SEMESTER VI

(AU601) AUTOMOTIVE ELECTRICAL & ELECTRONICS SYSTEMS

1. COURSE OBJECTIVES:

Every automobile possesses various kinds of electrical/electronic equipment required for the functioning of the vehicle and sometimes simply as supporting systems to the main vehicle system. This course provides valuable insight into these areas while equipping a student with the necessary fundamentals to tackle problems arising out of malfunctioning of any of these systems.

2. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
AU601 AUTOMOTIVE ELECTRICAL & ELECTRONICS SYSTEM	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU601CO1: Identify the various electrical and electronic components and systems used in automobiles.

AU601CO2: Describe the functions of various electrical and electronic components and accessories used in automobiles.

AU601CO3: Explain the construction and working of various automotive electrical components and systems.

AU601CO4: Apply the knowledge for troubleshooting and maintenance following standard procedures and safety norms.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	0	2	2	2	2	2
CO2	2	0	2	0	0	2	1	2	2
CO3	3	2	2	2	0	2	2	2	1
CO4	3	3	2	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**			
Unit		**M**	**Thr**	**CO**
Unit 1 AUTOMOTIVE BATTERIES		**18**	**10**	
1.1 Lead Acid battery its construction and operation, main components, chemical action.				
1.2 Maintenance-Free batteries- construction				
1.3 Battery ratings and specifications.				**CO1 CO2 CO4**
1.4 Battery maintenance and safety precautions.				
1.5 Battery testing – Open circuit test, Hydrometer Test, Load Test.				
1.6 Battery charging- Slow and fast rate charging and trickle charging.				
1.7 Jump Starting- Procedure and precautions.				
1.8 Battery failures– cycle failure, internal short circuit, overcharging, local action and sulphation.				
Unit 2 WIRING AND ELECTRICAL ACCESSORIES		**15**	**10**	
2.1 Role of electricity in modern vehicles and energy demand.				
2.2 Automotive Lighting: Purpose and construction of each lamp.				
2.2.1 Head lamps: Beam setting and adjustments				
2.2.2 Halogen lamps (components)				
2.2.3 Auxiliary lamps: Driving Lamps, Fog Lamps				
2.3 Headlight reflectors: parabolic and bi-focal				
2.4 Automotive Wiring:				
2.4.1 Electric cables: Cable sizes				
2.4.2 Cable colour codes				**CO1 CO2 CO3**
2.4.3 Wiring harness				
2.4.4 Types of cables (Advantages and Disadvantages).				
2.4.5 Symbols used in electrical wiring.				
2.4.6 Insulated & Earth return systems				
2.4.7 Positive & negative earth systems.				
2.5 Accessories: Construction and Working of				
2.5.1 Ignition warning light				
2.5.2 Horn relay				
2.5.3 Magnetic or coil type Fuel gauge				
2.5.4 Windscreen Wiper Mechanism.				
Unit 3 ELECTRIC MOTORS AND GENERATORS		**12**	**08**	
3.1 DC motors: -Principle, Construction and applications.				
3.2 AC motors: -Principle, Construction and applications.				
3.3 Stepper Motor- Principle, construction, applications and specifications.				
3.4 Introduction, working principle of Alternator.				**CO1 CO2 CO3 CO4**
3.5 Purpose of charging system.				
3.6 Advantage of an Alternator.				
3.7 Alternator: its construction and operation, main components, Rectification from AC to DC.				
3.8 Regulators: Electronic voltage regulator and its advantages.				

3.9 Maintenance, trouble shooting and its remedies.			
Unit 4 STARTING SYSTEM	**15**	**10**	
4.1 Construction and working of starting system.			
4.2 Types of starter drive (Bendix and overrunning clutch types only) construction and working.			**CO1 CO2 CO3 CO4**
4.3 Testing of starting system – Quick testing, Current draw test, Insulated circuit resistance test, Ground circuit test, No crank test, free speed test.			
Unit 5 IGNITION SYSTEM	**15**	**10**	
5.1 Need of ignition system.			
5.2 Conventional ignition system: its construction and operation, main components. - (Ignition coils, distributor, contact breaker, dwell angle, ballast resistor, capacitor).			**CO1 CO2 CO3**
5.3 CDI system: its construction and operation.			
5.4 Distributer-less ignition system: its construction and operation.			
5.5 Electronic ignition system with contactless trigger: its construction and operation.			
5.6 Electronic Spark advance.			
Total	**75**	**48**	

6. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Automotive Batteries	10	18
2	Wiring and Electrical Accessories	10	15
3	Electric Motors and Generators	08	12
4	Starting System	10	15
5	Ignition System	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

Sr. No.	Practical	Marks
1	Study of various components Lead Acid Battery.	
2	Study of various components of different types of Ignition system.	
3	Study of automotive wiring system.	
4	Study of various components of a Dynamo.	
5	Study of various components of an Alternator.	
6	Study of various components of a Starter Motor.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Al Santini	Automotive Technology (Electricity and Electronics)	Cengage Learning
2	W. Crouse & D. Anglin	Automotive Mechanics	McGraw Hill
3	A.W Judge	Auto Electrical Maintenance	Sir Isaac Pitman & Sons
4	P. L. Kohli	Automotive Electrical	Tata McGraw-Hill
5	C.P. Nakra	Auto Electrical Systems	Dhanpat Rai Publication

(AU602) ADVANCE AUTOMOBILE ENGINES

1. COURSE OBJECTIVES:

This subject deals with the aspects of injection systems in both Petrol as well as Diesel Engines, while also covering up topics like supercharging, emission control which are important features of the modern day automobile. It also provides a student with a brief insight into the diagnostics of the engine.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
AU602 ADVANCE AUTOMOBILE ENGINES		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**
		3	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

3. COURSE OUTCOMES:

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

AU602CO1: Describe the fundamentals of various automobile engine systems.

AU602CO2: Explain the operating principles, construction and functions of various automobile engine systems.

AU602CO3: Select appropriate diagnostic tools for inspection and troubleshooting of faults associated with different automobile engine systems.

AU602CO4: Analyse engine condition by performing various tests.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	0	0	2	2	3	2
CO2	3	2	2	0	2	2	2	2	1
CO3	3	3	2	3	3	3	3	3	3
CO4	3	3	2	3	3	3	2	2	2

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**				
Unit			**M**	**Thr**	**CO**
Unit 1 THEORY OF COMBUSTION			**12**	**06**	
1.1 Stages of combustion in SI engine					**CO1**
1.2 Effect of engine variables on Ignition lag.					
1.3 Effects of engine variables on flame propagation					
1.4 Abnormal combustion- Detonation, pre-ignition and their effects					
1.5 Control of detonation.					
1.6 Stages of combustion in CI engine					
1.7 Air Fuel ratio in Diesel engines					
1.8 Delay period and variables affecting delay period.					
1.9 Diesel knock and its control.					
Unit 2 PETROL & DIESEL ELECTRONIC INJECTION SYSTEM			**18**	**12**	
2.1 Petrol EFI systems: - Functions, Operating Principles.					**CO1 CO2 CO3**
2.2 Air-Fuel ratio metering & requirement, Stoichiometric A/F ratio					
2.3 Types of Petrol EFI systems: - TBI & MPFI. Comparison of MPFI and TBI systems.					
2.4 Main components of the Petrol EFI system					
2.4.1 Air Induction system components &it's function: - Air Filters, Throttle body assembly, Air box & Intake Manifold.					
2.4.2 Fuel Injection system & it's function: - Fuel Tank & Electric Fuel Pumps, Fuel Pressure Regulator & Fuel Lines, Fuel Filters, Fuel Accumulator, Fuel Injector Design & operation.					
2.4.3 Electronic control system: - Functions & Composition of the Engine Control Unit.					
2.5 Sensing Devices & it's applications in EFI: - O2 sensors, Thermistors, Potentiometers, Pressure sensors, Mass Air Flow sensors, Hall Effect Switches, Optical Sensors, Detonation sensors.					
2.6 Actuating devices & it's applications in EFI: - Solenoids, Relays.					
2.7 Diesel EFI systems: - Functions, Operating Principles.					
2.8 Types of Diesel EFI systems: - EUI & CRDI					
2.9 CRDI: - Main components and their function (Fuel tank and Transfer pump, Fuel Filters, High pressure fuel pump, Fuel metering control valve, Fuel rail pressure control valve, Fuel rail pressure sensor, Common rail, Fuel Injectors.					
2.9.1 Common Rail Fuel Injection sub-systems: - Low pressure, High pressure delivery and fuel leak back circuit					
2.10 Advantages of a CRDI system over conventional systems.					
Unit 3 FUEL ECONOMY, AIR POLLUTION AND EMISSION CONTROL			**15**	**08**	
3.1 Fuel Economy standards.					
3.2 Pollutants from gasoline engines.					
3.3 Gasoline engine emission control, Catalytic Converters.					

