2	-	1*
TOTAL CREDITS								21

* The student may opt for any one. They have to complete the respective Phase II and Phase III.

Those who are not opting NSS/NCC/YRC have to opt for Foreign language / Indian constitution in the sixth semester.

^{\$\$} Mandatory to register for the course and earn three credits.

SEMESTER III								
S.No	Course Code	Course Title	Category	L	T	P	R	C
THEORY								
1.	191MA301T	Engineering Mathematics - III	BS	2	2	0	-	3
2.	191ATC301T	Strength of Materials and Fluid Mechanics.	PC	3	0	0	-	3
3.	191ATC302T	Fundamentals of I.C Engine	PC	3	0	0	-	3
4.	191ATC303T	Manufacturing Processes for Automotive Engineers	PC	3	0	0	-	3
5.	191ATC304T	Automotive Materials and Metallurgy	PC	3	0	0	-	3
LABORATORY								
6.	191CEC313L	Strength of Materials and Fluid Mechanics and Machinery Lab	ES	0	0	4	-	2
7.	191ATC311L	Drafting and Modeling Laboratory	PC	0	0	3	1	2
HUMAN EXCELLENCE COURSE								
8.		Yoga / Social Service (Phase I)**	HS	-	-	2	-	1
EMPLOYABILITY ENHANCEMENT COURSE								
9.		Inplant Training / Internship [§]	EEC	-	-	-	-	1 [§]
ONLINE COURSE								
10.		Online Course (Optional) #	PE	-	-	-	-	3 [#]
TOTAL CREDITS								20

**Student may opt for any one. They have to complete the respective Phase II in semester V.

[§] Mandatory to do Internship and earn at least one credit. But optional to do Internship between III and VI semesters.

Evaluation will be done in ODD semester.

[#] Students may earn credits in lieu of Professional elective.

SEMESTER IV								
S.No	Course Code	Course Title	Category	L	T	P	R	C
THEORY								
1.	191MA401T	Engineering Mathematics IV	BS	3	0	0	-	3
2.	191ATC401T	Applied Thermodynamics and Thermal Engineering	PC	3	0	0	-	3
3.	191ATC402T	Automotive Chassis & Transmission System	PC	3	0	0	-	3
4.	191ATC403T	Machine Design for Automobile Engineers	PC	3	0	0	-	3
5.	191ECS401T	Electronics and Microprocessor	ES	3	0	0	-	3
6.		Professional Elective - 1	PE	3	0	0	-	3
LABORATORY								
7.	191ECS411L	Electronics and Microprocessor Lab	ES	0	0	4	-	2
8.	191ATC411L	Automotive Components Lab	PC	0	0	3	1	2
MANDATORY COURSE								
9.		NSS / NCC / YRC * (Phase II)	MC	-	-	2	-	1*
EMPLOYABILITY ENHANCEMENT COURSE								
10.		Inplant Training / Internship [§]	EEC	-	-	-	-	1 [§]
11.		Industry Supported Course (Optional) [#]	EEC	1	-	-	-	1 [#]
ONLINE COURSE								
12.		Online Course (Optional) [#]	PE	-	-	-	-	3 [#]
TOTAL CREDITS								22

* Students have to complete the phase II.

[§] Mandatory to do Internship and earn at least one credit. But optional to do Internship between III and VI semesters.

Evaluation will be done in ODD semester.

[#] Students may earn credits in lieu of Professional elective.

SEMESTER V								
S.No	Course Code	Course Title	Category	L	T	P	R	C
THEORY								
1.	191ATC501T	Automotive Engine Component Design	PC	3	0	0	-	3
2.	191ATC502T	Vehicle Dynamics	PC	3	0	0	-	3
3.	191ATC503T	Automotive Electrical and Electronics System	PC	3	0	0	-	3
4.		Professional Elective - 2	PE	3	0	0		3
5.		Open Elective - 1	OE	3	0	0	-	3
LABORATORY								
6.	191ATC511L	Automotive Electrical and Electronics System Lab	PC	0	0	4	-	2
7.	191ATC512L	Two and Three Wheeler Laboratory	PC	0	0	3	1	2
HUMAN EXCELLENCE COURSE								
8.		Yoga / Social Service (Phase II)**	HS	-	-	2	-	1
EMPLOYABILITY ENHANCEMENT COURSE								
9.		In plant Training / Internship ^{\$}	EEC	-	-	-	-	1 ^{\$}
10.		Industry Supported Course (Optional) [#]	EEC	1	-	-	-	1 [#]
ONLINE COURSE								
11.		Online Course (Optional) [#]	PE	-	-	-	-	3 [#]
TOTAL CREDITS								20

** Student have to complete the Phase II.

^{\$} Mandatory to do Internship and earn at least one credit. But optional to do Internship between III and VI semesters.

Evaluation will be done in ODD semester.

[#] Students may earn credits in lieu of Professional elective.

SEMESTER VI								
S.No	Course Code	Course Title	Category	L	T	P	R	C
THEORY								
1.	191ATC601T	Finite Element Analysis of Automotive Components	PC	3	0	0	-	3
2.	191ATC602T	Electric Vehicle Technology - I	PC	3	0	0	-	3
3.	191ATC603T	Automotive Chassis Component Design	PC	3	0	0	-	3
4.		Professional Elective – 3	PE	3	0	0	-	3
5.		Open Elective - 2	OE	3	0	0	-	3
LABORATORY								
6.	191ATC611L	Automotive Fuels and Lubricants Lab	PC	0	0	4	-	2
7.	191ATC612L	Vehicle Component Design Laboratory	PC	0	0	3	1	2
MANDATORY COURSE								
8.		NSS / NCC / YRC *(Phase III)	MC	-	-	2	-	1*
9.		Foreign Language / Indian Constitution ^{&}	MC	3	-	-	-	3 ^{&}
EMPLOYABILITY ENHANCEMENT COURSE								
10.		In plant Training / Internship [§]	EEC	-	-	-	-	1 [§]
11.		Industry Supported Course (Optional) [#]	EEC	1	-	-	-	1 [#]
ONLINE COURSE[#]								
12.		Online Course (Optional) [#]	PE	-	-	-	-	3 [#]
TOTAL CREDITS								19

* Students have to complete the phase III.

[&]Those who have not acquired / opted three credits through NSS / NCC / YRC have to opt for any one.

[§] Mandatory to do Internship and earn at least one credit. But optional to do Internship between III and VI semesters.

Evaluation will be done in ODD semester.

[#] Students may earn credits in lieu of Professional elective.

SEMESTER VII								
S.No	Course Code	Course Title	Category	L	T	P	R	C
THEORY								
1.	191ATC701T	Engine Management System and Emission Control	PC	3	0	0	-	3
2.	191ATC702T	Electric Vehicle Technology - II	PC	3	0	0	-	3
3.	191ATC703T	Vehicle Body Engineering	PC	3	0	0	-	3
4.		Professional Elective – 4	PE	3	0	0	-	3
5.		Open Elective – 3	OE	3	0	0	-	3
6.		Comprehensive Examination [@]	PC	-	-	-	-	3 [@]
LABORATORY								
7.	191ATC711L	Vehicle Maintenance Lab	PC	0	0	4	-	2
8.	191ATC712L	Engine Performance and Emission Control Lab	PC	0	0	3	1	2
EMPLOYABILITY ENHANCEMENT COURSE								
9.	191ATP711J	Project Work / Start up – Phase - I	EEC	-	-	4	-	2
10.		Inplant Training / Internship ^{\$}	EEC	-	-	-	-	1 ^{\$}
11.		Industry Supported Course (optional) [#]	EEC	1	-	-	-	1 [#]
ONLINE COURSE[#]								
12.		Online Course (optional) [#]	PE	-	-	-	-	3 [#]
TOTAL CREDITS								24

^{\$} Only evaluation for Internship and Online course.

[@] # Students may earn credits in lieu of Professional elective. Please refer clause 26.2 of regulation.

SEMESTER VIII								
S.No	Course Code	Course Title	Category	L	T	P	R	C
THEORY								
1.		Professional Elective**	PE	3	-	-	-	3
2.		Professional Elective**	PE	3	-	-	-	3
EMPLOYABILITY ENHANCEMENT COURSE								
3.	191ATP811J	Project Work / Start up – Phase - II	EEC	-	-	-	20	10
TOTAL CREDITS								16

** For each 3 credits earned through online course / comprehension / industry support courses, one professional elective course can be dropped.

TOTAL CREDITS = 166

BASIC SCIENCE COURSES (B)

Sl. No	Code No	Subject	Semester	Credits
1.	191MAB101T	Engineering Mathematics I	I	4
2.	191PYB101T	Engineering Physics	I	3
3.	191CYB101T	Engineering Chemistry	I	3
4.	191GEB111L	Physics and Chemistry Lab	I	2
5.	191MAB201T	Engineering Mathematics II	II	4
6.	191PYB203T	Material Science	II	3
7.	191MAB301T	Transforms And Partial Differential Equations	III	3
8.	191MAB401T	Engineering Mathematics IV	IV	3
TOTAL CREDITS				25

ENGINEERING SCIENCE COURSES (S)

Sl. No	Code No	Subject	Semester	Credits
1.	191GES101T	Engineering Graphics	I	4
2.	191GES102T	Problem Solving and Python Programming	I	3
3.	191GES111L	Python Programming Laboratory	I	2
4.	191GES202T	Engineering Mechanics	II	4
5.	191GES201T	Basic Electrical and Electronics Engineering	II	3
6.	191GES211L	Engineering Practices Lab	II	2
7.	191GES212L	Basic Electrical and Electronics Engineering Lab	II	2
8.	191CES313L	Strength of Materials and Fluid Mechanics and Machinery Lab	III	2
9.	191ECS401T	Electronics and Microprocessor	IV	3
10.	191ECS411L	Electronics and Microprocessor Lab	IV	2
TOTAL CREDITS				27

HUMANITIES & SOCIAL SCIENCES (H)

Sl. No	Code No	Subject	Semester	Credits
1.	191LEH101T	Technical English	I	3
2.	191LEH201T	Professional Communication / BEC Certification	II	3
3.		Yoga / Social Service (Phase I)	III	1
4.		Yoga / Social Service (Phase II)	V	1
TOTAL CREDITS				08

PROFESSIONAL CORE COURSES (PC)

Sl. No	Code No	Subject	Semester	Credits
1.	191ATC301T	Basics of Strength of Materials and Fluid Mechanics.	III	3
2.	191ATC302T	Fundamentals of I.C Engine	III	3
3.	191ATC303T	Manufacturing Processes for Automotive Engineers	III	3
4.	191ATC304T	Automotive Materials and Metallurgy	III	3
5.	191ATC311L	Drafting and Modeling Laboratory	III	2
6.	191ATC401T	Applied Thermodynamics and Thermal Engineering	IV	3
7.	191ATC402T	Automotive Chassis & Transmission System	IV	3
8.	191ATC403T	Machine Design for Automobile Engineers	IV	3
9.	191ATC411L	Automotive Components Lab	IV	2
10.	191ATC501T	Vehicle Component Design - I	V	3
11.	191ATC502T	Vehicle Dynamics	V	3
12.	191ATC503T	Automotive Electrical and Electronics System	V	3
13.	191ATC511L	Automotive Electrical and Electronics System Lab	V	2
14.	191ATC512L	Two and Three wheeler Lab	V	2
15.	191ATC601T	Finite Element Analysis	VI	3
16.	191ATC602T	Electric Vehicle Technology - I	VI	3
17.	191ATC603T	Vehicle Component Design - II	VI	3
18.	191ATC611L	Automotive Fuels and Lubricants Lab	VI	2
19.	191ATC612L	Vehicle Component Design Laboratory	VI	2

20.	191ATC701T	Engine Management System and Emission Control	VII	3
21.	191ATC702T	Electric Vehicle Technology - II	VII	3
22.	191ATC703T	Vehicle Body Engineering	VII	3
23.		Comprehension	VII	3
24.	191ATC711T	Vehicle Maintenance Lab	VII	2
25.	191ATC712T	Engine Performance and Emission Control Lab	VII	2
TOTAL CREDITS				67

PROFESSIONAL ELECTIVE COURSES (PE)

Sl. No	Code No	Subject	Semester	Credits
Professional Elective -I				
1.	191ATE401T	Applied Hydraulics and Pneumatics	IV	3
2.	191ATE402T	Vehicle Design Data Characteristics	IV	3
3.	191ATE403T	Metrology and Measurements for Automobile Engineers	IV	3
4.	191ATE404T	Applied Heat and Mass Transfer	IV	3
Professional Elective -II				
5.	191ATE501T	Advanced Machining Processes	V	3
6.	191ATE502T	Two and Three Wheeler	V	3
7.	191ATE503T	Industrial Engineering and Management Principles	V	3
8.	191ATE504T	Mechanics of Machines	V	3
Professional Elective -III				
9.	191ATE601T	Noise, Vibration and Harshness	VI	3
10.	191ATE602T	Professional Ethics in Engineering	VI	3
11.	191ATE603T	Automotive Fuels and Lubricants	VI	3
12.	191ATE604T	Composite Materials and Mechanics	VI	3
Professional Elective -IV				
13.	191ATE701T	Alternative Fuels and Energy Systems	VII	3
14.	191ATE702T	New Generation and Hybrid Vehicles	VII	3
15.	191ATE703T	Vehicle Air-Conditioning	VII	3
16.	191ATE704T	Automotive Safety	VII	3
Professional Elective -V				
17.	191ATE801T	Computer Integrated Manufacturing	VIII	3
18.	191ATE802T	Renewable Energy Sources	VIII	3

19.	191ATE803T	Vehicle Maintenance	VIII	3
20.	191ATE804T	Special Purpose Vehicles	VIII	3
Professional Elective -VI				
21.	191ATE805T	Non Destructive Testing and Evaluation	VIII	3
22.	191ATE806T	Operational Research	VIII	3
23.	191ATE807T	Entrepreneurship Development	VIII	3
24.	191ATE808T	Transport Management	VIII	3
TOTAL CREDITS				18

OPEN ELECTIVE COURSES (OE)

Sl. No	Code No	Subject	Semester	Credits
1.	191ATO601T	Motor Vehicle Act, Insurance and Policy		3
2.	191ATO602T	Theory of I.C Engine		3
3.	191ATO701T	Latest Technology in Hybrid Vehicles		3
4.	191ATO702T	Electrical Vehicle Technology		3
5.	191ATO801T	Troubleshooting and Maintenance of Vehicles		3
6.	191ATO802T	Off Road Vehicles		3
TOTAL CREDITS				9

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No	Code No	Subject	Semester	Credits
1.		In plant Training / Internship	III to VII	3
2.		Industry Supported Course	IV to VI	3
3.	191ATP711J	Project Work / Start up – Phase - I	VII	2
4.	191ATP811J	Project Work / Start up – Phase - II	VIII	10
TOTAL CREDITS				18

MANDATORY COURSES (M)

Sl. No	Code No	Subject	Semester	Credits
1.		Induction Training	I	1
2.		Environmental Science	II	3
3.		NSS / NCC / YRC (Phase I)	II	1
4.		NSS / NCC / YRC (Phase II)	IV	1
5.		NSS / NCC / YRC (Phase III)	VI	1
6.		Foreign Language / Indian Constitution	VI	3
TOTAL CREDITS				10

SYLLABUS OF HIGHER SEMESTER SUBJECTS

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191MAB301T	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	2	2	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To introduce the basic concepts of PDE for solving standard partial differential equations.
2.	To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
3.	To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
4.	To acquaint the student with Fourier transform techniques used in wide variety of situations.
5.	To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems

UNIT	TITLE	PERIODS
1	PARTIAL DIFFERENTIAL EQUATIONS	8+4
Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.		
UNIT	TITLE	PERIODS
2	FOURIER SERIES	8+4
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.		
UNIT	TITLE	PERIODS
3	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	8+4
Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.		
UNIT	TITLE	PERIODS
4	FOURIER TRANSFORMS	8+4
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.		
UNIT	TITLE	PERIODS
5	TRANSFORMS AND DIFFERENCE EQUATIONS	8+4
Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.		
TOTAL PERIODS:		60

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand how to solve the given standard partial differential equations.
CO2:	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
CO3:	Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations
CO4:	Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering
CO5:	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.
CO6:	Understand how to solve the given standard partial differential equations.

TEXT BOOKS:

1.	Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2.	Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998

REFERENCE BOOKS:

1.	B.V Ramana.., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
3.	G. James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4.	L.C Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
5.	N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
6.	R.C. Wylie, and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC301T	STRENGTH OF MATERIALS AND FLUID MECHANICS	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.
2.	To understand the applications of the conservation laws to flow through pipes and hydraulic machines are studied.

