S. No.	Course Code	Course title	Cate Gory	Periods per week			Total Contact Periods	Credits
				L	T	P		
THEORY								
1.	AU3501	Mechanics of Machines	PCC	3	0	0	3	3
2.	AU3502	Automotive Electrical and Electronics	PCC	3	0	0	3	3
3.		Professional Elective I	PEC	-	-	-	-	3
4.		Professional Elective II	PEC	-	-	-	-	3
5.		Professional Elective III	PEC	-	-	-	-	3
6.		Professional Elective IV	PEC	-	-	-	-	3
7.		Mandatory Course-I**&**	MC	3	0	0	3	0
PRACTICALS								
8.	AU3511	Automotive Electrical and Electronics Laboratory	PCC	0	0	4	4	2
			TOTAL	-	-	-	-	**20**

& **Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC- I)**

SEMESTER VI

S. No.	Course Code	Course title	Cate Gory	Periods per week			Total Contact Periods	Credits
				L	T	P		
THEORY								
1.	AU3601	Automotive Pollution and Control	PCC	3	0	0	3	3
2.		Open Elective I*	OEC	3	0	0	3	3
3.		Professional Elective V	PEC	-	-	-	-	3
4.		Professional Elective VI	PEC	-	-	-	-	3
5.		Professional Elective VII	PEC	-	-	-	-	3
6.		Professional Elective VIII	PEC	-	-	-	-	3
7.		Mandatory Course-II**&**	AC	3	0	0	3	0
8.		NCC Credit Course Level 3#		3	0	0	3	3#
PRACTICALS								
9.	AU3611	Computer Aided Vehicle Design and Analysis Laboratory	PCC	0	0	4	4	2
10.	AU3612	Engine Testing and Emission Measurement Laboratory	PCC	0	0	4	4	2
			TOTAL	-	-	-	-	**22**

*Open Elective – I shall be chosen from the emerging technologies.

& **Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC- II)**

**NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA**

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ELECTIVE – MANAGEMENT COURSES

Sl. No.	Course Code	Course Title	Cate Gory	Periods per week			Total Contact Periods	Credits
				L	T	P		
1.	GE3751	Principles of Management	HSMC	3	0	0	3	3
2.	GE3752	Total Quality Management	HSMC	3	0	0	3	3
3.	GE3753	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4.	GE3754	Human Resource Management	HSMC	3	0	0	3	3
5.	GE3755	Knowledge Management	HSMC	3	0	0	3	3
6.	GE3792	Industrial Management	HSMC	3	0	0	3	3

MANDATORY COURSES I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3081	Introduction to Women and Gender Studies	MC	3	0	0	3	0
2.	MX3082	Elements of Literature	MC	3	0	0	3	0
3.	MX3083	Film Appreciation	MC	3	0	0	3	0
4.	MX3084	Disaster Risk Reduction and Management	MC	3	0	0	3	0

MANDATORY COURSES II

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3085	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	MC	3	0	0	3	0
2.	MX3086	History of Science and Technology in India	MC	3	0	0	3	0
3.	MX3087	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0
4.	MX3088	State, Nation Building and Politics in India	MC	3	0	0	3	0
5.	MX3089	Industrial Safety	MC	3	0	0	3	0

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1 : ELECTRIC VEHICLES

Sl. No.	Course code	Course title	Category	Periods Per week			Total Contact periods	Credits
				L	T	P		
1.	AU3001	Electric Two and Three Wheelers	PEC	3	0	0	3	3
2.	AU3002	Batteries and Management system	PEC	3	0	0	3	3
3.	AU3003	Traction Motors	PEC	3	0	0	3	3
4.	AU3004	Automotive Power Electronics	PEC	3	0	0	3	3
5.	AU3005	Automotive Functional Safety	PEC	3	0	0	3	3
6.	AU3006	Fuel Cell Technologies	PEC	3	0	0	3	3
7.	AU3007	Autonomous and Connected Vehicles	PEC	3	0	0	3	3
8.	AU3008	Sensors and Actuators	PEC	3	0	0	3	3