3.4 Diesel emission, Diesel smoke and control			
3.5 Electronically controlled Exhaust-Gas recirculation (EGR) system.			
3.6 Positive crankcase ventilation (PCV) system			**CO1**
3.7 Electric assist choke system			**CO2**
3.8 Evaporation emission control system.			**CO3**
3.9 Euro Norms and Bharat stage Norms.			
3.10 Theory of Gas Analysis. (Concentration Sampling, Constant Volume Sampling)			
Unit 4 SUPERCHARGERS AND TURBOCHARGERS	**12**	**10**	
4.1 Introduction and Objectives of supercharging			
4.2 Supercharging of SI and CI engines, its effects on performance			
4.3 Supercharging Limits			
4.4 Reducing Supercharger drag			**CO1**
4.5 Types of Superchargers: Construction and Operation of Root type, Spiral or (Scroll) type, Centrifugal type.			**CO2** **CO3**
4.6 Turbocharger, its construction, operation, main components			**CO4**
4.7 Electronically controlled Waste-gate.			
4.8 Turbocharger Lag			
4.9 Turbocharger trouble diagnosis and service.			
Unit 5 I.C. ENGINE TESTING AND DIAGNOSTICS	**18**	**12**	
5.1 Engine Power – Indicated, Brake and Frictional Power.			
5.2 Efficiency- Mechanical, Thermal, Relative and Volumetric.			
5.3 Morse test, Motoring test.			
5.4 Heat Balance Sheet.			**CO3**
5.5 Diagnostic Trouble Codes.			**CO4**
5.6 Technical Service Bulletins.			
5.7 Pinpoint testing. (Testing of a load component. Testing of PCM)			
5.8 Purpose, Function, Advantages & Limitation of the following diagnostic Equipment. Scan tools. Breakout Boxes. Non-Powered Test Lights. Logic Probes.			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Theory Of Combustion	6	12
2	Petrol & Diesel electronic Injection System	12	18
3	Fuel Economy, Air Pollution And Emission Control	08	15
4	Superchargers And Turbochargers	10	12
5	I.C. Engine Testing And Diagnostics	12	18
	Total	**48**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Performance Test on Single Cylinder 4-stroke SI or CI Engine.	
2	Performance Test on Double Cylinder 4-stroke SI or CI Engine.	
2.	Heat Balance Test of Single Cylinder 4-Stroke CI Engine.	
3.	Morse Test on 4-Stroke Double Cylinder CI Engine.	
4.	Study of Induction and Exhaust system of Turbocharged Engine.	
5.	Study of injection system for SI system.	
6.	Study of injection system for CI system.	
7.	Perform Exhaust Gas Analysis of an engine exhaust using gas Analyzer.	
	Total	**25**

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	W. Crouse & D. Anglin	Automotive Mechanics	McGraw Hill
2	Ken Pickerill	Automotive Engineering (Engine Performance)	CENGAGE Learning
3	Joseph Heitner	Automotive Mechanics	Automotive Mechanics
4	Tim Gills	Automotive Service	Delmar Publisher Inc.