UNIT	TITLE	PERIODS
1	STRESS, STRAIN AND TRANSVERSE LOADING ON BEAMS	9
Rigid bodies and deformable solids, Deformation of simple and compound bars, Thermal stresses, Elastic constants, Volumetric strains. Beams, type of transverse loading on beams, Shear force and bending moment in beams, Cantilevers, Simply supported beams.		
UNIT	TITLE	PERIODS
2	TORSION AND THIN CYLINDERS, SPHERES, THICK CYLINDERS	9
Torsion formulation stresses and deformation in circular and hollow shafts, Stepped shafts. Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders, spherical shells subjected to internal pressure, Deformation in spherical shells, Lamé's theorem.		
UNIT	TITLE	PERIODS
3	DEFLECTION OF BEAMS	9
Elastic curve, Governing differential equation, Double integration method, Macaulay's method, Area moment method, conjugate beam method for computation of slope and deflection of determinant beams.		
UNIT	TITLE	PERIODS
4	FLUID PROPERTIES AND FLOW THROUGH PIPES	9
Properties of fluids, Flow characteristics, concept of control volume, application of continuity equation, energy equation and momentum equation. Boundary layer concepts, types of boundary layer thickness, Darcy Weisbach equation, Commercial pipes minor losses, Flow through pipes in series and parallel		
UNIT	TITLE	PERIODS
5	HYDRAULIC MACHINES	9
Centrifugal pumps, working principle, Work done by the impeller Performance curves, Reciprocating pump, working principle. Classification of turbines, Heads and efficiencies, Axial, Radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines working principles, Work done by water on the runner, draft tube.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Critically analyze problem and solve the problems related to mechanical elements and analyze the deformation behavior for different type of loads.
CO2:	Apply basic equation of simple torsion in designing of shafts and thin, thick shells for the applied internal and external pressures.
CO3:	Calculate the slope and deflection in beams using different methods.
CO4:	Apply basic knowledge study the properties of fluid and solve the problems in flow through pipes.
CO5:	Understood the hydraulic machine working and their performance curves.
CO6:	Critically analyze problem and solve the problems related to mechanical elements and analyze the deformation behavior for different type of loads.

TEXT BOOKS:	
1.	Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016.
2.	Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004

REFERENCE BOOKS:

1.	Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002.
2.	Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.
3.	Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
4.	Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC302T	FUNDAMENTALS OF IC ENGINES	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To understand the basic principles of engines used for automobiles and different systems.
2.	To impart the knowledge on basic concepts on automotive SI Engines and its various sub components along with its functions.
3.	To impart knowledge on basic concepts of automotive diesel engines, combustion process involved in diesel engines and the various subsystems used along with their functions in detail.

UNIT	TITLE	PERIODS
1	CONSTRUCTION AND OPERATION	9
Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines – construction and working. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles.		
UNIT	TITLE	PERIODS
2	FUEL SYSTEMS	9
Air fuel ratio requirements of SI engines, Working of a simple fixed venturi carburetor, Constant vacuum carburetors used in two wheelers. Electronic fuel injection system for gasoline engines- Throttle body injection, multi-point fuel injection and gasoline direct injection, Diesel fuel injection systems-Jerk pumps, distributor pumps, nozzles, Unit injector and common rail injection systems. Need for a governor for diesel engines and its description.		
UNIT	TITLE	PERIODS
3	COMBUSTION AND COMBUSTION CHAMBERS	9
Introduction to combustion in SI and CI engines and stages of combustion. Knock in SI and CI engines. Combustion chambers for SI engines. Combustion chambers for CI engines-Direct and indirect injection combustion chambers. Factors controlling combustion chamber design. Importance of Swirl, squish and turbulence.		
UNIT	TITLE	PERIODS
4	SUPERCHARGING , TURBOCHARGING AND ENGINE PERFORMANCE	9
Supercharging and Turbocharging, Different methods of turbocharging, Intercooling, Turbocharger controls including, waster gate, variable geometry, variable nozzle types. Dynamometers, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards.		

UNIT	TITLE	PERIODS
5	COOLING AND LUBRICATION SYSTEMS	9

Need for cooling, types of cooling systems- air and liquid cooling systems. Thermo-syphon and forced circulation and pressurized cooling systems. Properties of coolants. Requirements of lubrication systems. Types-mist, pressure feed, dry and wet sump systems.

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand the various components of the internal combustion engines and their functions.
CO2:	Identify the components of fuel systems to be used in SI and CI engines.
CO3:	Optimize the combustion process in both SI and CI Engine for better performance with reduced emissions.
CO4:	Apply the supercharging, turbo charging and scavenging concepts in IC engines to enhance the combustion process.
CO5:	Design, analyze and optimize the complete engine and its subsystems for better efficiency.
CO6:	Identify the suitable lubrication and cooling system to be used in IC Engines.

TEXT BOOKS:

1.	Mathur and Sharma, "A course on Internal combustion Engines", Dhanpat Rai & Sons, 2002.
2.	Ganesan V, "Internal combustion engines", 4th edition, Tata McGraw Hill Education, 2012.
3.	Rajput R. K, "A textbook of Internal Combustion Engines", 2nd edition, Laxmi Publications (P) Ltd, 2007.

REFERENCE BOOKS:

1.	John. B, Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill Publishing Co., New York, 1900 .
2.	Edward F, Obert, "Internal Combustion Engines and Air Pollution", Intext Education Publishers, 1980.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC303T	MANUFACTURING PROCESSES FOR AUTOMOTIVE ENGINEERS	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To introduce the concepts of basic manufacturing processes and fabrication techniques such as metal casting, metal joining, metal forming and manufacture of plastic components.
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UNIT	TITLE	PERIODS
1	CASTING	9
Casting steps, types of pattern, core making, procedure to make sand mould, moulding tools, machine moulding, special moulding processes – CO ₂ moulding, Shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.		
UNIT	TITLE	PERIODS
2	WELDING	9
Classification of welding processes. Principles of Oxy-acetylene gas welding. AC metal arc welding, resistance welding, submerged arc welding, tungsten inert gas welding, metal inert gas welding, plasma arc welding, thermit welding, friction welding, electron beam welding, laser beam welding, defects in welding, soldering and brazing.		
UNIT	TITLE	PERIODS
3	METAL FORMING AND POWDER METALLURGY	9
Hot and Cold working - Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing. Powder metallurgy - Principal steps involved advantages, disadvantages and applications of powder metallurgy.		
UNIT	TITLE	PERIODS
4	SHEET METAL PROCESSES	9
Sheet metal characteristics - shearing, bending and drawing operations - Stretch forming operations - Formability of sheet metal - Test methods - Special forming processes - Metal spinning - Explosive forming, Magnetic pulse forming, Electro-Hydraulic forming, Super plastic forming - Micro forming.		
UNIT	TITLE	PERIODS
5	PLASTIC MATERIALS AND PROCESSES	9
Types of plastics - Characteristics of the forming and shaping processes – Injection moulding - Blow moulding - Rotational moulding - Film blowing - Extrusion - Thermoforming - Compression moulding - Transfer moulding - typical industrial applications, Laminated plastics. Bonding of Thermoplastics - Fusion and solvent methods - Induction and Ultrasonic methods.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Select the best casting process for a component to be manufactured based on the economy of manufacture and its application.
CO2:	Choose the best joining process involved in the fabrication of components based on the simplicity, application and cost.
CO3:	Choose the best metal forming or powder metallurgy process for a component to be manufactured based the on the economy of manufacture and its application.
CO4:	Select the powder metallurgy process for a component to be manufactured based on its application.
CO5:	Choose best method of moulding/joining of plastics of a part based on cost and its use.
CO6:	Select the best casting process for a component to be manufactured based on the economy of manufacture and its application.

TEXT BOOKS:

1.	Hajra Choudhary S K, Hajra Choudhury A K and Nirjhar Roy, "Elements of workshop Technology", Volume I, Media promoters & Publishers Pvt. Ltd., Mumbai, 2008.
2.	Kalpakjian. S., "Manufacturing Engineering and Technology", Pearson Education India Edition, 2013.

REFERENCE BOOKS:

1.	Jain R.K. "Production Technology", 21st Edition, Khanna Publishers, 2005.
2.	Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" 8th Edition, Prentice – Hall of India, 1997.
3.	Rao, P.N. "Manufacturing Technology: Foundry, Forming and Welding", 4th Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2017.
4.	Roy. A. Lindberg, "Processes and Materials of Manufacture", Fourth Edition, PHI/Pearson Education 2015.
5.	Sharma, P.C., "A Text book of Production Technology", S.Chand and Co. Ltd., 2014.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC304T	AUTOMOTIVE MATERIALS AND METALLURGY	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To provide the basic knowledge needed to explore the discipline of materials science and engineering.
2.	To develop the knowledge of how the properties of materials are described technically and how material failure is analyzed
3.	To understand the materials and functions of the engine components.
4.	To understand the design aspects of the engine components.
5.	To develop knowledge in various class of materials and their applications.

UNIT	TITLE	PERIODS
1	FERROUS ALLOYS	9
Classification and characteristics of metals, Cast iron – Austempered ductile iron, compacted graphite iron, steels -Plain carbon steels, low alloy steels, HSLA steels, IF steels, bake hardening steels, TRIP steels, ultra high strength steels, stainless steels - production, properties and applications.		
UNIT	TITLE	PERIODS
2	NON FERROUS ALLOY	9
Aluminium alloys – Cast alloys, wrought alloys, age hardenable alloys, working and heat treatment, applications in automobiles, Magnesium alloys – Cast and wrought alloys, working and heat treatment, applications. Titanium alloys.		
UNIT	TITLE	PERIODS

3	POLYMERS AND CERAMICS	9
Processing of polymers, brief description of equipment and process details of extrusion, injection moulding, thermoforming, blow moulding, concept of polymer design, and selection criteria. Preparation and forming of ceramics, applications.		
UNIT	TITLE	PERIODS
4	COMPOSITE MATERIALS	9
Production of composite materials and products, moulding and forming of composites, machining and joining of composites, application of composites in automobiles, metal matrix composites, polymer matrix composites and ceramic matrix composites, applications.		
UNIT	TITLE	PERIODS
5	MECHANICAL PROPERTIES OF MATERIALS AND TESTING	9
Mechanical properties of materials – Strengthening mechanism -- Plastic deformation of single and poly-crystalline materials – Effect of Slip and twinning – Stress-strain curves of various ferrous and non-ferrous metals –Engineering stress strain – true stress strain relations –problems - Tensile test of ductile material – properties evaluation Hardness measurement tests – Fracture of metals – Ductile and Brittle fracture; Fatigue –Endurance limit of ferrous and non-ferrous metals – Fatigue test ; Creep and stress rupture–mechanism of creep – stages of creep and creep test – SEM, XRD.		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand the properties and production methods of various ferrous materials.
CO2:	Differentiate the properties and production methods of various non-ferrous alloy materials.
CO3:	Design the automobile components using polymers and ceramics.
CO4:	Identify the specific use of composites in engineering applications.
CO5:	Command over Testing, strengthening and failure mechanism of various materials.
CO6:	Understand the properties and production methods of various ferrous materials.

TEXT BOOKS:

1.	Balram Gupta, "Aerospace Materials", Vol. 1, 2 and 3, Chand & Co., New Delhi 1996.
2.	Dieter G.E, "Mechanical Metallurgy", McGraw Hill, 1997.

REFERENCE BOOKS:

1.	American Society for Metals "Volume 1, 2, 4, 7, 20 and 21", 1998.
2.	John Brown, "Fosco Ferrous and Non Ferrous Foundryman's Handbook" Butterworth-Heinemann, 1999.
3.	Charles A Harper, Ed., "Handbook of Plastics, Elastomers and Composites", McGraw Hill, 1997.
4.	Kurt Lange, "Handbook of Metal Forming, Society for Manufacturing Engineers", 1998

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191CEC313L	STRENGTH OF MATERIALS AND FLUID MECHANICS AND MACHINERY LABORATORY	0	0	4	0	2

COURSE OBJECTIVES:

1.	To study the mechanical properties of materials when subjected to different types of loading.
2.	To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

LIST OF EXPERIMENTS (STRENGTH OF MATERIALS)

1.	Tension test on a mild steel rod
2.	Double shear test on Mild steel and Aluminium rods
3.	Torsion test on mild steel rod
4.	Impact test on metal specimen
5.	Hardness test on metals - Brinnell and Rockwell Hardness Number
6.	Deflection test on beams
7.	Compression test on helical springs
8.	Strain Measurement using Rosette strain gauge
9.	Effect of hardening- Improvement in hardness and impact resistance of steels.
10.	Tempering- Improvement Mechanical properties Comparison
	Unhardened specimen
	Quenched Specimen and
	Quenched and tempered specimen.
11.	Microscopic Examination of
	Hardened samples and
	Hardened and tempered samples.

LIST OF EXPERIMENTS (FLUID MECHANICS AND MACHINES)

1.	Determination of the Coefficient of discharge of given Orifice meter.
2.	Determination of the Coefficient of discharge of given Venturi meter.
3.	Calculation of the rate of flow using Rota meter.
4.	Determination of friction factor for a given set of pipes.
5.	Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6.	Conducting experiments and drawing the characteristic curves of reciprocating pump.
7.	Conducting experiments and drawing the characteristic curves of Gear pump.
8.	Conducting experiments and drawing the characteristic curves of Pelton wheel.
9.	Conducting experiments and drawing the characteristics curves of Francis turbine.
10.	Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL PERIODS: 60

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Perform Mechanical testing of given material including tension & compression, torsion, Hardness and Deformation test on solid materials.
CO2:	Characterize mechanical properties given specimen including impact strength..
CO3:	Calibrate the fluid flow using Orifice & Venturi meter.
CO4:	Investigate the various losses takes place in fluid flow through pipes.
CO5:	Select the suitable Hydraulic turbines for power generation.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC311L	COMPUTER AIDED MACHINE DRAWING	0	0	3	1	2

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To make the students understand and interpret drawings of machine components
2.	To prepare assembly drawings both manually and using standard CAD packages
3.	To familiarize the students with Indian Standards on drawing practices and standard components
4.	To gain practical experience in handling 2D drafting and 3D modeling software systems.

UNIT	TITLE	PERIODS
1	DRAWING STANDARDS & FITS AND TOLERANCES	12
Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of geometric dimensioning & tolerancing.		
UNIT	TITLE	PERIODS
2	INTRODUCTION TO 2D DRAFTING	16
<ul style="list-style-type: none"> • Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing. • Bearings - Bush bearing, Plummer block • Valves – Safety and non-return valves. 		
UNIT	TITLE	PERIODS
3	3D GEOMETRIC MODELING AND ASSEMBLY	32
Sketcher - Datum planes – Protrusion – Holes - Part modeling – Extrusion – Revolve – Sweep – Loft – Blend – Fillet - Pattern – Chamfer - Round - Mirror – Section - Assembly <ul style="list-style-type: none"> • Couplings – Flange, Universal, Oldham's, Muff, Gear couplings • Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints • Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffing box, multi-plate clutch and Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck, vane and gear pump 		

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D / 3D CAD software

TOTAL PERIODS:	60
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Follow the drawing standards, Fits and Tolerances
CO2:	Re-create part drawings, sectional views and assembly drawings as per standards
CO3:	To make the students understand and interpret drawings of machine components
CO4:	To prepare assembly drawings both manually and using standard CAD packages
CO5:	To familiarize the students with Indian Standards on drawing practices and standard components
CO6:	To gain practical experience in handling 2D drafting and 3D modeling software systems.

TEXT BOOKS:

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| 1. | Gopalakrishna K.R., "Machine Drawing", 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013 |
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REFERENCE BOOKS:

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| 1. | N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers, 2013. |
| 2. | Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004 |
| 3. | N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing" , published by Tata Mc GrawHill, 2006 |
| 4. | S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007 |



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191MAB401T	STATISTICS AND NUMERICAL METHODS	2	2	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

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| 1. | This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology. |
| 2. | To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems? |
| 3. | To introduce the basic concepts of solving algebraic and transcendental equations. |
| 4. | To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines? |

5.	To acquaint the knowledge of various techniques and methods of solving ordinary differential equations
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UNIT	TITLE	PERIODS
1	TESTING OF HYPOTHESIS	9+3
Statistical hypothesis-Large sample test based on Normal distribution for single mean and difference of means – Tests based on t, F distributions for testing means and variance – Chi square distribution(Goodness of fit and Independence of Attributes).		
UNIT	TITLE	PERIODS
2	DESIGN OF EXPERIMENTS	9+3
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.		
UNIT	TITLE	PERIODS
3	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	9+3
Solution of algebraic and transcendental equations –Fixed point iteration method-Newton Raphson method – Gauss elimination method – Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by power method and Jacobi's method for symmetric matrices.		
UNIT	TITLE	PERIODS
4	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	9+3
Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials –Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.		
UNIT	TITLE	PERIODS
5	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	9+3
Single step methods: Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods: Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.		

TOTAL PERIODS:	60
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Understand the testing of hypothesis for small and large samples which plays an important role in real life problems
CO2:	To introduce the basic concepts of solving algebraic and transcendental equations.
CO3:	To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines
CO4:	To acquaint the knowledge of various techniques and methods of solving ordinary differential equations
CO5:	Use the effective mathematical tools for solving numerically different kinds of problems occurring in engineering and technology.

TEXT BOOKS:

1.	Grewal. B.S., and Grewal. J.S., "Numerical Methods in Engineering and Science", 10th Edition, Khanna Publishers, New Delhi, 2015.
2.	Johnson. R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, , Asia, 8 th edition, 2015.

REFERENCE BOOKS:

1.	Burden ,R.L and faires , J.D, "Numerical Analysis", 9 th Edition, Cengage Learning, 2016.
2.	Devore.J.L , "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8 th Edition, 2014.
3.	Gerald. C.F., and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.
4.	Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 2004.
5.	Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC401T	APPLIED THERMODYNAMICS AND THERMAL ENGINEERING	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

- To introduce fundamental concepts in thermodynamics, heat transfer, propulsion and refrigeration and air conditioning.