VERTICAL 2: COMPUTATIONAL DESIGN

Sl. No.	Course Code	Course title	Category	Periods Per week			Total contact periods	Credits
				L	T	P		
1.	AU3009	Computer Aided Design and Manufacturing	PEC	3	0	0	3	3
2.	AU3010	Integrated Computational Materials Engineering	PEC	3	0	0	3	3
3.	AU3011	Computational Theory on Solid Mechanics	PEC	3	0	0	3	3
4.	AU3012	Computational and Visualization Theory	PEC	3	0	0	3	3
5.	AU3013	Computer Integrated Manufacturing in Automotive Sector	PEC	3	0	0	3	3
6.	AU3014	Computational Aero Dynamics	PEC	3	0	0	3	3
7.	AU3015	CFD and Heat transfer	PEC	3	0	0	3	3
8.	AU3016	Digital Manufacturing of Automobiles	PEC	3	0	0	3	3

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VERTICAL 3: VEHICLE RESEARCH AND VALIDATION

Sl. No.	Course code	Course title	Category	Periods Per week			Total Contact periods	Credits
				L	T	P		
1.	AU3017	Advanced Automotive Materials	PEC	3	0	0	3	3
2.	AU3018	Noise, Vibration and Harshness	PEC	3	0	0	3	3
3.	AU3019	Combustion Thermodynamics and Heat Transfer	PEC	3	0	0	3	3
4.	AU3020	Alternative Fuels and Energy Systems	PEC	3	0	0	3	3
5.	AU3021	Automotive Instrumentation	PEC	3	0	0	3	3
6.	AU3022	Testing and Measurement Systems	PEC	3	0	0	3	3
7.	AU3023	Homologation	PEC	3	0	0	3	3
8.	AU3024	IC Engine Process Modelling	PEC	3	0	0	3	3

VERTICAL 4: SPECIAL PURPOSE VEHICLES

Sl. No.	Course code	Course title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1.	AU3025	Agricultural Vehicles	PEC	3	0	0	3	3
2.	AU3026	Defence Vehicles	PEC	3	0	0	3	3
3.	AU3027	Constructions Vehicles	PEC	3	0	0	3	3
4.	AU3028	Marine Vehicles	PEC	3	0	0	3	3
5.	AU3029	Space Vehicles	PEC	3	0	0	3	3
6.	CME386	Gas Dynamics and Jet Propulsion	PEC	3	0	0	3	3
7.	CRA332	Drone Technologies	PEC	3	0	0	3	3

VERTICAL 5 : PRODUCT AND PROCESS DEVELOPMENT

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1.	AU3030	Automotive Product Design	PEC	3	0	0	3	3
2.	AU3031	Ergonomics in Automotive Design	PEC	3	0	0	3	3
3.	AU3032	Vehicle Control Systems	PEC	3	0	0	3	3
4.	CME339	Additive Manufacturing	PEC	2	0	2	4	3
5.	AU3033	Finite Element Analysis	PEC	3	0	0	3	3
6.	AU3034	New Product Development Process	PEC	3	0	0	3	3
7.	AU3035	Automotive Product Life Cycle Management	PEC	3	0	0	3	3
8.	CAU332	Dynamics of Ground Vehicles	PEC	3	0	0	3	3

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4. Determination of Cloud and pour point of given oil.
5. Conduct of ASME distillation test of fuels (gasoline / diesel).
6. Determination of Carbon residue on given sample of lubrication oil.
7. Determination of Calorific value of liquid fuel by using bomb calorimeter.
8. Conduct of Penetration test for the given sample.
9. Determination of Density test of different fuels

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to:
Develop skills and understand various testing methods adopted to assess quality of fuels and lubricants like

1. Viscosity
2. Importance of flash, fire point
3. Cloud and pour point
4. Calorific value
5. Density

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	2	3	1	2	2		1	1		2		1	3
2	1	1	2	3	1	2	2		1	1		2		1	3
3	1	1	2	3	1	2	2		1	1		2		1	3
4	1	1	2	3	1	2	2		1	1		2		1	3
5	1	1	2	3	1	2	2		1	1		2		1	3
Avg.	1	1	2	3	1	2	2		1	1		2		1	3

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AU3501　　　　　　　　**MECHANICS OF MACHINES**　　　　　**L T P C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3 0 0 3

COURSE OBJECTIVES:
The objective of this course is to prepare the students to acquire knowledge and skills to analyze various types of kinematic mechanisms, cams and gears, effect of friction in power transmission, vibration and balancing.