(AU603) AUTOMOBILE CHASSIS AND BODY SYSTEMS

1. COURSE OBJECTIVES:

The students will able to comprehend information on automotive aerodynamics, body construction & design and vehicle corrosion prevention. They will gain fundamental knowledge on the construction and working of steering, suspension, braking and HVAC systems in an automobile. They will also be able to attain basic knowledge on the maintenance, troubleshooting and diagnosis of the steering, suspension, braking and HVAC systems.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
		L	**T**	**P**	C	**TH**	**TM**	**PR /OR**	**TW**	
AU603 AUTOMOBILE CHASSIS AND BODY SYSTEMS		**3**	**-**	**2**	**5**	**75**	**25**	**-**	**25**	**125**

3. COURSE OUTCOMES:

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

AU603CO1: State the purpose and necessity of different automobile chassis and body systems.

AU603CO2: Describe the fundamentals of different automotive chassis systems and automotive aerodynamics.

AU603CO3: Explain the construction and working of different automobile chassis and body systems.

AU603CO4: Apply the knowledge for diagnosis and troubleshooting of issues related to automobile chassis and body systems.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1	2	0	0	2	2	2	1
CO2	3	2	2	0	1	2	2	2	2
CO3	3	2	2	1	2	2	2	3	2
CO4	3	3	3	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | Thr = Teaching hours | CO = Course Objectives			
Unit	**M**	**Thr**	**CO**
Unit 1 STEERING SYSTEMS	**15**	**10**	**CO1 CO2 CO3 CO4**
1.1 Front Wheel Assembly & Types of Axles.			
1.2 Purpose & necessity of steering systems.			
1.3 Types of Steering gears: 1.3.1 Recirculating ball type: Construction & working. 1.3.2 Rack and Pinion type: Construction & working.			
1.4 Power steering systems: 1.4.1 Hydraulic Power Steering: Construction & working. 1.4.2 Electronic Power Steering: Construction & working.			
1.5 Front Wheel geometry, Wheel alignment & Balancing			
1.6 Diagnosis and troubleshooting of steering systems			
Unit 2 SUSPENSION SYSTEMS	**18**	**12**	**CO1 CO2 CO3 CO4**
2.1 Purpose & necessity of suspension systems.			
2.2 Types of springs: - Coil, Leaf, Torsion, Air spring.			
2.3 Types of Shock absorber: - Twin-tube shock, Mono-tube, Spring-assisted.			
2.4 Dependent and Independent systems: Features, Advantages of Independent over dependent type.			
2.5 Front & Rear Suspension systems: 2.5.1 Coil spring Suspension: Double wishbone type / Short-Long arm type (SLA): Construction & Main Parts. 2.5.2 MacPherson Strut Suspension: Construction & Main Parts. 2.5.3 Leaf Spring Suspension: Construction & Main Parts. 2.5.4 Torsion Bar Suspension: Construction & Main Parts. 2.5.5 Air suspension system: Construction & Main Parts.			
2.6 Anti-Roll / Stabilizer Bar			
2.7 Diagnosis & troubleshooting of Suspension systems.			
Unit 3 BRAKING SYSTEMS	**18**	**12**	**CO1 CO2 CO3 CO4**
3.1 Purpose and necessity of braking system.			
3.2 Classification of brakes and braking systems.			
3.3 Principle, construction and working of – disc brakes, drum brake			
3.4 Construction and working of the following braking systems: 3.4.1 Mechanical braking system 3.4.2 Hydraulic Braking system. 3.4.3 Air Braking system.			
3.5 Properties of Brake material, Brake fluids and their specifications			
3.6 Parking Brakes			
3.7 Diagnosis & troubleshooting of Braking systems.			