UNIT	TITLE	PERIODS
1	BASIC THERMODYNAMICS	9
Systems, closed, open and isolated. Property, state, path and process, quasi-static process, Zeroth law, First law. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement – Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes. Availability and Un Availability. Properties of gases and vapours.		
UNIT	TITLE	PERIODS
2	AIR STANDARD CYCLES AND COMPRESSORS	9
Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.		
UNIT	TITLE	PERIODS
3	STEAM NOZZLES	9
Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles.		
UNIT	TITLE	PERIODS

4	REFRIGERATION AND AIR-CONDITIONING	9
Principles of refrigeration, Vapour compression – Vapour absorption types, comparison - Coefficient of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.		
UNIT	TITLE	PERIODS
5	HEAT TRANSFER	9
Modes of heat transfer, Heat conduction in parallel, radial and composite wall – Basics of Convective heat transfer. Fundamentals of Radiative heat transfer – Flow through heat exchangers, Logarithmic Mean Temperature Difference (LMTD) for parallel flow and Arithmetic Mean Temperature Difference (AMTD) counter flow heat exchangers.		
(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)		

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand the basic concept of thermodynamics.
CO2:	Understand the basic of air standard cycle and compressor.
CO3:	Apply the knowledge for selection of steam nozzles.
CO4:	Impart the knowledge on Refrigeration And Air-Conditioning
CO5:	Understand the concept of heat transfer.

TEXT BOOKS:

1.	Chattopadhyay. P Engineering Thermodynamics”, oxford University Press, New Delhi, 2010.
2.	Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2007.
3.	Rathakrishnan E., “Fundamentals of Engineering Thermodynamics” Prentice-Hall India, 2005.

REFERENCE BOOKS:

1.	Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006.
2.	Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2007.
3.	Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987
4.	Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
5.	Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
6.	Mathur& Sharma Steam Tables, Jain Publishers, NewDelhi.



Course Code	Course Title	Periods per week				Credits
191ATC402T	AUTOMOTIVE CHASSIS AND TRANSMISSION SYSTEM	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To understand the constructional details and theory of important drive line, steering, braking and suspension systems of automobiles.
2.	To impart the knowledge on problem-solving in steering mechanism, propeller shaft, braking and suspension systems.
3.	To know about the various transmission and drive line units of automobiles.

UNIT	TITLE	PERIODS
1	CHASSIS FRAME, FRONT AXLE AND STEERING SYSTEM	9
Types of chassis layout with reference to power plant locations and drive, Vehicle frames. Various types of frames. Constructional details, Materials. Testing of vehicle frames. Unitized frame body construction: Loads acting on vehicle frame. Types of front axles. Construction details materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe-in Conditions for true rolling motion of wheels during steering. Steering geometry. Ackerman and Davis steering system. Constructional details of steering linkages. Different types of steering gear boxes. Steering linkages and layouts. Power and power assisted steering-Steering of crawler tractors.		
UNIT	TITLE	PERIODS
2	TRANSMISSION AND DRIVE LINE	9
Requirement of transmission system, Different types of gearboxes - Sliding mesh gearbox, Constant mesh gearbox and Synchromesh gearbox. Automatic transmission - Types and Operations. Effect of driving thrust and torque reactions. Hotch kiss drive, torque tube drive and radius rods. Propeller shaft. Universal joints. Constant velocity universal joints. Front wheel drive. Different types of final drive. Worm and worm wheel, straight bevel gear, Spiral bevel gear and hypoid gear final drives. Double reduction and twin speed final drives. Differential principles. Construction details of differential unit. Non-slip differential. Differential locks-Differential housings.		
UNIT	TITLE	PERIODS
3	AXLES, WHEELS AND TYRES	9
Construction of rear axles. Types of loads acting on rear axles. Full floating. Three quarter floating and semi-floating rear axles. Rear axle housing. Construction of different types of axle housings. Multi-axled vehicles. Construction details of multi drive axle vehicles. Wheels and Rims, Types of tyres and their constructional details.		
UNIT	TITLE	PERIODS
4	SUSPENSION SYSTEM	9
Need of suspension system-Types of suspension-Suspension springs-Constructional details and characteristics of leaf, coil and torsion bar springs - Independent suspension-Rubber suspension-Pneumatic suspension-Shock absorbers.		
UNIT	TITLE	PERIODS
5	BRAKING SYSTEM	9
Classification of brakes-Drum brakes and Disc brakes. Constructional details-theory of braking, Mechanical hydraulic and pneumatic brakes-Servo brake. Power and power assisted brakes-Different types of retarders like eddy current and hydraulic retarder-Anti lock braking systems.		
(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Understand the construction details of various types of automotive frames and basic chassis layouts.
CO2:	Understand the basic function steering system and steering components.
CO3:	Select the appropriate transmission system for various automobiles.
CO4:	Infer the final drive system of a vehicle
CO5:	Apply the knowledge for selection of suitable axles, wheels and tyres for a vehicle.
CO6:	Distinguish various types of suspension system, brake system.

TEXT BOOKS:	
1.	Kripal Singh, "Automobile Engineering" ,Standard Publishers,2011.
2.	R.K. Rajput, "A Text–Book of Automobile Engineering", Laxmi Publications Pvt.Ltd, 2007.

REFERENCE BOOKS:	
1.	Steed.W., Mechanics of Road vehicles, Illiffe Books Ltd., London, 1960.
2.	Judge.A.W., Mechanism of the car, Chapman and Halls Ltd., London, 1986.
3.	Giles.J.G., Steering, Suspension and tyres, Iliffe Book Co., London, 1988.
4.	Crouse.W.H., Automotive Chassis and Body, McGraw Hill. Newyork. 1971.
5.	Tim Gilles, "Automotive Chassis-Brakes, Steering and Suspension", Thomson Delmer Learning, 2005.
6.	Jornsen Reimpell, Helmut Stoll, "Automotive Chassis: Engineering Principles", Elsevier, 2nd edition, 2001.
8.	Heldt.P.M, "Automotive Chassis", Chilton Co., New York,1990.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC403T	MACHINE DESIGN FOR AUTOMOBILE ENGINEERS	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To understand the design methodology for machine elements.
2.	To analyze the forces acting on a machine element and apply the suitable design methodology.
3.	To understand the various standards and methods of standardization.
4.	To apply the concept of parametric design and validation by strength analysis.

UNIT	TITLE	PERIODS
1	DESIGN FOR STATIC OR STEADY LOAD	9
Introduction to Design process - Factors - Materials selection direct - Bending and Torsional stress equation - Impact and Shock loading - calculation of principle stresses for various load combinations, eccentric loading - curved beams - crane hook and 'C' frame - Factor of safety - Theories of failure.		
UNIT	TITLE	PERIODS
2	DESIGN FOR FLUCTUATING LOAD AND SHAFT DESIGN	9
Variable and cyclic loads - Fatigue strength - S- N curve - Continued cyclic stress - Stress concentration factor - Soderberg and Goodman equations - Design of solid and hollow shafts based on strength, rigidity and critical speed - Shaft design for fluctuating load		
UNIT	TITLE	PERIODS
3	DESIGN OF KEYS AND COUPLINGS	9
Keys, keyways and splines - Types of keys - Design of key - Couplings - Types of couplings - Design of couplings based on given speed and load conditions.		
UNIT	TITLE	PERIODS
4	TEMPORARY AND PERMANENT JOINTS	9
Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints - Welded joints, riveted joints for structures - theory of bonded joints.		
UNIT	TITLE	PERIODS
5	DESIGN OF SPRINGS AND BEARINGS	9
Various types of springs, optimization of helical springs - rubber springs - Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfield Number - Selection of Rolling Contact bearings.		
(Use of standard Design data Book are permitted)		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Understand the standard design procedure for Design of machine elements and analyze stresses acting on components and determine the size based on theories of failure.
CO2:	Describe the design process, material selection, calculation of stresses and stress concentrations under static and variable loading
CO3:	Analyze and design the various machine elements/components for different loading condition using design data hand books.
CO4:	Apply the design concept for different types of joining technique for integrating various machine elements in assembly under different loading condition.
CO5:	Decide specifications as per standards given in design data and select standard components to improve interchangeability.
CO6:	Function effectively as individual and as a team to design and fabricate various machine elements.

TEXT BOOKS:	
1.	Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.
2.	Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill, 2011.

REFERENCE BOOKS:	
1.	Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010.
2.	Ansel Ugural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003.
3.	P.C. Gope, "Machine Design – Fundamental and Application", PHI learning private ltd, New Delhi, 2012.
4.	R.B. Patel, "Design of Machine Elements", MacMillan Publishers India P Ltd., Tech-Max Educational resources, 2011.
5.	Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005.
6.	Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2015.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ECS401T	ELECTRONICS AND MICROPROCESSORS	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 8085 Microprocessors.

UNIT	TITLE	PERIODS
1	SEMICONDUCTORS AND RECTIFIERS	9
Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction diode-LED-Zenor effect-Zenor diode characteristics-Half wave and full wave rectifiers -Voltage regulation.		
2	TRANSISTORS AND AMPLIFIERS	9
Bipolar junction transistor- CB, CE, CC configuration and characteristics- Class A, B and C amplifiers-Junction Field effect transistor- JFET Characteristics- SCR, Diac, Triac, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback- Negative feedback-Application in temperature and motor speed control.		
3	DIGITAL ELECTRONICS	9
Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra- Exclusive OR gate - Flip flops-Half and full adders-Shift Registers-Counters-A/D and D/A conversion.		
4	8085 MICROPROCESSOR	9
Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set- Addressing modes-Simple programs using arithmetic and logical operations.		
UNIT	TITLE	PERIODS

5	INTERFACING AND APPLICATIONS OF MICROPROCESSOR	9
Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	The students will be well versed in the fundamental knowledge of electronic and its applications..
CO2:	Impart knowledge in electronic concept of microprocessor
CO3:	Design and analyze the detailed concept, construction and principle of operation of different types of semi conductors.
CO4:	Command over detailed design and construction of rectifiers and the recent development in the area of electrical.
CO5:	Develop their knowledge in the field of digital electronics.

TEXT BOOKS:	
1.	Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill publishers, 1995.
2.	Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCE BOOKS:	
1.	Malvino and Leach, "Digital Principles and Applications", Tata McGraw-Hill, 1996
2.	Mehta V.K, "Principles of Electronics", S. Chand and Company Ltd., 1994
3.	Douglas V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 1999.
4.	Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices and Circuits" First Edition, Tata McGraw-Hill, 1999.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ECS411L	ELECTRONICS AND MICROPROCESSORS LABORATORY	0	0	4	0	2

COURSE OBJECTIVES:	
1.	To supplement the theoretical knowledge with practical use of electronic components and programming and control using micro-processors.

LIST OF EXPERIMENTS (ELECTRONICS)	
1.	VI Characteristics of PN Junction Diode
2.	VI Characteristics of Zener Diode
3.	VI Characteristics of LED.
4.	Characteristics of CE Transistor

5.	Characteristics of JFET
6.	Characteristics of Uni Junction Transistor.
7.	Study of Logic Gates (Basic Gates).
8.	Half Adder and Full Adder.
9.	Shift Registers and Counters
10.	Operational Amplifier (Inverting and Non inverting amplifier, Adder and Subtractor)
LIST OF EXPERIMENTS (MICROPROCESSORS)	
1.	8 bit Addition, Subtraction Multiplication and Division
2.	Maximum and Minimum of block of data
3.	Sorting
4.	Stepper Motor Interfacing

TOTAL PERIODS:	60
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Ability to perform speed characteristic of different electronics and microprocessor machine
CO2:	Impart knowledge in electronic concept of microprocessor
CO3:	Design and analyze the detailed concept, construction and principle of operation of different types of semi conductors.
CO4:	Command over detailed design and construction of rectifiers and the recent development in the area of electrical
CO5:	Develop their knowledge in the field of digital electronics.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC411L	AUTOMOTIVE COMPONENTS LABORATORY	0	0	3	1	2

COURSE OBJECTIVES:	
1.	To train the Students to know the details of different components, dismantling and assembling them.

LIST OF EXPERIMENTS	
1.	Dismantling and study of Multi-cylinder Petrol Engine
2.	Assembling of Multi-cylinder Petrol Engine
3.	Dismantling and study of Multi-cylinder Diesel Engine
4.	Assembling of Multi-cylinder Diesel Engine
5.	Study of petrol engine fuel system
6.	Study of diesel engine fuel system
7.	Study and measurement of light and heavy commercial Vehicle Frame

8.	Study, dismantling and assembling of front and rear Axles
9.	Study, dismantling and assembling of differential
10.	Study, dismantling and assembling of Clutch
11.	Study, dismantling and assembling of Gear Box
12.	Study of steering system

TOTAL PERIODS:	60
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Ability to dismantle and assemble the automobile components
CO2:	Ability to dismantle and assemble multi cylinder petrol and diesel engine.
CO3:	Ability to dismantle and assemble differential
CO4:	Ability to dismantle and assemble front and rear Axles
CO5:	Study and analyze the heavy commercial vehicle frame and chassis

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC501T	AUTOMOTIVE ENGINE COMPONENTS DESIGN	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To understand the design concepts and principles of various engine components.
2.	To understand the materials and functions of the engine components.
3.	To understand the design aspects of the engine components.

UNIT	TITLE	PERIODS
1	INTRODUCTION	9
Engineering materials - Introduction endurance limit, notch sensitivity. Tolerances, types of tolerances and fits, design considerations for interference fits, surface finish, surface roughness, Rankine's formula - Tetmajer's formula - Johnson formula- design of pushrods.		
UNIT	TITLE	PERIODS
2	DESIGN OF CYLINDER, PISTON AND CONNECTING ROD	9
Choice of material for cylinder and piston, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly. Material for connecting rod, determining minimum length of connecting rod, small end design, shank design, design of big end cap bolts.		
UNIT	TITLE	PERIODS
3	DESIGN OF CRANKSHAFT	9
Balancing of I.C. engines, significance of firing order. Material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations, development of short and long crank arms.		

Front and rear-end details.		
UNIT	TITLE	PERIODS
4	DESIGN OF FLYWHEELS	9
Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheel - stresses on the rim of the flywheels. Design of hubs and arms of the flywheel, turning moment diagram.		
UNIT	TITLE	PERIODS
5	DESIGN OF VALVES AND VALVE TRAIN	9
Design aspects of intake & exhaust manifolds, inlet & exhaust valves, valve springs, tappets and valve train. Design of cam & camshaft. Design of rocker arm. Cam profile generation.		
Note: (Use of Approved Design Data Book is permitted in the examination)		
TOTAL PERIODS:		45

COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Understand about the engineering materials and their properties, Design consideration of Fits, Tolerance.
CO2:	Impart knowledge in automotive engine and their internal part such as Cylinder, Piston and connecting rod.
CO3:	Design and analyze the detailed concept, construction and principle of operation of different types Crank shaft.
CO4:	Command over detailed design and construction of flywheel and the recent development in the area of engines.
CO5:	Develop their knowledge in the field of designing the valves and valve mechanism in engine.
CO6:	Function effectively as individual and as a team to design and fabricate various machine elements.

TEXT BOOKS:	
1.	Khurmi. R.S. & Gupta. J.K., "A text book of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2001.

REFERENCE BOOKS:	
1.	Jain.R.K, "Machine Design", Khanna Publishers, New Delhi, 2005.
2.	Giri.N.K, "Automobile Mechanics", Khanna Publishers, New Delhi, 2007.



Course Code	Course Title	Periods per week				Credits
191ATC502T	VEHICLE DYNAMICS	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To Develop physical and mathematical models to predict the dynamic response of vehicles
2.	To Apply vehicle design performance criteria and how to use the criteria to evaluate vehicle dynamic response
3.	To Use dynamic analyses in the design of vehicles.
4.	To understand the principle behind the lateral dynamics.
5.	To Evaluate the longitudinal dynamics and control in an automobile

UNIT	TITLE	PERIODS
1	CONCEPT 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 ratio, Base excitation. Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed		
UNIT	TITLE	PERIODS
2	TYRES	9
Tyre axis system, tyre forces and moments, tyre marking, tyre structure, hydroplaning, wheel and rim. Rolling resistance, factors affecting rolling resistance, Longitudinal and Lateral force at various slip angles, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tyres. Various test carried on a tyre.		
UNIT	TITLE	PERIODS
3	VERTICAL DYNAMICS	9
Human response to vibration, Sources of Vibration. Suspension requirements – types. State Space Representation. Design and analysis of Passive, Semi active and Active suspension using Quarter car, Bicycle Model, half car and full car vibrating model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law. Suspension optimization techniques. Air suspension system and their properties.		
UNIT	TITLE	PERIODS
4	LONGITUDINAL DYNAMICS AND CONTROL	9
Aerodynamic forces and moments. Equation of motion. Load distribution for three-wheeler and four-wheeler. Calculation of maximum acceleration, tractive effort and reaction forces for different drive vehicles. Power limited acceleration and traction limited acceleration. Estimation of CG location. Stability of vehicles resting on slope. Driveline dynamics. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.		
UNIT	TITLE	PERIODS
5	LATERAL DYNAMICS	9

Steady state handling characteristics. Steady state response to steering input – Yaw velocity gain, Lateral acceleration gain, curvature response gain. Testing of handling characteristics. Transient response characteristics. Steering dynamics. Direction control of vehicles. Roll center, Roll axis. Stability of vehicle on banked road, during turn. Effect of suspension on cornering. Minuro Plot for Lateral Transient Response.