UNIT I　　　MECHANISMS　　　　　　　　　　　　　　　　　　　　9
Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint and motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II　　　FRICTION　　　　　　　　　　　　　　　　　　　　　9
Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (Flat and V) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNIT III　　　GEARS AND CAMS　　　　　　　　　　　　　　　　9
Gear – Types and profile – nomenclature of spur and helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV　　　VIBRATION　　　　　　　　　　　　　　　　　　　　9

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

UNIT V   BALANCING   9

Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi-cylinder engines – Governors and Gyroscopic effects.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to:
1. Apply the concepts of kinematics and dynamics of machinery in design and analysis of engineering problems.
2. Demonstrate the ability to synthesize and analysis mechanisms
3. Design and analyze cam and their motion.
4. Select the gears and gear trains for their applications.
5. Examine the concept of free, forced and damped vibrations.

TEXT BOOKS:
1. Bansal R.K., "Theory of Machines", Laxmi Publications Pvt Ltd., New Delhi, 20th edition 2009.
2. Rattan S.S., "Theory of machines", Tata McGraw Hill publishing Co., New Delhi, 2nd edition 2011.

REFERENCES:
1. Gosh A and Mallick A.K., "Theory of Machines and Mechanisms", Affiliated East West press, 2009.
2. Malhotra D.R. and Gupta H.C ,"The Theory of machines", Satya Prakasam, Tech. India Publications, 2008.
3. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory", Second Edition, Wiley Eastern Limited, 2006.
4. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw Hill, 2006.
5. Ambekar A.G., "Mechanism and Machine Theory", PHI India Pvt Ltd, 2007

C O	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	2	1	3		2					2		1	3
2	1	1	2	1	3		2					2		1	3
3	1	1	2	1	3		2					2		1	3
4	1	1	2	1	3		2					2		1	3
5	1	1	2	1	3		2					2		1	3
Avg.	1	1	2	1	3		2					2		1	3

PROGRESS THROUGH KNOWLEDGE

AU3502	AUTOMOTIVE ELECTRICAL AND ELECTRONICS	L T P C
		3 0 0 3

COURSE OBJECTIVES:
The objective of this course is to prepare the students to become familiar with the basic concepts and applications of different sensor and actuators used for electronic control, different communication protocols and networking in vehicles

UNIT I   INTRODUCTION AND AUTOMOTIVE BATTERIES   9
Introduction - Overview of vehicle electrical systems- Electrical circuits - Electrical power supply in conventional vehicle- Dimensioning of wires- Circuit diagrams and symbols - Electromagnetic Compatibility and interference suppression. Batteries – Battery design – Method of operation – Lead acid battery construction – Battery ratings and testing- Maintenance -free batteries – Battery– Substitute, versions, special cases

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UNIT II STARTING AND CHARGING SYSTEM 9
Alternators – Generation of electrical energy in vehicle- physical principles- Alternator and voltage regulations versions – power losses – characteristics curve- Alternator operation in the vehicle- Alternator circuitry. Starter Motors – Development and Starting requirements in the IC engines starter motor design – Starter motor design variations – starter motor control and power circuits

UNIT III IGNITION, LIGHTING AND AUXILLARY SYSTEM 9
Ignitions System - Ignition fundamentals- Electronic ignition- Programmed ignition- Distributor less ignition -Direct ignition - Spark plugs. Automotive lighting Technology – Technical demands – Development of lighting technology- Light sources – physical principles – Front and rear lighting system- Interior lighting system – Special purpose lamps – Adaptive Lighting system - Instrument clusters - Wiper and Washer systems- electric horns

UNIT IV AUTOMOTIVE ELECTRONICS AND SENSORS AND ACTUATORS 9
Automotive Electronics- overview and demands- Basic principles of semiconductor technology - Electronic Components- semiconductor components- Microcontrollers - Sensor-Signal Processing - Data Processing in the vehicle - Glossary for automotive microelectronics. Automotive Sensors – Basics – Sensors : Position, speed, leration/Vibrational , Force/Torque, Flow meters, Gas/Concentration , Temperature- Measured Quantities, Measuring Principles and automotive applications Automotive Actuators - Electromechanical actuators- Fluid-mechanical actuators- Electrical machines- Direct-current machines- Three-phase machines- Single-phase alternating-current Machines - Duty-type ratings for electrical machines

UNIT V VEHICLE NETWORKING 9
Data transfer between automotive Electronics systems - Basic principles of networking- Network topology- Network organization- OSI reference model- Control mechanisms - communication protocols in embedded systems- - Vehicle Communication Protocols – Cross-system functions - Requirements for bus systems- Classification of bus systems- Applications in the vehicle -Coupling of networks- Examples of networked Vehicles - Bus system- CAN, LIN, Flexray – MOST etc.