Unit 4 BODY ENGINEERING AND AERODYNAMICS	**12**	**8**	
4.1 Introduction to body engineering: Vehicle body requirements, Visibility, Classifications based on type of construction and body shapes.			
4.2 Monocoque and Space frame construction.			
4.3 Vehicle major body sections & nomenclature of various structural body parts: Front section, Centre section and Rear section.			
4.4 Industrial Automotive Painting: Study of different stages involved in Automotive Painting			
4.5 Vehicle body protection & rust prevention techniques: 4.5.1 Conversion Coatings 4.5.2 Hot Melt Wax Coatings 4.5.3 E-Coating 4.5.4 Metallic Coatings 4.5.5 Organic & Powder Coatings 4.6 Vehicle Aerodynamics: Introduction and its Importance			**CO2**
4.7 Various Aerodynamic Forces: Aerodynamic Lift and Aerodynamic Drag			
4.8 Concept of an Airfoil, Basics of Boundary layer flow and Flow separation.			
4.9 Down Force and Grounding effect.			
4.10 Diffusers, Spoilers, Dams, Wings, Vortex generators			
Unit 5 AUTOMOTIVE AIR CONDITIONING	**12**	**6**	
5.1 Purpose of the HVAC system.			
5.2 Air conditioning components (Function, Construction and Operation) 5.2.1 Compressor (Piston type, Vane type, Swash plate type) 5.2.2 Condenser. 5.2.3 Evaporator. 5.2.4 Orifice tube. 5.2.5 Thermostatic Expansion Valve. 5.2.6 Receiver-dryer. 5.2.7 Accumulator.			**CO1** **CO2** **CO3**
5.3 Servicing of AC systems. 5.3.1 Refrigerant Identification. 5.3.2 Vacuum Pump. 5.3.3 Evacuating Procedure. 5.3.4 Refrigerant Charging. 5.3.5 Refrigerant Recovery.			
Total	**75**	**48**	

6. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	STEERING SYSTEMS	10	15
2	SUSPENSION SYSTEMS	12	18
3	BRAKING SYSTEMS	12	18
4	BODY ENGINEERING AND AERODYNAMICS	08	12
5	AUTOMOTIVE HEATING, VENTILATION AND AIR CONDITIONING	06	12
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1.	Study of different Steering section:- Recirculating ball, Rack & Pinion, hydraulic power steering.	
2.	Study of different Suspension systems:- Twin-Tube type Shock absorber MacPherson, SLA, Leaf spring type.	
3.	Study of different types of braking systems.	
4.	Diagnosis & Troubleshooting of Braking systems.	
5.	Study of automotive HVAC system.	
6.	Dismantling and Assembling of Master cylinder, wheel cylinder assembly.	
7.	Diagnosis & Troubleshooting of Steering & Suspension systems.	
8.	Servicing of air conditioning system.	
	Total	25

9. LEARNING RESOURCES

9.1 Text Books

S. No.	Author	Title of Books	Publishers
1	Anthony Schwaller	Motor Automotive Technology	Delmar Publisher Inc.
2	Crouse / Anglin	Automobile Mechanics	Tata McGraw- Hill
3	Kirpal Singh	Automobile Engineering Vol.I	Standard Publication
4	R.B. Gupta	Automobile Engineering	Satya Prakashan New Delhi
5	S. Srinivisan	Automotive Mechanics	Tata McGraw- Hill

9.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Boyce H. Dwiggins	Automobile Air Conditioning	THOMSON LEARNING
2	Tim Gills	Automotive Service	Delmar Publisher Inc.
3	Anil Chikara	Automobile Engineering Vol. II	Satya Prakashan New Delhi

(AU604) MODERN AUTOMOTIVE SYSTEMS

1. COURSE OBJECTIVES:

The students will able to gain exposure to several modern automotive technologies related to stability, suspension and braking, safety, comfort and convenience, vehicle engine & drive train systems. They will also be able to attain basic knowledge on the working principle, construction and working of such modern automotive systems.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
AU604 MODERN AUTOMOTIVE SYSTEMS		**L**	**T**	**P**	**C**	**TH**	**TM**	**PR /OR**	**TW**	
		3	**-**	**-**	**3**	**75**	**25**	**-**	**-**	**100**