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Develop physical and mathematical models to predict the dynamic response of vehicles
CO2:	Apply vehicle design performance criteria and how to use the criteria to evaluate vehicle dynamic response
CO3:	Use dynamic analyses in the design of vehicles.
CO4:	Understand the principle behind the lateral dynamics.
CO5:	Evaluate the longitudinal dynamics and control in an automobile

TEXT BOOKS:

1.	Y. Wong, "Theory of Ground Vehicles", Fourth Edition, Wiley-Interscience, 2008
2.	Singiresu S. Rao, "Mechanical Vibrations," Fifth Edition, Prentice Hall, 2010
3.	Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics," Society of Automotive Engineers Inc, 2014

REFERENCE BOOKS:

1.	Dean Karnopp, "Vehicle Dynamics, Stability, and Control", Second Edition, CRC Press, 2013
2.	Hans B Pacejka, "Tyre and Vehicle Dynamics," Second edition, SAE International, 2005



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC503T	AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	Knowledge in vehicle electrical and electronics components for engine operation.
2.	Enhancing the knowledge of lighting system and microprocessor applications in vehicle control systems.
3.	Gaining information's on modern safety system in vehicle braking.

UNIT	TITLE	PERIODS
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1	BATTERIES AND STARTING SYSTEMS	9
Different types of Batteries – principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms. Starter switches.		
UNIT	TITLE	PERIODS
2	CHARGING SYSTEM LIGHTING AND ACCESSORIES	9
DC Generators and Alternators their characteristics. Control unit – cut out, electronic regulators. Vehicle interior lighting system. Vehicle exterior lighting system. Wiring requirements. Lighting design Dashboard instruments. Horn, trafficator.		
UNIT	TITLE	PERIODS
3	ELECTRONIC IGNITION AND INJECTION SYSTEMS	9
Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel injection systems, mono and multi point fuel injection system (MPFI).		
UNIT	TITLE	PERIODS
4	SENSORS AND MICROPROCESSORS IN AUTOMOBILES	9
Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anaemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor. Microprocessor and microcomputer controlled devices in automobiles such voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.		
UNIT	TITLE	PERIODS
5	SAFETY SYSTEMS	9
Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti theft system.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Understand the various types of batteries and components of starting system.
CO2:	Identify the Charging, lighting and accessories of automotive vehicle.
CO3:	Critically identify the Electronics components of ignition and injection system.
CO4:	Understand the importance of sensors and microprocessors in automobiles.
CO5:	Analyze the automotive safety systems.

TEXT BOOKS:	
1.	Judge. A.W., "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992.

REFERENCE BOOKS:	
1.	Young.A.P., & Griffiths.L., "Automobile Electrical Equipment", English Language Book Society & New Press, 1990.
2.	Spreadbury. F.G., "Electrical Ignition Equipment", Constable & Co Ltd., London, 1962
3.	Robert N Brady "Automotive computers and Digital Instrumentation". A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey, 1988.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC511L	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY	0	0	4	0	2

COURSE OBJECTIVES:

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| 1. | To introduce the testing procedure for electrical and electronics system in automobile |
|----|--|

LIST OF EXPERIMENTS (ELECTRICAL)

- | | |
|----|--|
| 1. | Testing of batteries and battery maintenance |
| 2. | Testing of starting motors and generators |
| 3. | Testing of regulators and cut – outs |
| 4. | Diagnosis of ignition system faults |
| 5. | Study of Automobile electrical wiring |

LIST OF EXPERIMENTS (ELECTRONICS)

- | | |
|-----|---|
| 6. | Study of logic gates, adder and flip-flops. |
| 7. | Study of SCR and IC timer |
| 8. | Interfacing Sensors like RTD, LVDT. |
| 9. | Interfacing ADC for Data Acquisition |
| 10. | Interfacing DAC for Control Application |
| 11. | Interfacing A/D converter and simple data acquisition |
| 12. | Micro controller programming and interfacing |
| 13. | Interfacing Actuators |

TOTAL PERIODS:	60
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

- | | |
|-------------|--|
| CO1: | Ability to identify suitability of batteries for various vehicles |
| CO2: | Ability to charge the batteries as per the need and do simple projects on lighting and accessories using relays |
| CO3: | Ability to analyze the drawbacks in the existing safety systems and give solutions for that. |
| CO4: | Ability to create rectifies, filters, logic gates, adders and flip flop for the desired conversion to the load utilities |
| CO5: | Ability to analyze sensors in the required area to sense the resistance and temperature |
| CO6: | Ability to apply ADC and DAC conversion for control and transfer data to the system |

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC512L	TWO AND THREE WHEELERS LABORATORY	0	0	3	1	2

COURSE OBJECTIVES:

1.	To train the students to conduct performance test on two and three wheelers
2.	To train the students to dismatle and assemble the gear box, steering system etc.,

LIST OF EXPERIMENTS (ELECTRICAL)

1.	Performance test of a two wheeler using chassis dynamometer.
2.	Performance test on shock absorber
3.	Performance test on coil spring.
4.	Two wheeler chain test
5.	Brake and Clutch adjustment as per specification.
6.	Dismantling and assembling of two wheeler gear box and finding gear ratios
7.	Dismantling and assembling of three wheeler box and finding gear ratios
8.	Three wheeler brake and clutch play adjustment
9.	Dismantling and assembling of three wheeler steering system.
10.	Study of three wheeler chassis frame and power transmission system.

TOTAL PERIODS: 60

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	To analyze the performance of two wheeler using chassis dynamometer.
CO2:	To analyze the components of two wheeler and three wheeler gear boxes.
CO3:	To interpret the performance of shock absorber and coil spring.
CO4:	To examine the gear ratios of two and three wheelers.
CO5:	To interpret the brake and clutch adjustments of two and three wheelers.
CO6:	To analyze the chassis frame and power transmission system.



Course Code	Course Title	Periods per week				Credits
191ATC601T	FINITE ELEMENT ANALYSIS OF AUTOMOTIVE COMPONENTS	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To understand the design methodology for machine elements.
2. To analyze the forces acting on a machine element and apply the suitable design methodology.
3. To understand the various standards and methods of standardization.
4. To apply the concept of parametric design and validation by strength analysis.

UNIT	TITLE	PERIODS
1	INTRODUCTION	9
Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations –Introduction - Review of variational Calculus - Mathematical modeling - Initial Value Problems and boundary value problems - Classical methods - Variational approach - Rayleigh-Ritz method - Weighted Residual Method: Least squares, Collocation method, Galerkin methods		
UNIT	TITLE	PERIODS
2	ONE-DIMENSIONAL STRUCTURAL ANALYSIS	9
Degree of freedom - steps in FEA - discretization of domain - linear and quadratic shape functions - natural co-ordinate system - derivation of element stiffness matrix for elasticity and thermal strain problems - assembly of equations - applying boundary conditions - solution and post processing - solving problems for elastically deforming bars - Extension of bar elements to solve truss problems - beam elements and problems.		
UNIT	TITLE	PERIODS
3	TWO DIMENSIONAL STRUCTURAL ANALYSIS	9
Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems – Plane stress, plane strain and Axisymmetric problems – Body forces and temperature effects – Stress calculations		
UNIT	TITLE	PERIODS
4	APPLICATION TO HEAT TRANSFER AND DYNAMIC ANALYSIS	9
One dimensional heat transfer element - application to one-dimensional heat transfer problems-scalar variable problems in 2- Dimensions - Applications to simple heat transfer problems in 2-Dimension. Dynamic Analysis - Equation of Motion - Mass & damping matrices - Free Vibration analysis - Natural frequencies of Longitudinal, Transverse vibration.		
UNIT	TITLE	PERIODS
5	ISOPARAMETRIC FORMULATION	9
Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Introduction to Analysis Software.		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Apply the knowledge of Mathematics and Engineering to solve problems in structural and thermal engineering by approximate and numerical methods.
CO2:	Solve the one dimensional structural problem using FEM and analyze the stress distribution and displacement for bar, trusses and beam element.
CO3:	Solve the two dimensional structural for Triangular and Axisymmtric element using FEA technique.
CO4:	Analyze Heat transfer and dynamic problems using FEM and solve the natural frequency for bar and beam element.
CO5:	Understand about the isoparametric formulation and natural coordinates for solving two dimensional problems.
Co6:	Function effectively to act as team and individual to analyze the different type of automobile components by mathematically.

TEXT BOOKS:

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

REFERENCE BOOKS:

1.	Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann,2004
2.	Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002.
3.	Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.
4.	Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition,Prentice Hall College Div, 1990
5.	Bhatti Asghar "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2013.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC602T	ELECTRIC VEHICLE I	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To understand the fundamental concepts, principles, analysis and design of electric vehicles.
2.	To Impart knowledge on the batteries and other energy sources
3.	To understand different aspects of drives application.

UNIT	TITLE	PERIODS
1	NEED FOR ELECTRIC VEHICLES	9

Need of electric vehicles – comparative study of diesel, petrol, and pure electric vehicles. Limitations of electric vehicles, Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, Classification - according to the source of power and the drive arrangement, Configuration of electric vehicles, Performance of electric vehicles.

UNIT	TITLE	PERIODS
2	ENERGY SOURCES AND CHARGING	9
Requirements of energy sources in electric vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Charging of electric vehicles-home charging, public charging, swap station, inductive charging. Locations and type of chargers.		
UNIT	TITLE	PERIODS
3	PROPULSION MOTORS AND CONTROLLERS	9
Requirements of motor for electric vehicles, electric components used in electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency. Energy Management Strategies used in electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.		
UNIT	TITLE	PERIODS
4	ELECTRIC DRIVE TRAINS	9
Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Steering system for electric vehicles, Suspension for electric vehicles, Brake system for electric vehicles.		
UNIT	TITLE	PERIODS
5	DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES	9
Aerodynamic-Rolling resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering- Tyre choice- Wing Mirror, Aerials and Luggage racks. Case Studies: Design of a Battery Electric Vehicle (BEV).		

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand the subsystems and components used in electric vehicles.
CO2:	Differentiate electric and hybrid vehicles.
CO3:	Select the suitable charging methods for electric vehicles.
CO4:	Understand the drive trains used in different configurations of electric vehicles.
CO5:	Apply design considerations for electric vehicles.

TEXT BOOKS:

1.	Ali Emadi et al., Vehicular Electric Power Systems, Marcel Dekker, Inc, 2004.
2.	C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, Oxford University Press, 2001.
3.	James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons, 2003.

REFERENCE BOOKS:	
1.	Ron HodKinson, "light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005
2.	Lino Guzzella, " Vehicle Propulsion System" Springer Publications, 2005.
3.	Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press, 2003.
4.	Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press, 2005



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC603T	AUTOMOTIVE CHASSIS COMPONENTS DESIGN	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To familiarize the various steps involved in the design process.
2.	To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
3.	To learn to use standard practices and standard data.
4.	To understand the fundamental principles involved in design of components of automotive chassis, the complete design exercise and arrive at important dimensions of chassis components.

UNIT	TITLE	PERIODS
1	VEHICLE FRAME AND SUSPENSION	9
Study of loads-moments and stresses on frame members. Design of frame for passenger and commercial vehicle - Design of leaf Springs-Coil springs and torsion bar springs.		
UNIT	TITLE	PERIODS
2	FRONT AXLE AND STEERING SYSTEMS	9
Analysis of loads-moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of Bearings. Determination of optimum dimensions and proportions for steering linkages, ensuring minimum error in steering. Design of front axle beam.		
UNIT	TITLE	PERIODS
3	CLUTCH	9
Design of single plate clutch, multiplate clutch and cone clutch. Torque capacity of clutch. Design of clutch components, Design details of roller and sprag type of clutches.		
UNIT	TITLE	PERIODS
4	GEAR BOX	9
Gear train calculations, layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of three speed and four speed gearboxes.		
UNIT	TITLE	PERIODS
5	DRIVE LINE AND REAR AXLE	9
Design of propeller shaft. Design details of final drive gearing. Design details of full floating, semi-		

floating and three quarter floating rear shafts and rear axle housings and design aspects of final drive.

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

- | | |
|-------------|--|
| CO1: | Design the chassis frames and suspension springs. |
| CO2: | Design the chassis front axle and steering system components. |
| CO3: | Design the clutches used in modern vehicles and analyze the causes. |
| CO4: | Design the various gearboxes used in 4-wheelers. |
| CO5: | Design the driveline components from universal and slip joints to differential assembly. |

TEXT BOOKS:

- | | |
|----|---|
| 1. | Giri, .K., "Automobile Mechanics", Khanna publishers, New Delhi, 2007. |
| 2. | Khurmi. R.S. and Gupta. J.K., "A textbook of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2001. |

REFERENCE BOOKS:

- | | |
|----|---|
| 1. | Heldt, P.M., "Automotive Chassis", Chilton Book Co., 1992. |
| 2. | Dean Avern, "Automobile Chassis Design", Illife Book Co., 2001. |
| 3. | Julian Happian-Smith, Introduction to Modern Vehicle DesignII, SAE International, 2004. |
| 4. | Stokes. A, "Manual Gearbox Design", Society of Automotive Engineers, 1992. |



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC611L	AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY	0	0	4	0	2

COURSE OBJECTIVES:

- | | |
|----|---|
| 1. | To study the characteristics of the fuels and Lubricants used in automobile |
|----|---|

LIST OF EXPERIMENTS (ELECTRICAL)

- | | |
|----|---|
| 1. | Study of International and National standards for fuels and lubricants. |
| 2. | Study of Octane and Cetane Number of fuels. |
| 3. | ASTM distillation test of liquid fuels |
| 4. | Aniline Point test of diesel |
| 5. | Calorific value of liquid fuel. |
| 6. | Calorific value of gaseous fuel. |
| 7. | Reid vapour pressure test. |

8.	Flash and Fire points of petrol and diesel.
9.	Copper strip Corrosion Test
10.	Cloud & Pour point Test.
11.	Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
12.	Viscosity Index of lubricants & Fuels by Saybolt Viscometer
13.	Ash content and Carbon Residue Test
14.	Drop point of grease and mechanical penetration in grease.

TOTAL PERIODS:	60
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COURSE OUTCOMES:	
Upon completion of this course:	
CO1:	Students will able to investigate the various properties of fuels.
CO2:	Students will able to investigate the various properties of lubricants.
CO3:	Students will able to identify the fuel testing method for different types of fuel.
CO4:	Students will able to identify the testing method for different types of Lubricant.
CO5:	Students able to calculate the amount of energy in the specific fuels.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC612L	VEHICLE COMPONENT DESIGN LABORATORY	0	0	3	1	2

COURSE OBJECTIVES:	
1.	To famiarise the students to use modeling software to model engine components and chassis design.

LIST OF EXPERIMENTS (ENGINE DESIGN)	
1.	Design and drawing of piston, piston pin and piston rings and drawing of these components.
2.	Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly.
3.	Design of crankshaft, balancing weight calculations.
4.	Development of short and long crank arms, front end and rear end details, drawing of the crankshaft assembly.
5.	Design and drawing of flywheel.
6.	Ring gear design, drawing of the flywheel including the development of ring gear teeth.
7.	Design and drawing of the inlet and exhaust valves.
8.	Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.
9.	Design of combustion chamber.
LIST OF EXPERIMENTS (CHASSIS DESIGN)	

10.	Complete design of clutch components.
11.	Assembly drawing of clutch using drafting software.
12.	Gear train calculations.
13.	Layout of gear box.
14.	Calculation of bearing loads
15.	Selection of bearings.
16.	Assembly drawing of gear box using drafting software
17.	Design of propeller shaft.
18.	Design details of final drive gearing.
19.	Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings
20.	Design aspects of final drive.

TOTAL PERIODS:	60
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	To use design software for designing vehicle components
CO2:	To design the front axles of commercial vehicles and steering components of passenger and commercial vehicles.
CO3:	To design the clutches used in passenger and commercial vehicles.
CO4:	To design the gearboxes of passenger and commercial vehicles.
CO5:	To design the driveline and rear axles of commercial vehicles.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC701T	ENGINE MANAGEMENT SYSTEM AND EMISSION CONTROL	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To understand the principle of electronic engine management systems.
2.	To have an understanding about the management of SI Engine.
3.	To have an understanding about the management of CI engines.
4.	To understand about engine pollutant formation and management.
5.	To understand the principle of vehicle management systems

UNIT	TITLE	PERIODS
1	FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS	9
Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines .Sensors and actuators.		
UNIT	TITLE	PERIODS
2	MANAGEMENT OF SI ENGINES	9
Layout and working of SI engine management systems. Group and sequential injection techniques. TBI, MPFI and GDI systems. Electronic ignition system, Electronic sparks timing control.		
UNIT	TITLE	PERIODS
3	MANAGEMENT OF CI ENGINES	9
Diesel injection, Pilot, main, advanced post injection and retarded post injection techniques. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valves		
UNIT	TITLE	PERIODS
4	MANAGEMENT OF POLLUTANTS	9
Emission from automobiles, transient emission, effect of pollutants, global warming, formation of pollutants in SI engines, formation of pollutants in CI engines. Noise pollution and control. Measurement of pollution. NVH.		
UNIT	TITLE	PERIODS
5	VEHICLE MANAGEMENT SYSTEMS	9
Sensors for throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level, knock, engine temperature, manifold temperature and pressure , actuators, various types of actuators. ABS, ESP		

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	On completion of the course the students should be able to, analyze the requirement and components of engine management system in SI Engine.
CO2:	On completion of the course the students should be able to, analyze the requirement and components of engine management system in CI Engine.
CO3:	Select sensors for ignition and injection system with justification.
CO4:	Analyze design and operating parameters on emission and select suitable control devices.
CO5:	Identify various sensors in VMS and link the actuators

TEXT BOOKS:

1.	Tom Weather Jr and Cland C.Hunter, "Automotive Computers and Control System", Prentice Hall Inc., New Jersey, 1984.
2.	William B.Ribbens Butterworth, Heinemann,"Understanding Automotive Electronics",5th Edition, 1998.
3.	Jeff Hartman, "How to tune and Modify Automotive Engine Management System"Motor books, 2013.
4.	Ganesan.V., "Internal Combustion Engines", Tata McGraw-Hill Publishing Co.,New Delhi, 2003.