TOTAL:45 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to:
1. Define the glossary related to vehicle electrical and electronic system
2. Explain the need for starter batteries, starter motor and alternator in the vehicle.
3. Differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols
4. List common types of sensor and actuators used in vehicles.
5. Understand networking in vehicles.

TEXT BOOK:
1. Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th Edition, 2007, ISBN No: 978-3-658-01783-5

REFERENCES:
1. Barry Holembeak, "Automotive Electrical and Electronics" , Delmar Publishers, Clifton Park,USA,2010
2. James D Halderman, "Automotive Electrical and Electronics", Prentice Hall, USA, 2013
3. Tom Denton, "Automotive Electrical and Electronics Systems," Third Edition, 2004, SAE International
4. William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.

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CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	2	3	1	2	2		1	1		2		1	3
2	1	1	2	3	1	2	2		1	1		2		1	3
3	1	1	2	3	1	2	2		1	1		2		1	3
4	1	1	2	3	1	2	2		1	1		2		1	3
5	1	1	2	3	1	2	2		1	1		2		1	3
Avg.	1	1	2	3	1	2	2		1	1		2		1	3

AU3511   AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY   L T P C
0 0 4 2

COURSEOBJECTIVES:
The objective of this course is to prepare the students to trouble shoot the connectivity and program various electrical and electronics circuits used in automobiles

LIST OF EXPERIMENTS:
Electrical System
1. Study of Vehicle lighting system.
2. Study of an Ignition system.
3. Study of Layout of an Automotive Electrical System.
4. Study of Voltage regulator, solenoids, Horn and wiper mechanism.
5. Testing of Battery – Hydrometer, Load test, Individual Cell voltage test, Jump Start
6. Testing of Starter Motor – Continuity test, Insulation Test, Load test.
7. Testing of Alternator – Continuity test, Insulation Test, Load test.

Electronic System
1. Visualization of Engine Sensor Signals and fault Diagnosis using OBD Kit.
2. Interface of Seven segment display
3. Interfacing of ADC for a sensor and Interfacing of DAC for an actuator
4. Interface circuit like amplifier, filter, Multiplexer and De Multiplexer
5. Basic microprocessor programming like arithmetic and Logic operation, code conversion, waveform generation, look up table etc.
6. Programming in microcontroller
7. Study of Virtual Instrumentation and Communication Protocols (CAN, LIN, MOST etc.)

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to:
1. Understand the working principle of Electrical circuits in automobile.
2. Evaluate the working principle of Battery, and starter motor.
3. Describe the working principle of auxiliary systems used in automobiles.
4. Explain the use of sensors in an automobile.
5. Develop a programing knowledge on Microprocessor

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CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	2	3	1	2	2		1	1		2		1	3
2	1	1	2	3	1	2	2		1	1		2		1	3
3	1	1	2	3	1	2	2		1	1		2		1	3
4	1	1	2	3	1	2	2		1	1		2		1	3
5	1	1	2	3	1	2	2		1	1		2		1	3
Avg.	1	1	2	3	1	2	2		1	1		2		1	3

SEMESTER VI

AU3601   **AUTOMOTIVE POLLUTION AND CONTROL**   **L T P C**
                                                                        3 0 0 3

COURSE OBJECTIVES:
The objective of this course is to prepare the students to have knowledge on the harmful effects of major pollutants of IC engines, emission standards, various pollution measurement devices and control techniques

UNIT I   EMISSION FROM AUTOMOBILES   9
Sources of Pollution. Various emissions from Automobiles — Formation — Effects of pollutants on environment human beings. Emission control techniques – Emission standards - National and international.

UNIT II   EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL   9
Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon, NOx, Smoke — Effects of design and operating variables on emission formation – controlling of pollutants -Catalytic converters — Charcoal Canister — Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion.

UNIT III   EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL   9
Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, EGR, HCCI, Particulate Traps, SCR — Cetane number Effect.

UNIT IV   NOISE POLLUTION FROM AUTOMOBILES   9
Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design.

UNIT V   TEST PROCEDURES AND EMISSION MEASUREMENTS   9
Constant Volume Sampling I and 3 (CVSI & CVS3) Systems- Sampling Procedures — Chassis dyno - Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems — world harmonized driving cycles - Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters. Particle counter

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, students will be able to
1. Differentiate the various emissions formed in IC engines
2. Analyze the effects of pollution on human health and environment
3. Design the control techniques for minimizing emissions
4. Categorize the emission norms
5. Identify suitable methods to reduce the noise emissions.

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