3. COURSE OUTCOMES:

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

AU604CO1: Demonstrate understanding of fundamentals of various modern automotive systems.
AU604CO2: Describe the block diagram of various modern automotive systems.
AU604CO3: Explain the constructional features, working principles and functions of various modern automotive systems.
AU604CO4: Compare the advantages and disadvantages between modern verses conventional automotive systems.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	3	2	2	2	2	3
CO2	3	2	2	2	1	2	2	2	2
CO3	3	2	2	2	2	3	3	2	2
CO4	3	0	0	0	2	2	2	1	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
Unit 1 Modern Automotive Braking, Suspension & Stability systems	**20**	**12**	**CO1 CO2 CO3 CO4**
1.1 Antilock Braking Systems: Working Principle, Construction & main components, Operation & Basic Troubleshooting.			
1.2 Traction Control Systems: Working Principle, Construction & main components, Operation.			
1.3 Electronic Stability Control Program: Construction & main components, Operation, ESP features.			
1.4 Electronic Brake Force Distribution: Construction & Operation.			
1.5 Active Suspension System: Working Principle, Construction & Operation.			
1.6 Liquid Filled Engine Mountings: Operation.			
1.7 Four Wheel Steering: Working Principle, Main Components, and Operation.			
Unit 2 Modern Automotive Safety Systems	**15**	**12**	**CO1 CO2 CO3 CO4**
2.1 Crumple Zones: Necessity, Main Features and Working Principle.			
2.2 Laminated and Tempered Glass: Main Features, Advantages & Applications.			
2.3 Advanced Automatic Collision Notification: Necessity, Main components, Operation.			
2.4 Airbags: Necessity, Types & Location of Airbags, Construction & main components, Operation.			
2.5 Auto Retracting Seat belts: Pre-tensioner & Force Limiter, Construction & Operation.			
2.6 Pedestrian Protection Systems: Necessity, Methods used for Pedestrian Protection (FPS, Active Bonnet, Pedestrian Airbags)			
2.7 Reverse Backup Sensors: Electromagnetic v/s Ultrasonic types, Main components and Working.			
2.8 Adaptive Headlamps: Necessity, Construction & main components, Working principle.			
2.9 Collision Mitigation Braking System: Necessity, Main components, Working.			
2.10 Whiplash protection system: Whiplash, Necessity, Working Principle.			
2.11 Child Safety Seats: Necessity, Types of Child Seats.			
2.12 Collapsible Steering: Necessity and Working Principle.			
Unit 3 Modern Automotive Engine Systems	**15**	**8**	**CO1 CO2**
3.1 Variable Valve Timing: Variable Valve Lift & Variable Cam Phasing, Necessity, Working, Advantages			
3.2 Variable Geometric Turbines: Necessity, Main components, Working, Advantages.			

3.3 Variable Displacement Engines: Necessity, Working principle, Advantages.			**CO3 CO4**
3.4 Start- Stop Systems: Necessity, Main Components, Working.			
3.5 Hybrid Engine Vehicles: Working Principle, Main components, Advantages over Conventional Engines.			
3.6 Electric Vehicles: Working Principle, Advantages over Conventional Engines			
3.7 Flexible Fuel Vehicles: Flex-Fuel Production, Flex Fuel advantages over Conventional Fuels (Petrol, Diesel)			
3.8 Gasoline Direct injection: Principle of Working, Benefits over M.P.F.I. systems			
Unit 4 Modern Automotive Comfort & Convenience Systems	**15**	**10**	
4.1 Telematics: Scope & Applications of telematics in modern automobiles			
4.2 Keyless Go & Push Button Ignition: Features, Basic components & Working, Advantages.			**CO1 CO2 CO3 CO4**
4.3 Power Windows: Comparison with traditional windows, Basic components & working.			
4.4 Power & Memory Seats: Features and Benefits, basic components.			
4.5 UV & IR reducing glass: Features and benefits.			
4.6 Heads Up Display: Features & Benefits, Basic components and working.			
4.7 Adaptive Cruise Control: Features and Advantages, Main components and working.			
Unit 5 Modern Automotive Drive Train Systems	**10**	**6**	
5.1 Electronic Limited Slip Differential: Necessity, Benefits over conventional types, Working principle.			**CO1 CO2 CO3 CO4**
5.2 Run-Flat & Self Sealing tires: Construction and advantages over conventional types.			
5.3 Tire pressure-monitoring systems: Necessity, Main components & Basic working.			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Modern Automotive Braking, Suspension & Stability systems	12	20
2	Modern Automotive Safety Systems	12	15
3	Modern Automotive Engine Systems	08	15
4	Modern Automotive Comfort & Convenience Systems	10	15
5	Modern Automotive Drive Train Systems	06	10
	Total	48	75