5.	M.L.Mathur and R.P.Sharma, "A course in Internal combustion engines",Dhanpat Rai & Sons Publications, New Delhi, 2001.
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REFERENCE BOOKS:

1.	Robert Bosch , "Diesel Engine Management", Wiley Publications, 2006
2.	Robert Bosch , "Gasoline Engine Management", Wiley Publications, 2006
3.	Robert N Brady, "Automotive Computers and Digital Instrumentation", A reston Book, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
4.	Bechtold, "Understanding Automotive Electronics", SAE, 1998 5. John B.Heywood, "Internal Combustion Engine Fundamental", McGraw-Hill, 1988



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC702T	ELECTRIC VEHICLE II	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To understand the fundamental concepts, principles, analysis and design of hybrid electric vehicles.
2.	To Impart knowledge on the internal combustion engines and batteries.
3.	To understand different aspects of drives application for hybrid electric vehicles.

UNIT	TITLE	PERIODS
1	NEED FOR HYBRID ELECTIC VEHICLES	9
Need of hybrid vehicles - comparative study of diesel, petrol, pure electric and hybrid vehicles. Limitations of hybrid electric vehicles. Specification of some electric and hybrid vehicles. Layout of Hybrid vehicles - Advantages and drawbacks of hybrid vehicles. Energy flows in hybrid electric vehicles, System components, Electronic control system. Range and type of hybrid systems - Series, parallel, split-parallel, series-parallel - Advantages and Disadvantages. Power split device social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Performance of hybrid electric vehicles.		
UNIT	TITLE	PERIODS
2	ENERGY STORAGE FOR HYBRID ELECTRIC VEHICLES	9
Energy Storage Requirements in Hybrid Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Energy Management System.		
UNIT	TITLE	PERIODS
3	ELECTRIC MOTOR AND INTERNAL COMBUSTION ENGINE	9
Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, Communications, supporting subsystems.		
UNIT	TITLE	PERIODS
4	HYBRID ELECTRIC DRIVE TRAINS	9

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Steering, suspension and brake systems suitable for hybrid electric vehicles.

UNIT	TITLE	PERIODS
5	DESIGN CONSIDERATIONS FOR HYBRID ELECTRIC VEHICLES	9
Aerodynamic-Rolling resistance- Transmission efficiency- Vehicle mass- Hybrid electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering- Tyre choice-Wing Mirror, Aerials and Luggage racks. Case Studies: Design of a Hybrid Electric Vehicle (HEV).		

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand the subsystems and components used in electric hybrid vehicles.
CO2:	Understand the need of internal combustion engines in terms of vehicle range.
CO3:	Differentiate electric and hybrid vehicles.
CO4:	Understand the drive trains used in different configurations of electric hybrid vehicles.
CO5:	Apply design considerations for electric hybrid vehicles.

TEXT BOOKS:

1.	Colin R. Ferguson, Internal Combustion Engines, 2 nd Edition, John Wiley & Sons. Inc., 2001.
2.	Curtis D.Anderson, Electric and Hybrid Cars, 2 nd Edition, McFarland & Company, Inc. Publishers, 2010.
3.	Allen E.Fuhs, Hybrid Vehicles, CRC Press, 2009.

REFERENCE BOOKS:

1.	M J Nunney, Light and Heavy Vehicle Technology, B/H, 2007.
2.	Ron Hodkinson and John Fenton, Lightweight Electric/Hybrid Vehicle Design, B/H, 2001.
3.	Mehrdad Ehsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, 2005.
4.	Tom Denton, Electric and Hybrid Vehicles, IMI, 2016.
5.	Sandeep Dhameja, Electric Vehicle Battery Systems, Newnes, 2002.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC703T	VEHICLE BODY ENGINEERING	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	The students can impart knowledge in construction of car body, design criteria, types of car and safety aspects of car.
2.	The students able to know the construction of bus body and dimensions of bus body and safety aspects.
3.	The students can impart knowledge in types of commercial vehicles; design of cab and in aerodynamic testing, forces and moments.
4.	The student will be well versed in the design and construction of external body of the vehicles and materials used in vehicles.

UNIT	TITLE	PERIODS
1	CAR BODY DETAILS	9
Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Variou panels in car bodies. Safety aspect of car body.		
UNIT	TITLE	PERIODS
2	BUS BODY DETAILS	9
Types of bus body: based on capacity, distance traveled and based on construction. Bus body lay out for various types, floor height, engine location, entrance and exit location, seating dimensions. Types of metal sections used – Regulations – Constructional details: Conventional and integral.		
UNIT	TITLE	PERIODS
3	COMMERCIAL VEHICLE DETAILS	9
Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of commercial vehicle body - Flat platform body, Trailer, Tipper body and Tanker body, Drivers cab design - Regulations.		
UNIT	TITLE	PERIODS
4	BODY MATERIALS AND BODY REPAIR	9
Types of materials used in body construction-Steel sheet, timber, plastics, GRP, properties of materials. Hand tools-power tools-panel repair-repairing sheet metal-repairing plastics-body fillers-passenger compartment service- corrosion and Anticorrosion methods. Modern painting process procedure-paint problems and Body trim items-body mechanisms.		
UNIT	TITLE	PERIODS
5	VEHICLE AERODYNAMICS	9
Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:

CO1:	The students will able to know design of car body and identify the car body Parts in a vehicle.
CO2:	The students will able to evaluate about different aspects of car body and bus body, types, commercial vehicle.
CO3:	The students will able to analyze the Role of various aerodynamic forces and moments, measuring instruments.
CO4:	The students will able to evaluate about different aspects of car body and bus body, types, commercial vehicle.

CO5:	The students able to find the material which can be used in car body, bus Body of an automobile vehicle and know painting process for a Commercial vehicle and tools used for body repairs.
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TEXT BOOKS:	
1.	Powloski, J., "Vehicle Body Engineering", Business Books Ltd., 1998
2.	James E Duffy, "Body Repair Technology for 4-Wheelers", Cengage Learning, 2009

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



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC711L	VEHICLE MAINTENANCE LABORATORY	0	0	4	0	2

COURSE OBJECTIVES:	
1.	To train the structures in identifying the fault and rectification.

LIST OF EXPERIMENTS (STUDY)	
1.	Tools and instruments required for maintenance
	Safety aspects with respect to man, machine and tools
	General procedures for servicing and maintenance schedule
	Wheel Alignment procedure

LIST OF EXPERIMENTS	
1.	Minor and major tune up of gasoline and diesel engines
2.	Calibration of Fuel pump
3.	Engine fault diagnosis using scan tool
4.	Fault diagnosis and service of transmission system
5.	Fault diagnosis and service of driveline system
6.	Fault diagnosis and service of braking system
7.	Fault diagnosis and service of suspension system
8.	Fault diagnosis and service of steering system
9.	Fault diagnosis and service of Electrical system like battery, starting system, charging system ,lighting system etc

10.	Fault diagnosis and service of vehicle air conditioning system
11.	Practice the following:
	<ul style="list-style-type: none"> Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
	<ul style="list-style-type: none"> Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
	<ul style="list-style-type: none"> Wheel bearings tightening and adjustment.
	<ul style="list-style-type: none"> Adjustment of head lights beam.
	<ul style="list-style-type: none"> Removal and fitting of tire and tube.

TOTAL PERIODS:	60
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Upon the completion of the course, the student can able to understand the importance of Maintenance and also the step by step procedure for maintain the various automotive sub systems.
CO2:	Ability to identify the faults and knowledge on maintenance.
CO3:	The student can able to understand the importance of maintain the various automotive sub systems.
CO4:	The student can able to understand the importance of maintain the Vehicle body repair.
CO5:	Ability to identify the faults and knowledge on driveline maintenance.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATC712L	ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY	0	0	3	1	2

COURSE OBJECTIVES:	
1.	To conduct performance test and emission test on the IC engines.

LIST OF EXPERIMENTS	
1.	Study of hydraulic, electrical and eddy current dynamometers
2.	Valve timing and port timing diagrams
3.	Performance and emission test on two wheeler SI engine
4.	Performance and emission test on automotive multi-cylinder SI engine
5.	Performance and emission test on automotive multi-cylinder CI engine
6.	Retardation test on I.C. Engines.
7.	Heat balance test on automotive multi-cylinder SI engine
8.	Heat balance test on automotive multi-cylinder CI engine
9.	Morse test on multi-cylinder SI engine
10.	Engine cylinder pressure measurement P-θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and data acquisition system.

11.	Motoring test for indicated power
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TOTAL PERIODS:	60
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Investigate the various properties of dynamometer.
CO2:	Investigate the various performance of S.I Engine.
CO3:	Identify the fuel testing method for different Emission of fuel.
CO4:	Evaluate the various performance of C.I Engine.
CO5:	Calculate the amount of energy in the specific fuels.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATP711J	PROJECT WORK PHASE I	0	0	0	4	2

COURSE OBJECTIVES:	
1.	To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
2.	To develop the methodology to solve the identified problem.
3.	To train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS
The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL PERIODS:	60
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COURSE OUTCOMES:	
CO1:	Discover potential research areas in the field of Automobile Engineering.
CO2:	Conduct a survey of several available literature in the preferred field of study
CO3:	Compare and contrast the several existing solutions for research challenge
CO4:	Demonstrate an ability to work in teams and manage the conduct of the research study.
CO5:	Formulate and propose a plan for creating a solution for the research plan identified
CO6:	To report and present the findings of the study conducted in the preferred domain



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATP811J	PROJECT WORK PHASE II	0	0	0	20	10

COURSE OBJECTIVES:

1.	To solve the identified problem based on the formulated methodology.
2.	To develop skills to analyze and discuss the test results, and make conclusions.

SYLLABUS

The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report submitted and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL PERIODS: 300

COURSE OUTCOMES:

CO1:	Apply mathematical knowledge and research based knowledge to solve engineering problems.
CO2:	Use techniques, skills and modern engineering tools necessary for engineering practice and able to manage projects in multidisciplinary environments either as a member or a leader of a team.
CO3:	Apply the engineering knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.
CO4:	communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms
CO5:	Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task
CO6:	Capable of preparing project reports, facing reviews and vice voce examinations.



SYLLABUS OF PROFESSIONAL ELECTIVES

Course Code	Course Title	Periods per week				Credits
191ATE401T	APPLIED HYDRAULICS AND PNEUMATICS	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To provide student with knowledge on the application of fluid power in process, construction and manufacturing Industries.
2.	To provide students with an understanding of the fluids and components utilized in modern industrial fluid power system.
3.	To develop a measurable degree of competence in the design, construction and operation of fluid power circuits.

UNIT	TITLE	PERIODS
1	FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS	9
Introduction to Fluid power, Advantages and Applications, Fluid power systems, Types of fluids, Properties of fluids and selection, Basics of Hydraulics , Pascal's Law, Principles of flow, Friction loss, Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory, Pump Classification, Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary, Fixed and Variable displacement pumps , Problems.		
UNIT	TITLE	PERIODS
2	HYDRAULIC ACTUATORS AND CONTROL COMPONENTS	9
Hydraulic Actuators: Cylinders, Types and construction, Application, Hydraulic cushioning, Hydraulic motors, Control Components : Direction Control, Flow control and pressure control valves, Types, Construction and Operation, Servo and Proportional valves, Applications, Accessories : Reservoirs, Pressure Switches, Applications, Fluid Power ANSI Symbols, Problems.		
UNIT	TITLE	PERIODS
3	HYDRAULIC CIRCUITS AND SYSTEMS	9
Accumulators, Intensifiers, Industrial hydraulic circuits, Regenerative, Pump Unloading, Double Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.		
UNIT	TITLE	PERIODS
4	PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS	9
Properties of air, Perfect Gas Laws, Compressor, Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit, Cascade method, Electro Pneumatic System, Elements, Ladder diagram, Problems, Introduction to fluidics and pneumatic logic circuits.		
UNIT	TITLE	PERIODS
5	TROUBLE SHOOTING AND APPLICATIONS	9
Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools, Low cost Automation, Hydraulic and Pneumatic power packs.		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Explain the Fluid power and operation of different types of pumps.
CO2:	Summarize the features and functions of Hydraulic motors, actuators and Flow control valves
CO3:	Design the different types of Hydraulic circuits and systems
CO4:	Explain the working of different pneumatic circuits and systems
CO5:	Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.

TEXT BOOKS:

1.	Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2.	Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2001.

REFERENCE BOOKS:

1.	Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
2.	Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
3.	Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
4.	Michael J, Princes and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
5.	Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE402T	VEHICLE DESIGN AND DATA CHARACTERISTICS	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	The Students able to collect important technical specifications of an automobile from Technical notes, research publications.
2.	To calculate and tabulate various vehicle performance parameters.
3.	To draw vehicle performance curves using design parameters.

UNIT	TITLE	PERIODS
1	INTRODUCTION	9
Fundamentals of vehicle design, Gross Vehicle, Weight, laden and un-laden weights, Front and rear axle weights, Frontal Area, maximum speed, maximum acceleration, gradability in different gears.		
UNIT	TITLE	PERIODS
2	RESISTANCE TO VEHICLE MOTION	9

Analysis of air and rolling resistances at various vehicle speeds - Calculation, Tabulation and Plotting of Curves, Estimation of Driving force, determination of power, requirement for different loads and speeds, Maximum Power calculation.

UNIT	TITLE	PERIODS
3	PERFORMANCE CURVES	9

Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different vehicle speeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity, Bore and Stroke Length.

UNIT	TITLE	PERIODS
4	VELOCITY , ACCERELATION AND TURNING MOVEMENT	9

Connecting rod length to Crank Radius Ratio, Plotting of Piston Velocity and Acceleration against Crank Angle, Plotting Gas force, inertia force and Resultant force against Crank Angle, Turning Moment and Side Thrust against Crank Angle.

UNIT	TITLE	PERIODS
5	GEAR RATIOS	9

Determination of Gear Ratios, Acceleration and Gradability, Typical Problems on Vehicle performance

TOTAL PERIODS:	45
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COURSE OUTCOMES:

CO1:	The students can able to understand the basic design of an Engine.
CO2:	The students can able to understand various resistance and power calculation.
CO3:	The students can able to draw the performance curves pertain to engine.
CO4:	Calculate and tabulate various vehicle performance parameters and design parameters
CO5:	Design various gear ratios related to vehicle Performance.

TEXT BOOKS:

1.	Giri. N. K., "Automotive Mechanics", Khanna Publishers, New Delhi, 2005. 2. Heldt, P.M.,
2.	"High Speed Combustion Engines", Oxford and I.B.H. Publishing Co., Kolkata, 2002.

REFERENCE BOOKS:

1.	Gupta. R.B., "Automobile Engineering", Sathya Prakashan, 8 Editionj., 2013.
2.	V. Ganesan "Internal Combustion Engines" Tata Mcgraw Hill Publishers 2003,1999
3.	Internal combustion engine Fundamentals by John B. Heywood, Second Edition, 2018 McGraw-Hill Education.



Course Code	Course Title	Periods per week				Credits
191ATE403T	METROLOGY AND MEASUREMENTS FOR AUTOMOBILE ENGINEERS	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To understand the design concepts and principles of various measuring instruments.
2. To understand the standards used for quality assurance.
3. To design new measuring instrument for vehicles.

UNIT	TITLE	PERIODS
1	MEASUREMENT STANDARDS AND COMPARATORS	9
Principles of Engineering metrology, Measurement standards, Types and sources of errors, Accuracy and Precision, introduction to uncertainty in measurement, linear and angular measuring instruments and their applications. Calibration -Concept and procedure, traceability, Gauge R&R. Comparators - Mechanical, Pneumatic, Optical, Electrical (LVDT).		
UNIT	TITLE	PERIODS
2	DESIGN OF GAUGES, INTERFEROMETERS AND SURFACE ROUGHNESS MEASUREMENTS	9
Design of Gauges: Tolerances, Limits and Fits, Taylor's principle, Types of gauges. Interferometer: Principle, NPL Interferometer, Laser Interferometer and their applications. Surface Roughness Measurement: Surface texture, Parameters for measuring surface roughness, Contact & non-contact type surface roughness measuring instruments		
UNIT	TITLE	PERIODS
3	METROLOGY OF THREAD, GEARS AND ADVANCE METROLOGY	9
Measurement of Thread form: Thread form errors, Measurement of Minor, Major and Effective diameter (Three Wire Method), Flank angle, pitch, Floating Carriage Micrometer. Gear Metrology: Types of errors, Gear tooth Vernier, Constant chord, Base tangent, Gear Rolling Tester. Profile Projector, Tool maker's microscope and their applications.		
UNIT	TITLE	PERIODS
4	AUTOMOTIVE SENSORS	9
Wiper potentiometers, Eddy-current pedal-travel sensor, Hall acceleration sensor, Knock sensors-RPM and Velocity Sensors: Inductive rotational speed sensor Hall Effect sensor Temperature Sensors:- intered ,Ceramic resistors, Thin film resistors, Thick film resistors, Mono crystalline silicon semiconductor resistor 'Thermopile sensors'. Flow Sensors:- Ultrasonic flow sensors Pitot tube air-flow sensor ,Hot wire air-mass flow meter Micro mechanical hot-film air-mass flow meter Lambda sensor Imaging sensor Rain Sensor Introduction to MEMs		
UNIT	TITLE	PERIODS
5	VARIABLE RESISTANCE, INDUCTANCE AND CAPACITIVE SENSOR	9
Variable air gap type,variable area type and variable permittivity typecapacitor microphone Piezoelectric, Magnetostrictive, Hall Effect,semiconductor sensor digital transducers Humidity Sensor.Rain sensor,climatic condition sensor, solar,light sensor, antiglare sensor.		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand various metrology standards and its importance in quality assurance.
CO2:	Command over different types of measuring equipments and its usage.
CO3:	Impart knowledge in advance metrology used in measuring various profiles for industrial applications
CO4:	Design new component with the help of modern measuring equipments.
CO5:	Analyse various performance parameters of a vehicle.

TEXT BOOKS:

1.	Doebelin E.O, "Measurement Systems : Applications and Design", 5th Edition, Tat McGraw-Hill Publishing Co,2007
2.	Jain R. K. "Engineering Metrology" Khanna Publishers, New Delhi, 2012
3.	William Kimberley,"Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH, 2004

REFERENCE BOOKS:

1.	Murthy D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2007
2.	Robert Brandy, "Automotive Electronics and Computer System", Prentice Hall, 2001.
3.	Dr.S.Sathiyamurthy, "Metrology and Measurements", Sri Seyon Publication, Chennai, 2019.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE404T	APPLIED HEAT AND MASS TRANSFER	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To understand the mechanisms of heat transfer under steady and transient conditions.
2.	To understand the concepts of heat transfer through extended surfaces.
3.	To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.

UNIT	TITLE	PERIODS
1	CONDUCTION	9
General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler's charts.		
UNIT	TITLE	PERIODS
2	CONVECTION	9

Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes.		
UNIT	TITLE	PERIODS
3	PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS	9
Nusselt's theory of condensation - Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method - NTU method.		
UNIT	TITLE	PERIODS
4	RADIATION	9
Black Body Radiation – Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases.		
UNIT	TITLE	PERIODS
5	MASS TRANSFER	9
Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems
CO2:	Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems
CO3:	Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems
CO4:	Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems
CO5:	Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications.

TEXT BOOKS:	
1.	Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000
2.	Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 5th Edition 2015

REFERENCE BOOKS:	
1.	Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
2.	Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
3.	Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
4.	Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
5.	R.C. Sachdeva, "Fundamentals of Engineering Heat & Mass transfer", New Age International Publishers, 2009



Course Code	Course Title	Periods per week				Credits
191ATE501T	ADVANCED MACHINING PROCESSES	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To learn about various advanced machining process, the various process parameters and their influence on performance and their application

UNIT	TITLE	PERIODS
1	INTRODUCTION MECHANICAL ENERGY BASED PROCESSES	9
Unconventional machining Process – Need – classification – Brief overview .Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining – Ultrasonic Machining.(AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.		
UNIT	TITLE	PERIODS
2	ELECTRICAL ENERGY BASED PROCESSES	9
Electric Discharge Machining (EDM) – Wire cut EDM – Working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing — Applications.		
UNIT	TITLE	PERIODS
3	CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES	9
Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters-ECG and ECH - Applications.		
UNIT	TITLE	PERIODS
4	THERMAL ENERGY BASED PROCESSES	9
Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.		
UNIT	TITLE	PERIODS
5	ADVANCED NANO FINISHING PROCESSES	9
Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations. Recent developments in non-traditional machining processes.		

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

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|-------------|--|
| CO1: | Explain the need for unconventional machining processes and its classification |
| CO2: | Compare various electrical energy based unconventional machining processes. |
| CO3: | Summarize various chemical and electro-chemical energy based unconventional machining processes. |

CO4:	Explain thermal energy and beam energy unconventional machining processes.
CO5:	Distinguish various recent trends based unconventional machining processes.

TEXT BOOKS:	
1.	Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007
2.	Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2007.

REFERENCE BOOKS:	
1.	Benedict. G.F. “Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York, 1987.
2.	Sathiyamurthy.S “Unconventional Machining Process” Kavitha Publications, Chennai, 2019.
3.	Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998.
4.	Paul De Garmo, J.T.Black, and Ronald. A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., 8th Edition, New Delhi , 2001.



Course Code	Course Title	Periods per week				Credits
191ATE502T	TWO AND THREE WHEELERS	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To understand the constructional details of vehicles.
2.	To understand operating characteristics and vehicle design aspects.

UNIT	TITLE	PERIODS
1	INTRODUCTION	9
Development, Classification & layouts of two wheelers (motorcycles, scooters, mopeds) and Three wheelers, applications & capacity – goods & passengers, study of technical specification of Two & Three wheelers. Frames & Body: Types of frame, construction, loads, design consideration, materials, Types of three wheeler bodies, layout, RTO regulations, aerodynamic, aesthetic & ergonomics considerations for body work.		
UNIT	TITLE	PERIODS
2	THE POWER UNIT	9
Selection of engine for two wheeler & three wheeler, Design considerations for two wheeler & three wheeler power plants, special systems requirements for lubrication, cooling, starting. Recent engine developments.		
UNIT	TITLE	PERIODS
3	TRANSMISSION AND STEERING SYSTEM	9
Transmission Systems : Clutch – special requirements, different types used in two & three wheelers, need of primary reduction, selection of transmission - gear transmission, gear shift mechanism, belt		

transmission, automatic transmission (Continuous Variable Transmission - CVT, Epicyclic), final drive & differential for three wheeler, wheel drive arrangement. Steering: Steering geometry, steering column construction, steering system for three wheelers.

UNIT	TITLE	PERIODS
4	BRAKE AND SUSPENSION SYSTEM	9

Brake, Wheel & Tyres: Design consideration of brake, types of brakes – disc, drum, braking mechanism – mechanical, hydraulic & servo, wheel types - spokes, disc, split, special tyre requirements for two & three wheelers. Suspension requirements, design considerations, trailing & leading link, swinging arm, springs & shock absorbers.

UNIT	TITLE	PERIODS
5	PERFORMANCE AND MAINTENANCE	9

Road Performance: Handling characteristics, driver & pillion seating arrangement, ergonomics & comfort, road holding & vehicle stability, riding characteristics, safety arrangements, Racing bikes – special requirements. Maintenance: Preventive & brake down maintenance, factors affecting fuel economy & emission.

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand about two and three wheeler construction and its parts.
CO2:	Impart knowledge in designing power unit of the vehicle.
CO3:	Differentiate the working of various vehicle transmission line.
CO4:	Design and develop various needs in the vehicle.
CO5:	Troubleshoot the various problem in a two and three wheeler.

TEXT BOOKS:

1.	Gaetano Cocco, "Motorcycle Design and Technology", Giorgio Nada Editore (April 1, 2013)
2.	Irving, P.E., "Motor cycle Engineering", Temple Press Book, London, 1992

REFERENCE BOOKS:

1.	Mick Walker, "Motorcycle: Evolution, design and Passion", Johns Hopkins, 2006.
2.	Marshall Cavensih, "Encyclopedia of Motor cycling, 20 volumes", New York and London, 1989.
3.	John Robinson, "Motorcycle Tuning: Chasis", Butterworth-Heinemann, 2001
4.	Service Manuals of Manufacturers of Indian Two & Three wheelers.



Course Code	Course Title	Periods per week				Credits
191ATE503T	INDUSTRIAL ENGINEERING AND MANAGEMENT PRINCIPLES	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To enable the students to study the evolution of Management,
2. To understand the functions and principles of management and to learn the application of the principles in an organization.

UNIT	TITLE	PERIODS
1	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	9
Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.		
UNIT	TITLE	PERIODS
2	PLANNING	9
Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques-Decision making steps and process.		
UNIT	TITLE	PERIODS
3	ORGANISING	9
Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.		
UNIT	TITLE	PERIODS
4	DIRECTING	9
Foundations of individual and group behavior – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.		
UNIT	TITLE	PERIODS
5	CONTROLLING	9
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	The students will be able to have clear understanding of managerial functions. and have same basic knowledge on international aspect of management.
CO2:	To understand management functions like planning, organizing, staffing, leading & controlling in industry.
CO3:	To apply the some basic knowledge on international aspect of management.
CO4:	The students develop the skills in Productivity problems and management control.
CO5:	To analyze the Strategic Management Planning Tools and Techniques

TEXT BOOKS:

1.	Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10 th Edition, 2009.
2.	JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.

REFERENCE BOOKS:

1.	Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7 th Edition, Pearson Education, 2011.
2.	Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
3.	Harold Koontz & Heinz Wehrich, "Essentials of Management", Tata McGraw Hill, 1998.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE504T	MECHANICS OF MACHINES	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To understand the principles in the formation of mechanisms and their kinematics.
2.	To understand the effect of friction in different machine elements.
3.	To understand the importance of balancing and vibration.

UNIT	TITLE	PERIODS
1	BASICS AND KINEMATICS OF MECHANISM	9
Classification of mechanisms, Basic kinematic concepts and definitions, Degree of freedom. Mobility Kutzbach criterion, Gruebler's criterion, Grashof's Law, Kinematic inversions of four-bar chain and slider crank chains. Displacement, velocity and acceleration analysis of simple mechanisms, Graphical method– Velocity and acceleration polygons.		
UNIT	TITLE	PERIODS
2	KINEMATICS OF CAM MECHANISMS AND FRICTION IN MACHINE ELEMENTS	9

Classifications of CAM and follower, Terminology and Definitions, Displacement Diagram, Uniform velocity, parabolic, simple harmonic and cycloidal motion, Derivatives of follower motions. Types of friction, Friction Drives friction in clutches and Belt drives.

UNIT	TITLE	PERIODS
3	GEARS AND GEAR TRAINS	9

Law of toothed gearing, Involute and cycloidal tooth profiles, Spur Gear terminology and definitions, Gear tooth action – contact ratio, Interference and undercutting, nonstandard teeth. Gear trains – parallel axis gears trains – epicyclic gear trains.

UNIT	TITLE	PERIODS
4	BALANCING OF MACHINES	9

Static and Dynamic balancing, Balancing of revolving and reciprocating masses, Balancing machines, Balancing a single cylinder engine – Balancing of Multi-cylinder inline. Partial balancing in engines, V-Engines.

UNIT	TITLE	PERIODS
5	VIBRATION	9

Free, forced and damped vibrations of single degree of freedom systems, force transmitted to supports, vibration Isolation, and vibration absorption, Torsional vibration of shafts, single and multi-rotor systems ,geared shafts, critical speed of shafts.

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Discuss the basics of mechanism and Calculate velocity and acceleration in simple mechanisms.
CO2:	Develop CAM profiles and Examine friction in machine elements.
CO3:	Critically solve the problems on gears and gear trains.
CO4:	Understood the importance of balancing and Governors& Gyroscopic effects.
CO5:	Analyze the vibration in various machine parts.

TEXT BOOKS:

1.	Vijay.K. Jain “1. Kurmi R.S, “Theory of machines”, Eurasia Publishing house [PVT] Ltd ., 2016.
2.	Rattan, S.S, “Theory of Machines”, 4th Edition, Tata McGraw-Hill, 2014
3.	Ambekar A.G.,Mechanism and Machine Theory Prentice Hall of India, New Delhi, 2007

REFERENCE BOOKS:

1.	Ghosh.A, and A.K.Mallick, —Theory and Machine II, Affiliated East-West Pvt. Ltd., New Delhi, 1988.
2.	Ramamurthi. V., "Mechanisms of Machine", Narosa Publishing House, 2005.
3.	Rao.J.S. and Dukkipatti R.V. —Mechanisms and Machines II, Wiley-Eastern Ltd., New Delhi, 1998.
4.	Robert L.Norton, "Design of Machinery", McGraw-Hill, 2012.
5.	Thomas Bevan, —Theory of MachinesII, CBS Publishers and Distributors, 2010.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE601T	NOISE, VIBRATION, AND HARSHNESS	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	Knowledge in basic of vibration and noise
2.	Understanding the effect of noise an human comfort and environment
3.	Knowing the methods of vibration and noise measurement.

UNIT	TITLE	PERIODS
1	FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION	9
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	TITLE	PERIODS
2	EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE	9
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	TITLE	PERIODS
3	TRANSPORTATION NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL	9
Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise Prediction and Control—Diesel, Exhaust and Intake Noise and Acoustical Design of Mufflers, Tire/Road Noise—Generation, Measurement, and Abatement, Aerodynamic Sound Sources in Vehicles—Prediction and Control, Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.		
UNIT	TITLE	PERIODS
4	INTERIOR TRANSPORTATION NOISE AND VIBRATION SOURCES - PREDICTION AND CONTROL	9
Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors- Prediction and Control,		
UNIT	TITLE	PERIODS
5	NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES	9
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 PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand the source of noise, vibration pertain to an automobile.
CO2:	Analyze the effect of noise, vibration pertain to an automobile.
CO3:	Apply the concept to predict the control techniques of noise, vibration pertain to an automobile.
CO4:	Understand measurement techniques of noise, vibration pertain to an automobile
CO5:	Analyze the vibration in various machine parts.

TEXT BOOKS:

1.	Clarence W. de Silva , “Vibration Monitoring, Testing, and Instrumentation “,CRC Press, 2007
2.	David A.Bies and Colin H.Hansen “Engineering Noise Control: Theory and Practice “Spon Press, London, 2009

REFERENCE BOOKS:

1.	Allan G. Piersol ,Thomas L. Paez “Harris’ Shock and Vibration Handbook” , McGraw-Hill, New Delhi, 2010
2.	Colin H Hansen “Understanding Active Noise Cancellation“ , Spon Press , London 2003
3.	Matthew Harrison “Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles “, Elsevier Butterworth-Heinemann, Burlington, 2004



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE602T	PROFESSIONAL ETHICS IN ENGINEERING	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.
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UNIT	TITLE	PERIODS
1	HUMAN VALUES	9
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for		

others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT	TITLE	PERIODS
2	ENGINEERING ETHICS	9
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.		
UNIT	TITLE	PERIODS
3	ENGINEERING AS SOCIAL EXPERIMENTATION	9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.		
UNIT	TITLE	PERIODS
4	SAFETY, RESPONSIBILITIES AND RIGHTS	9
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.		
UNIT	TITLE	PERIODS
5	GLOBAL ISSUES	9
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand the core values that shape the ethical behavior of an engineer.
CO2:	Recognize the awareness on professional ethics with stress management
CO3:	Understand the basic perception of various moral issues in ethical theories
CO4:	Manipulate the various social issues in engineering field
CO5:	Discover the professional responsibilities of an engineering safety issues.
CO6:	Solve the several of global issues by ethical principles.

TEXT BOOKS:

1.	Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2.	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

REFERENCE BOOKS:

1.	Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
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2.	Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3.	Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
4.	John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
5.	Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6.	World Community Service Centre, 'Value Education', Vethathiri publications, Erode, 2011.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE603T	AUTOMOTIVE FUELS AND LUBRICATION	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To understand the properties of fuels in internal combustion Engine.
2.	To identify the lubricants used in the automobile.
3.	To study various fuel and lubricants manufacturing process.
4.	To have command over various fuels rating methods.

UNIT	TITLE	PERIODS
1	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	TITLE	PERIODS
2	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	TITLE	PERIODS
3	LUBRICANTS	9
Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.		
UNIT	TITLE	PERIODS
4	PROPERTIES AND TESTING OF FUELS	9
Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, flashpoint, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pourpoint, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion etc.		
UNIT	TITLE	PERIODS

5	COMBUSTION AND FUEL RATING	9
SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Know about the fuels and lubrications manufacturing process.
CO2:	Understand about the need of lubrication in the automobile.
CO3:	Understand about the automotive lubricants and their properties.
CO4:	Impart knowledge in automotive fuels testing methods.
CO5:	Know about combustion and fuel rating of automotive fuels.

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", Dhanpatraipublication, 2003.
3.	Obert.E.F "Internal Combustion Engineering and Air Pollution", International book Co., 1988.

REFERENCE BOOKS:	
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.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE604T	COMPOSITE MATERIALS AND MECHANICS	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To understand the composite materials and its applications in automotive industry
2.	To impart knowledge in several composite materials production processes.