8. LEARNING RESOURCES

8.1Text Books

S. No.	Author	Title of Books	Publishers
1	William B. Ribbens	Understanding Automotive Electronics	6th Edition, Newnes/ Butter worth Heinemann Woburn.
2	Crouse / Anglin	Automobile Mechanics	Tata McGraw- Hill
3	Robert N Brady	Automotive computers and Digital Instrumentation	A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey.
4	Ronald K Jurgen	Navigation and Intelligent Transportation systems – Progress in technology	Automotive Electronics Series, SAE, USA.
5	Bechhold	Understanding Automotive Electronics	SAE.
6	LjuboVlacic, Michel Parent and Fumio Harashima	Intelligent Vehicle Technologies	Butterworth-Heinemann publications, Oxford.

8.2 Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Robert Bosch	Automotive Handbook	SAE, 2000
2	Allan W M B	Automotive Computer Controlled Systems	Elsevier Butterworth-Heinemann.

(AU605) AUTOMOBILE WORKSHOP PRACTICE

1. COURSE OBJECTIVES

To provide students with the basic knowledge and skills required in the adjustments, testing, maintenance and repair of various automobile systems. The students will able to demonstrate various skills required while working on jobs using appropriate tools, equipments, instruments and following safety norms and procedures. Students will be able to do troubleshooting of faults in automotive systems.

2. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
AU605 AUTOMOBILE WORKSHOP PRACTICE	-	-	5	5	-	-	50	50	100

3. COURSE OUTCOMES:

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

AU605CO1: Identify various tools, equipments and instruments used in automobile workshop.

AU605CO2: Explain various procedures to be followed for testing repairs and maintenance in automobile workshop.

AU605CO3: Execute testing, repairs and maintenance of various automotive systems using appropriate tools and equipments following proper procedures and safety norms.

AU605CO4: Apply the knowledge for fault finding and trouble shooting.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	2	2	3	0	2	2	2	2
CO2	2	3	2	2	2	2	2	2	1
CO3	3	3	2	3	3	2	3	3	3
CO4	3	3	3	2	2	2	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 Automobile Workshop Basics		**12**	
1.1 Safety Precautions 1.2 Protective clothing 1.3 Measuring tools 1.4 Fasteners, sealants and cleaning liquids. 1.5 Automotive hand tools 1.6 Workshop tools and equipments			**CO1**
2 Engine testing and overhauling		**30**	
2.1 Introduction 2.2 Cylinder bore measurement and calculation of oversize. 2.3 Crankshaft journal measurement and calculation of undersize. 2.4 Troubleshooting 2.5 Compression tests on petrol/diesel engines - Dry & Wet test 2.6 Valve clearance adjustment 2.7 Valve timing 2.8 Lapping of valve seat			**CO1** **CO2** **CO3** **CO4**
3 Maintenance of Petrol and Diesel engine fuel system		**18**	
3.2 Introduction 3.3 Carburetor 3.3 Fuel pump of petrol engine 3.4 Fuel injection pump of diesel engine 3.5 FIP timing. 3.6 Fuel injector 3.7 Testing fuel injector			**CO1** **CO2** **CO3** **CO4**
4 Wheel mechanics		**18**	
4.1 Introduction 4.2 Wheel balancing of rimmed and alloy wheels 4.3 Wheel alignment			**CO1** **CO2** **CO3** **CO4**
5 Auto Body work practice		**24**	
5.1 Introduction 5.2 Automobile body repair 5.3 Removing of dents 5.4 Paints and varnishes 5.5 Materials used for painting 5.6 Preparation of surface 5.6.1 Patching/Body filling, Levelling, Primering, Surfacing 5.7 Painting equipment 5.7.1 Air-compressor and spray-gun, 5.7.2 Its use, care and maintenance and operating instructions 5.8 Type of Spray-painting and advantages of spray painting. 5.9 Manual spray painting 5.10Rust protection			**CO1** **CO2** **CO3**
Total	**-**	**96**	**-**