3.	To understand the various types of composite materials
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UNIT	TITLE	PERIODS
1	INTRODUCTION	9
Reinforcement – Fibres – Glass fibre, Aramid fibre, Carbon fibre, boron fibre – Fabrication – Properties – Applications – Comparison of fibres – Particulate and whisker reinforcements. Matrix materials – Properties-Wettability – Effect of surface roughness – Interfacial bonding – Methods for measuring bond strength.		
UNIT	TITLE	PERIODS
2	POLYMER MATRIX COMPOSITES	9
Polymer Matrix Composites -Types – Processing – Thermal matrix composites – Hand layup and spray technique, filament winding, Pultrusion, resin transfer moulding, autoclave molding – Thermoplastic matrix composites – Injection molding, film stacking – Diaphragm forming – Thermoplastic tape laying. Glass fibre/polymer interface. Mechanical properties – Fracture. Applications.		
UNIT	TITLE	PERIODS
3	METAL MATRIX COMPOSITES	9
Metal Matrix Composites Types. Important metallic matrices. Processing – Solid state, liquid state, deposition, Mechanical properties. Applications.		
UNIT	TITLE	PERIODS
4	CERAMIC MATRIX COMPOSITES	9
Ceramic matrix materials – Processing – Hot pressing, liquid infiltration technique, Lanxide process, insitu chemical reaction techniques – CVD, CVI, sol gel process. Interface in CMCs. Mechanical properties – Thermal shock resistance – Applications.		
UNIT	TITLE	PERIODS
5	COMPOSITE STRUCTURES	9
Fatigue – S-N curves – Fatigue behaviors of CMCs – Fatigue of particle and whisker reinforced composites – Hybrid composites – Thermal fatigue – Creep ,AUTOMOTIVE APPLICATIONS: Drive Shafts, Suspension Arms, Wheels, Valve Guides, Clutch Plates, use of MMC in disc brakes, Mufflers and other applications.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Classify the characterization of different composite materials.
CO2:	Demonstrate the polymer matrix composite manufacturing processes.
CO3:	Identify different metal matrix composites and their productions with justification
CO4:	Enumerate the ceramic applications in the composite materials.
CO5:	Analyze current automotive applications of composite materials in the industry.

TEXT BOOKS:	
1.	Handbook of Composites – American Society of Metals, 1990.
2.	Derek Hull, “An introduction to Composite Materials”, Cambridge University Press, 1988.

REFERENCE BOOKS:	
1.	Mallick P K “ Fiber Reinforced Composites- Materials , Manufacturing and Design” ”, CRC Press and Taylor and Francis Group,2007.
2.	Mathews F L and Rawlings R D, “Composite Materials: Engineering and Science”, CRC Press and Woodhead Publishing Limited, 2002.
3.	Krishnan K Chawla, “Composite Materials Science and Engineering”, Springer, 2001.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE701T	ALTERNATIVE FUELS AND ENERGY SYSTEMS	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To know about the types of alternative fuels and energy sources for IC engines.

UNIT	TITLE	PERIODS
1	ALCOHOLS AS FUELS	9
Introduction to alternative fuels. - Need for alternative fuels - Availability of different alternative fuels for SI and CI engines. Alcohols as fuels. Production methods of alcohols. Properties of alcohols as fuels. Methods of using alcohols in CI and SI engines. Blending, dual fuel operation, surface ignition and oxygenated additives. Performance emission and combustion characteristics in CI and SI engines.		
UNIT	TITLE	PERIODS
2	VEGETABLE OILS AS FUELS	9
Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Trans-esterification and emulsification of Vegetable oils – Performance in engines – Performance, Emission and Combustion Characteristics in diesel engines.		
UNIT	TITLE	PERIODS
3	HYDROGEN AS ENGINE FUEL	9
Production methods of hydrogen. Combustive properties of hydrogen. Problems associated with hydrogen as fuel and solutions. Different methods of using hydrogen in SI and CI engines. Performance, emission and combustion analysis in engines. Hydrogen storage - safety aspects of hydrogen.		
UNIT	TITLE	PERIODS
4	BIOGAS, NATURAL GAS AND LPG AS FUELS	9
Production methods of Biogas, Natural gas and LPG. Properties studies. CO ₂ and H ₂ S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines.		
UNIT	TITLE	PERIODS
5	ELECTRIC, HYBRID AND FUEL CELL VEHICLES	9
Layout of Electric vehicle and Hybrid vehicles – Advantages and drawbacks of electric and hybrid vehicles. System components, Electronic control system – Different configurations of Hybrid vehicles. Power split device. High energy and power density batteries – Basics of Fuel cell vehicles.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Have the knowledge Alcohol as fuels and performance on various Engines.
CO2:	Use Vegetable oil as alternate fuels in CI engines.
CO3:	Use Hydrogen gas as engine Fuel.
CO4:	Generate Bio Gas, CNG and LPG as fuel
CO5:	Have the basic knowledge on Electric, Hybrid and fuel cell vehicles

TEXT BOOKS:

1.	Ayhan Demirbas, 'Biodiesel A Realistic Fuel Alternative for Diesel Engines', Springer-Verlag London Limited 2008, ISBN-13: 9781846289941
2.	Arumugam S. Ramadhas, "Alternative Fuels for Transportation" CRC Press, 2011 by Taylor and Francis Group LLC.

REFERENCE BOOKS:

1.	Devaradjane. Dr. G., Kumaresan. Dr. M., "Automobile Engineering", AMK Publishers, 2013.
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.	Science direct Journals (Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy, etc.) on biofuels.
5.	Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE702T	NEW GENERATION AND HYBRID VEHICLES	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To illustrate the new generation vehicles and their operation and controls
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UNIT	TITLE	PERIODS
1	INTRODUCTION	7
Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, vehicles, fuel cells vehicles.		
UNIT	TITLE	PERIODS
2	POWER SYSTEM AND NEW GENERATION VEHICLES	11

Hybrid Vehicle engines, Stratified charge engines, lean burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, flexible fuel systems.

UNIT	TITLE	PERIODS
3	VEHICLE OPERATION AND CONTROL	9

Computer Control for pollution and noise control and for fuel economy – Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

UNIT	TITLE	PERIODS
4	VEHICLE AUTOMATED TRACKS	9

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel, GPS.

UNIT	TITLE	PERIODS
5	SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY	9

Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air bags- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand electric vehicle technology and electric vehicles
CO2:	Perform design calculations of hybrid system under study
CO3:	Perform design calculations of hybrid system under study
CO4:	Understand the various vehicle power sources in hybrid vehicle technology
CO5:	Identify different areas of new generation and hybrid vehicles.

TEXT BOOKS:

1.	Bosch Hand Book, SAE Publication, 2000
2.	Heinz, "Modern Vehicle Technology" Second Edition

REFERENCE BOOKS:

1.	Advance hybrid vehicle power transmission, SAE.
2.	Light weight electric for hybrid vehicle design.
3.	Noise reduction, Branek L.L., McGraw Hill Book company, New York, 1993.



Course Code	Course Title	Periods per week				Credits
191ATE703T	VEHICLE AIR-CONDITIONING	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

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

UNIT	TITLE	PERIODS
1	AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS	9
Purposes of Heating, Ventilation and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system. Psychrometry – Basic terminology and Psychrometric mixtures- Psychrometric Chart- Related problems.		
UNIT	TITLE	PERIODS
2	AUTOMOTIVE COOLING AND HEATING SYSTEM	9
Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system- Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system.		
UNIT	TITLE	PERIODS
3	AIR-CONDITIONING CONTROLS, DELIVERY SYSTEM AND REFRIGERANTS	9
Types of Control devices- Preventing Compressor damage- Preventing damage to other systems- Maintaining driveability- Preventing Overheating Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.		
UNIT	TITLE	PERIODS
4	AUTOMATIC TEMPERATURE CONTROL	9
Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system		
UNIT	TITLE	PERIODS
5	SYSTEM SERVICING AND TESTING	9
Special tools for servicing vehicle air conditioning – Diagnosing components and air conditioning systems- Diagnosing cooling system- Air delivery system- Automatic temperature Control system diagnosis and service		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Students able to acquired adequate knowledge about vehicle air conditioning fundamentals.
CO2:	Students understand the various components of automotive air conditioning systems.
CO3:	Students can identify the problem in AC system.
CO4:	Students can understand semi and automatic temperature control system for AC.
CO5:	Students can understand AC testing and services.

TEXT BOOKS:

1.	Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and Air Conditioning systems", Classroom Manual, Pearson Prentice Hall, 2004
2.	William H Crouse and Donald L Anglin, "Automotive Air conditioning", McGraw Hill Inc., 1990.

REFERENCE BOOKS:

1.	Goings,L.F., "Automotive Air Conditioning", American Technical services, 1974.
2.	Mitchell Information Services, Inc., "Mitchell Automatic Heating and Air Conditioning Systems", Prentice Hall Inc., 1989.
3.	McDonald,K.L., "Automotive Air Conditioning", Theodore Audel series, 1978.
4.	Paul Weisler, "Automotive Air Conditionioing", Reston Publishing Co. Inc., 1990.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE704T	AUTOMOTIVE SAFETY	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To understand the safety system of the automobile.
2.	To make use the various types of safety system in the automobile.
3.	To apply the various safety techniques in vehicles.
4.	To understand the comfort and Convenience systems in automobiles.

UNIT	TITLE	PERIODS
1	INTRODUCTION	9
Basic safety features of vehicles, Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.		
UNIT	TITLE	PERIODS
2	SAFETY CONCEPTS	9

Active safety: driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT	TITLE	PERIODS
3	SAFETY EQUIPMENTS	9

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

UNIT	TITLE	PERIODS
4	COLLISION WARNING AND AVOIDANCE	9

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

UNIT	TITLE	PERIODS
5	COMFORT AND CONVENIENCE SYSTEM	9

Steering and mirror adjustment, central locking system, keyless entry system, garage door opening system, tyre pressure control system, rain sensor system, environment information system.

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	To understand the safety equations in automobiles.
CO2:	To apply the various types of safety concept in automobiles.
CO3:	To understand the functions of various safety devices in vehicles.
CO4:	To understand collision warning sensors in automobiles.
CO5:	To use the various types of safety comfort systems in automobiles.

TEXT BOOKS:

1.	Bosch, "Automotive Handbook", 8 th Edition, SAE publication, 2011.
2.	Powloski. J., "Vehicle Body Engineering", Business books limited, London, 1969.

REFERENCE BOOKS:

1.	Ronald.K.Jurgen, Automotive Electronics Handbook, Second Edition, McGraw-Hill Inc., 1999.
2.	Jullian Happian, Smith An Introduction to Modern Vehicle Design, SAE, 2002.



Course Code	Course Title	Periods per week				Credits
191ATE801T	COMPUTER INTEGRATED MANUFACTURING SYSTEMS	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system

UNIT	TITLE	PERIODS
1	INTRODUCTION	9
Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system –Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.		
UNIT	TITLE	PERIODS
2	PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING	9
Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.		
UNIT	TITLE	PERIODS
3	CELLULAR MANUFACTURING	9
Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.		
UNIT	TITLE	PERIODS
4	FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS)	9
Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control – Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.		
UNIT	TITLE	PERIODS
5	INDUSTRIAL ROBOTICS	9
Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.		

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Explain the basic concepts of CAD, CAM and computer integrated manufacturing systems
CO2:	Summarize the production planning and control and computerized process planning
CO3:	Differentiate the different coding systems used in group technology
CO4:	Explain the concepts of flexible manufacturing system (FMS) and automated guided vehicle (AGV) system
CO5:	Classification of robots used in industrial applications

TEXT BOOKS:

1.	Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.
2.	Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

REFERENCE BOOKS:

1.	Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach" Chapman & Hall, London, 1995.
2.	Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India.
3.	Rao. P, N Tewari &T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE802T	RENEWABLE ENERGY SOURCES	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To get exposure on solar radiation and its environmental impact to power, various collectors used for storing solar energy and applications in solar energy.
2.	To learn about the wind energy and biomass and its economic aspects.
3.	To know about geothermal energy with other energy sources.

UNIT	TITLE	PERIODS
1	PRINCIPLES OF SOLAR RADIATION	9
Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.		
UNIT	TITLE	PERIODS

2	SOLAR ENERGY COLLECTION	9
Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.		
UNIT	TITLE	PERIODS
3	SOLAR ENERGY STORAGE AND APPLICATIONS	9
Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications solar heating/ cooling technique, solar distillation and drying, photovoltaic energy conversion.		
UNIT	TITLE	PERIODS
4	WIND ENERGY	9
Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria. BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.		
UNIT	TITLE	PERIODS
5	GEOTHERMAL ENERGY	9
Resources, types of wells, methods of harnessing the energy, potential in India. OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. TIDAL AND WAVE ENERGY: Potential and conversion techniques, mini-hydel power plants, and their economics. DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, and principles of DEC.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Understand the physics of solar radiation.
CO2:	Classify the solar energy collectors and methodologies of storing solar energy.
CO3:	Applying solar energy in a useful way.
CO4:	Explain wind energy and biomass with its economic aspects.
CO5:	Capturing and applying other forms of energy sources like wind, tidal, wave and geothermal energies.

TEXT BOOKS:	
1.	Rai G.D. , "Non-Conventional Energy Sources", Khanna Publishers, 2011
2.	Twidell & Wier, "Renewable Energy Resources", CRC Press (Taylor & Francis), 2011

REFERENCE BOOKS:	
1.	Tiwari and Ghosal, "Renewable energy resources", Narosa Publishing House, 2007
2.	Ramesh R & Kumar K.U , "Renewable Energy Technologies",Narosa Publishing House, 2004
3.	Mittal K M , "Non-Conventional Energy Systems", Wheeler Publishing Co. Ltd, New Delhi, 2003
4.	Kothari D.P, Singhal ., K.C., "Renewable energy sources and emerging technologies", P.H.I, New Delhi, 2010



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE803T	VEHICLE MAINTENANCE	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To know about the various methods of maintaining vehicles and their subsystems.

UNIT	TITLE	PERIODS
1	MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS	10
Maintenance – Need ,importance, primary and secondary functions, policies - classification of Maintenance work-vehicle insurance- basic problem diagnosis. Automotive service procedures– workshop operations – workshop manual - vehicle identification. Safety Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools measuring instruments– condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.		
2	ENGINE AND ENGINE SUBSYSTEM MAINTENANCE	8
General Engine service- Dismantling of Engine components- Engine repair- working on the underside ,front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system,Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls		
3	TRANSMISSION AND DRIVELINE MAINTENANCE	8
Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings servicing differential assemblies- fault diagnosis.		
4	STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE	11
Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shockabsorbers. Dismantling and assembly procedures. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, power steering system		
5	AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE	10
Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Maintenance and also the step by step procedure for maintain the various automotive sub systems.
CO2:	Ability to identify the faults and knowledge on maintenance.
CO3:	The student can able to understand the importance of maintain the various automotive sub systems.
CO4:	The student can able to understand the importance of maintain the Vehicle body repair.
CO5:	Ability to identify the faults and knowledge on driveline maintenance.

TEXT BOOKS:

1.	Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2.	Vehicle Service Manuals of reputed manufacturers

REFERENCE BOOKS:

1.	Bosch Automotive Handbook, Sixth Edition, 2004
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Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE804T	SPECIAL PURPOSE VEHICLES	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	The students will be able to understand the various Off road vehicle and their systems and features.
2.	To understand the function and components of Farm Equipment's, Military and Combat Vehicles.
3.	To understand the basic vehicle system for off road vehicle such as brake, steering etc.

UNIT	TITLE	PERIODS
1	CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES	6
Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi axle vehicles.		
UNIT	TITLE	PERIODS
2	EARTH MOVING MACHINES	10
Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrapers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.		
UNIT	TITLE	PERIODS

3	SCRAPPERS, GRADERS, SHOVELS AND DITCHERS	10
Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.		
UNIT	TITLE	PERIODS
4	FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES	8
Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.		
UNIT	TITLE	PERIODS
5	VEHICLE SYSTEMS, FEATURES	11
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.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Know the fundamental knowledge about various type of off road vehicles.
CO2:	Understand the special features about the earth moving machines and other off road vehicles.
CO3:	Select and apply the appropriate design methodology for the off road vehicles.
CO4:	Understand the knowledge about the working principle for various type of off road vehicles.
CO5:	Remember the knowledge about application of the off road vehicles and can apply the new methodology to improve the performance of the vehicles.

TEXT BOOKS:	
1.	Robert L Peurifoy, "Construction, planning, equipment and methods" Tata McGraw Hill Publishing company Ltd.
2.	Nakra C.P., "Farm machines and equipments" Dhanparai Publishing company Pvt. Ltd.
3.	Abrosimov.K. Bran berg.A and Katayer.K., "Road making machinery", MIR Publishers, Moscow, 1971.
4.	Wong.J.T., "Theory of Ground Vehicles", John Wiley & Sons, New York, 1987.

REFERENCE BOOKS:	
1.	Ia. S. Ageikin, "Off the Road Wheeled and Combined Traction Devices: Theory and Calculation", Ashgate Publishing Co. Ltd. 1988.
2.	Schulz Erich.J, "Diesel equipment I & II", McGraw Hill company, London, 1982.
3.	Bart H Vanderveen, "Tanks and Transport Vehicles", Frederic Warne and Co Ltd., London.
4.	Satyanarayana. B., "Construction planning and equipment", standard publishers and distributors, New Delhi, 1985



Course Code	Course Title	Periods per week				Credits
191ATE805T	NON DESTRUCTIVE TESTING AND EVALUATION	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To enable the students to understand basic principles of NDT and its applications.

UNIT	TITLE	PERIODS
1	OVERVIEW OF NDT	9
NDT Versus Destructive Testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided.		
2	SURFACE NDE METHODS	9
Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing		
3	ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE)	9
Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique –Principle, AE parameters, Applications		
4	RADIOGRAPHY (RT)	9
Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films – graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography		
5	EDDY CURRENT TESTING (ET) and LEAK AND PRESSURE TESTING	9
Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation. Leak and pressure testing: Definition of leak and types, Principle, Various methods of pressure and leak testing, Application and limitation		

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

- | | |
|-------------|--|
| CO1: | Demonstrate the ultrasonic inspection methods of NDT. |
| CO2: | Test the surfaces by the various surface NDT techniques. |

CO3:	Understand the basic concept of Ultrasonic inspection method.
CO4:	Understand the basic concept of radiographic inspection method.
CO5:	Recognize the various testing methods.

TEXT BOOKS:	
1.	Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.
2.	Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010

REFERENCE BOOKS:	
1.	ASM Metals Handbook,"Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2.	Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005
3.	Charles, J. Hellier," Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.
4.	ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook, Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE806T	OPERATIONS RESEARCH	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT	TITLE	PERIODS
1	LINEAR MODELS	15
The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.		
UNIT	TITLE	PERIODS
2	TRANSPORTATION MODELS AND NETWORK MODELS	8
Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.		
UNIT	TITLE	PERIODS
3	INVENTORY MODELS	6
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.		

UNIT	TITLE	PERIODS
4	QUEUEING MODELS	6
Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.		
UNIT	TITLE	PERIODS
5	DECISION MODELS	10
Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Use the Linear programming optimization techniques for use engineering and Business problems.
CO2:	Understand the Transportation model and Network models for optimize the solution.
CO3:	Get the knowledge in Inventory models
CO4:	Analyze the problem by Queueing Models
CO5:	Remember the decision models for Linear programming solution.

TEXT BOOKS:

1.	Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.
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REFERENCE BOOKS:

1.	Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
2.	Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 1990.
3.	Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4.	Hillier and Libebberman, "Operations Research", Holden Day, 1986
5.	Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
6.	Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.



Course Code	Course Title	Periods per week				Credits
191ATE807T	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1. To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT	TITLE	PERIODS
1	ENTREPRENEURSHIP	9
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.		
2	MOTIVATION	9
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.		
3	BUSINESS	9
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.		
4	FINANCING AND ACCOUNTING	9
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.		
5	SUPPORT TO ENTREPRENEURS	9
Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

- | | |
|-------------|---|
| CO1: | define who is an Entrepreneur and what his or her characteristic features are, what skills made them successful and what qualities are required to become an Entrepreneur. |
| CO2: | understand the concept of Business environment and the various factors influencing it, Government and its role in encouraging and supporting Entrepreneurship through various services including EDP training programs. |

CO3:	get the capabilities to select Products, doing a pre-feasibility study, and prepare a feasibility report and evaluate it.
CO4:	explain the various issues involved in starting a venture, apply the growth strategies and scaling up the venture and also how to launch a product.
CO5:	start a venture, monitor and evaluate it for avoiding sickness, how to revive sick units and effectively manage small business units.

TEXT BOOKS:

1.	Khanka. S.S, "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
2.	Donald F Kuratko, "Entrepreneuership – Theory, Process and Practice", 9th Edition, Cengage Learning, 2014.

REFERENCE BOOKS:

1.	Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2.	Mathew J Manimala, Enterpreneuership theory at cross roads: paradigms and praxis", 2 nd Edition, Dream tech, 2005.
3.	Rajeev Roy, 'Entrepreneurship', 2nd Edition, Oxford University Press, 2011.
4.	EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATE808T	TRANSPORT MANAGEMENT	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	The students are able to manage a transport fleet and their related activities for minimizing operational cost.
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UNIT	TITLE	PERIODS
1	INTRODUCTION	9
Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.		
UNIT	TITLE	PERIODS
2	TRANSPORT SYSTEMS	9
Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.		
UNIT	TITLE	PERIODS

3	SCHEDULING AND FARE STRUCTURE	9
Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.		
UNIT	TITLE	PERIODS
4	MOTOR VEHICLE ACT	9
Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.		
UNIT	TITLE	PERIODS
5	MAINTENANCE	9
Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:	
Upon completion of this course, student will be able to:	
CO1:	Know about different aspects related to interview process and Job description.
CO2:	Knowledge about various transport systems and advantages of motor transport.
CO3:	Features of scheduling, fixing the fares
CO4:	Know about the motor vehicle act and the maintenance aspects of transport.
CO5:	Know about the motor vehicle act and maintenance aspects of transport.

TEXT BOOKS:	
1.	John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2.	Kitchin.L.D., "Bus Operation", III edition, Illiffie and Sons Co., London, 1992.

REFERENCE BOOKS:	
1.	Government Motor Vehicle Act, Publication on latest act to be used as on date



SYLLABUS OF OPEN ELECTIVES

Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATO601T	MOTOR VEHICLE ACT, INSURANCE & POLICY	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	To learn about basic act and regulation followed for road vehicle
2.	To learn about systematic steps involved to get licence and registration of motor vehicle
3.	To learn about various types of motor vehicle polices and insurances

UNIT	TITLE	PERIODS
1	LICENSING OF DRIVERS OF MOTOR VEHICLES	9

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on conviction- Endorsement.

UNIT	TITLE	PERIODS
2	REGISTRATION OF MOTOR VEHICLE	9

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

UNIT	TITLE	PERIODS
3	INSURANCE OF MOTOR VEHICLE	9

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

UNIT	TITLE	PERIODS
4	CONTROL OF TRANSPORT VEHICLES	9

Power to State Government to control road transport- Transport authorities- General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles- Temporary permits

UNIT	TITLE	PERIODS
5	OFFENCES AND PUNISHMENT	9

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously /

its Abetment Driving an uninsured vehicle Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Explain the analysis of rules and regulations for road vehicles
CO2:	Analyze the procedure for getting driving license for vehicles at national and international level
CO3:	Analyze the procedure for registration of vehicles.
CO4:	Analyze the procedure for Insurance of vehicles and claims.
CO5:	Analyze the procedure for obtaining Government Permits and renewal
CO6:	Analyze the consequences of not following the rules and regulations

TEXT BOOKS:

1.	The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2.	A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCE BOOKS:

1.	The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications & Table of Offences and Punishments Asia Law House; 15th edition (2014)
	Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATO602T	Theory of I.C Engine	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	Knowledge in usage of software for simulating the performance of IC engines
2.	Acquiring ability to simulate the various types combustion processes of IC engines.
3.	Knowledge in performance simulation of IC engines.

UNIT	TITLE	PERIODS
1	COMBUSTION OF FUELS	9

Chemical composition and molecular structure of hydrocarbon fuels. Combustion Stoichiometry of hydrocarbon fuels – Chemical energy and heat of reaction calculations – Chemical equilibrium and adiabatic flame temperature calculation. Theory of SI and CI engine combustion – Flame velocity and area of flame front. Fuel spray characteristics – droplet size, depth of penetration and atomization.

UNIT	TITLE	PERIODS
2	ENGINE CYCLE ANALYSIS	9
Ideal air, fuel air cycle and actual cycle analysis. Progressive combustion analysis in SI engines. Parametric studies on work output, efficiency and other engine performance.		
UNIT	TITLE	PERIODS
3	COMBUSTION MODELLING	9
Basic concepts of engine simulation – Governing equations, Classification of engine models- Thermodynamic models for Intake and exhaust flow process – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models for SI engine and CI engines.		
UNIT	TITLE	PERIODS
4	NON-CONVENTIONAL IC ENGINES	9
Concept of L.H.R. engine and its recent developments. Variable compression ratio engine and its use in engine research. Wankel rotary combustion engine. Dual fuel engine concept for multi fuel usage in CI engines - performance studies on dual fuel engine. Free piston engine. Stratified charge and lean burn engines . Locomotive and marine engines.		
UNIT	TITLE	PERIODS
5	COMBUSTION ANALYSIS IN IC ENGINES	9
Photographic studies of combustion processes – Analysis of Pressure crank angle diagrams in SI and CI engines. Knock study for Pressure crank angle histories. Apparent heat release rate and Wiebe's law analysis for combustion. Calculation of Ignition delay and combustion duration. – Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.		

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand various types of I.C. Engines and Cycles of operation.
CO2:	Analyze the effect of various operating variables on engine performance
CO3:	Identify fuel metering and fuel supply systems for different types of engines
CO4:	Understand normal and abnormal combustion phenomena in SI and CI engines
CO5:	Evaluate performance Analysis of IC Engine and Justify the suitability of IC Engine for different application
CO6:	Understand the conventional and non-conventional fuels for IC engines and effects of emission formation of IC engines, its effects and the legislation standards.

TEXT BOOKS:

1.	Ganesan,V., "Internal combustion engines", Tata McGraw Hill Publishing Co., 1994.
2.	Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderabad, 1996.

REFERENCE BOOKS:

1.	Benson,R.S., Whitehouse,N.D., "Internal Combustion Engines", Pergamon Press, Oxford, 1979.
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2.	Ganesan,V., "Compute Simulation of Compression Ignition engine process", Universities Press (India) Ltd., Hyderabad, 1996.
3.	John,B., Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill Publishing Co., New York, 1990.
4.	Ramalingam. K.K., "Internal combustion engine", scitech publications, Chennai, 2003.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATO701T	LATEST TECHNOLOGY IN HYBRID VEHICLES	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:
1. To illustrate the new generation vehicles and their operation and controls

UNIT	TITLE	PERIODS
1	INTRODUCTION	7
Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, vehicles, fuel cells vehicles.		
UNIT	TITLE	PERIODS
2	POWER SYSTEM AND NEW GENERATION VEHICLES	11
Hybrid Vehicle engines, Stratified charge engines, lean burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, flexible fuel systems.		
UNIT	TITLE	PERIODS
3	VEHICLE OPERATION AND CONTROL	9
Computer Control for pollution and noise control and for fuel economy – Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.		
UNIT	TITLE	PERIODS
4	VEHICLE AUTOMATED TRACKS	9
Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel, GPS.		
UNIT	TITLE	PERIODS
5	SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY	9
Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air bags- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.		
TOTAL PERIODS:		45

COURSE OUTCOMES:
Upon completion of this course, student will be able to:

CO1:	Understand electric vehicle technology and electric vehicles
CO2:	Perform design calculations of hybrid system under study
CO3:	Perform design calculations of hybrid system under study
CO4:	Understand the various vehicle power sources in hybrid vehicle technology
CO5:	Identify different areas of new generation and hybrid vehicles.

TEXT BOOKS:	
1.	Bosch Hand Book, SAE Publication, 2000
2.	Heinz, "Modern Vehicle Technology" Second Edition

REFERENCE BOOKS:	
1.	Advance hybrid vehicle power transmission, SAE.
2.	Light weight electric for hybrid vehicle design.
3.	Noise reduction, Branek L.L., McGraw Hill Book company, New York, 1993.



Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATO702T	ELECTRIC VEHICLE TECHNOLOGY	3	0	0	0	3

PREREQUISITES:
NIL

COURSE OBJECTIVES:	
1.	To understand the fundamental concepts, principles, analysis and design of electric vehicles.
2.	To Impart knowledge on the batteries and other energy sources
3.	To understand different aspects of drives application.

UNIT	TITLE	PERIODS
1	NEED FOR ELECTRIC VEHICLES	9
Need of electric vehicles – comparative study of diesel, petrol, and pure electric vehicles. Limitations of electric vehicles, Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, Classification - according to the source of power and the drive arrangement, Configuration of electric vehicles, Performance of electric vehicles.		
UNIT	TITLE	PERIODS
2	ENERGY SOURCES AND CHARGING	9
Requirements of energy sources in electric vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Charging of electric vehicles-home charging, public charging, swap station, inductive charging. Locations and type of chargers.		
UNIT	TITLE	PERIODS

3	PROPULSION MOTORS AND CONTROLLERS	9
Requirements of motor for electric vehicles, electric components used in electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency. Energy Management Strategies used in electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.		
UNIT	TITLE	PERIODS
4	ELECTRIC DRIVE TRAINS	9
Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Steering system for electric vehicles, Suspension for electric vehicles, Brake system for electric vehicles.		
UNIT	TITLE	PERIODS
5	DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES	9
Aerodynamic-Rolling resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering- Tyre choice- Wing Mirror, Aerials and Luggage racks. Case Studies: Design of a Battery Electric Vehicle (BEV).		
TOTAL PERIODS:		45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Understand the subsystems and components used in electric vehicles.
CO2:	Differentiate electric and hybrid vehicles.
CO3:	Select the suitable charging methods for electric vehicles.
CO4:	Understand the drive trains used in different configurations of electric vehicles.
CO5:	Apply design considerations for electric vehicles.

TEXT BOOKS:

1.	Ali Emadi et al., Vehicular Electric Power Systems, Marcel Dekker, Inc, 2004.
2.	C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, Oxford University Press, 2001.
3.	James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons, 2003.

REFERENCE BOOKS:

1.	Ron HodKinson, "light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005
2.	Lino Guzzella, " Vehicle Propulsion System" Springer Publications, 2005.
3.	Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press, 2003.
4.	Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press, 2005



Course Code	Course Title	Periods per week				Credits
191ATO801T	TROUBLESHOOTING AND MAINTENANCE OF VEHICLES	L	T	P	R	
		3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

- To know about the various methods of maintaining vehicles and their subsystems.

UNIT	TITLE	PERIODS
1	MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS	10
Maintenance – Need ,importance, primary and secondary functions, policies - classification of Maintenance work-vehicle insurance- basic problem diagnosis. Automotive service procedures– workshop operations – workshop manual - vehicle identification. Safety Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools measuring instruments– condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.		
2	ENGINE AND ENGINE SUBSYSTEM MAINTENANCE	8
General Engine service- Dismantling of Engine components- Engine repair- working on the underside ,front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system,Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls		
3	TRANSMISSION AND DRIVELINE MAINTENANCE	8
Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings servicing differential assemblies- fault diagnosis.		
4	STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE	11
Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, power steering system		
5	AUTO ELECTRICAL AND AIR CONDITIONING MAINTENANCE	10
Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.		

TOTAL PERIODS: 45

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Maintenance and also the step by step procedure for maintain the various automotive sub systems.
CO2:	Ability to identify the faults and knowledge on maintenance.
CO3:	The student can able to understand the importance of maintain the various automotive sub systems.
CO4:	The student can able to understand the importance of maintain the Vehicle body repair.
CO5:	Ability to identify the faults and knowledge on driveline maintenance.

TEXT BOOKS:

1.	Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2.	Vehicle Service Manuals of reputed manufacturers

REFERENCE BOOKS:

1.	Bosch Automotive Handbook, Sixth Edition, 2004
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Course Code	Course Title	Periods per week				Credits
		L	T	P	R	
191ATO802T	OFF ROAD VEHICLES	3	0	0	0	3

PREREQUISITES:

NIL

COURSE OBJECTIVES:

1.	The students will be able to understand the various Off road vehicle and their systems and features.
2.	To understand the function and components of Farm Equipment's, Military and Combat Vehicles.
3.	To understand the basic vehicle system for off road vehicle such as brake, steering etc.

UNIT	TITLE	PERIODS
1	CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES	6
Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi axle vehicles.		
UNIT	TITLE	PERIODS
2	EARTH MOVING MACHINES	10
Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.		
UNIT	TITLE	PERIODS
3	SCRAPPERS, GRADERS, SHOVELS AND DITCHERS	10

Scrapers, elevating graders, motor graders, self powered scrapers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

UNIT	TITLE	PERIODS
4	FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES	8

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

UNIT	TITLE	PERIODS
5	VEHICLE SYSTEMS, FEATURES	11

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.

TOTAL PERIODS:	45
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COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1:	Know the fundamental knowledge about various type of off road vehicles.
CO2:	Understand the special features about the earth moving machines and other off road vehicles.
CO3:	Select and apply the appropriate design methodology for the off road vehicles.
CO4:	Understand the knowledge about the working principle for various type of off road vehicles.
CO5:	Remember the knowledge about application of the off road vehicles and can apply the new methodology to improve the performance of the vehicles.

TEXT BOOKS:

1.	Robert L Peurifoy, "Construction, planning, equipment and methods" Tata McGraw Hill Publishing company Ltd.
2.	Nakra C.P., "Farm machines and equipments" Dhanparai Publishing company Pvt. Ltd.
3.	Abrosimov.K. Bran berg.A and Katayer.K., "Road making machinery", MIR Publishers, Moscow, 1971.
4.	Wong.J.T., "Theory of Ground Vehicles", John Wiley & Sons, New York, 1987.

REFERENCE BOOKS:

1.	Ia. S. Ageikin, "Off the Road Wheeled and Combined Traction Devices: Theory and Calculation", Ashgate Publishing Co. Ltd. 1988.
2.	Schulz Erich.J, "Diesel equipment I & II", McGraw Hill company, London, 1982.
3.	Bart H Vanderveen, "Tanks and Transport Vehicles", Frederic Warne and Co Ltd., London.
4.	Satyanarayana. B., "Construction planning and equipment", standard publishers and distributors, New Delhi, 1985