6. COURSE DELIVERY:

The Course will be delivered through class room interactions, practicals and field visits.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Automobile Workshop Basics	12	
2	Engine testing and overhauling	30	
3	Maintenance of Petrol and Diesel engine fuel system	18	
4	Wheel mechanics	18	
5	Auto Body work practice	24	
	Total	**96**	**-**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Identification of general tools and equipments in an automobile workshop.	
2	Cylinder bore measurement and calculation of oversize.	
3	Crankshaft journal measurement and calculation of undersize.	
4	Compression tests on petrol/diesel engines.	
5	Valve timing and troubleshooting.	
6	Overhauling and setting timing of fuel injection pump.	
7	Overhauling and testing of fuel injector.	
8	Demonstration of Wheel alignment.	
9	Demonstration of Wheel balancing.	
10	Job on Body repair and spray painting.	
	Total	**50**

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Automotive Mechanics	Joseph Heitner	Affilated East west Press Pvt. Ltd, New Delhi
2	Automotive Mechanics	S. Srinivasan	Tata McGraw Hill Publishing Company, New Delhi
3	Automobile Engineering (Vol.2)	Kirpal Singh	Nem Chand Jain, Delhi
4	Automotive Mechanics	William H. Crouse	Tata McGraw Hill Publishing Company, New Delhi

AUDIT COURSE

(AC102) INDIAN CONSTITUTION

1. COURSE OBJECTIVES:

As a proud citizen of this country every student must be aware about the Indian Constitution to appreciate the provisions available for the people of this biggest democracy in Indian Constitution so that the youth of this country plays active role in development of the country by participating in the formation of sensitive and proactive Government at national and state level. This course intends to make students aware about various constituents of the Indian Constitution.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI									
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(AC102) INDIAN CONSTITUTION		L	T	P	H	TH	TM	TW	PR/OR	
		2	-	-	2	-	-	-	-	-

3. Course Content

Unit 1 – The Constitution - Introduction • The History of the Making of the Indian Constitution • Preamble and the Basic Structure, and its interpretation • Fundamental Rights and Duties and their interpretation • State Policy Principles
Unit 2 – Union Government • Structure of the Indian Union • President – Role and Power • Prime Minister and Council of Ministers • Lok Sabha and Rajya Sabha
Unit 3 – State Government • Governor – Role and Power • Chief Minister and Council of Ministers • State Secretariat
Unit 4 – Local Administration • District Administration • Municipal Corporation • Zila Panchayat
Unit 5 – Election Commission • Role and Functioning • Chief Election Commissioner • State Election Commission

4. Suggested Learning Resources:

Title of Book Author Publication
1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi,2008
2. The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition

5. Suggested Software/Learning Websites:

a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/

ELECTIVES-I

(AU611) AUTOMOTIVE QUALITY SYSTEMS

1. COURSE OBJECTIVES:

Through this course the students will acquire the knowledge of quality concepts, tool and techniques used in automotive industries, and also acquire knowledge of quality management system and standards. They will also analyze and apply management tools and techniques for process improvement. Student will also get familiarized with automotive TS16949 quality system practices.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	H	TH	TM	TW	PR/OR	
AU611 AUTOMOTIVE QUALITY SYSTEMS	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU611CO1: Understand the fundamentals of quality and various quality management systems.

AU611CO2: Explain the details of various quality management systems along with tools and techniques.

AU611CO3: Apply management tools and techniques for process improvement.

AU611CO4: Make use of statistical and other quality tools for system analysis.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	0	2	2	2	2
CO2	3	2	1	0	0	2	2	2	2
CO3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	2	3	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**			
Units:		**M**	**Thr**	**CO**
1. BASIC CONCEPTS OF QUALITY		**12**	**9**	
1.1 Quality, classification of quality and services				
1.2 Quality systems overview				
1.3 Product Quality design				
1.4 Quality engineering in design of production processes				
1.5 Quality characteristics				**CO1**
1.6 Quality , Reliability and Safety				**CO2**
1.7 Quality engineering in production				
1.8 Quality engineering in service				
2. QUALITY MANAGEMENT SYSTEMS		**18**	**10**	
2.1 Quality Management – A conceptual Frame Work				
2.2 Dimensions of Quality				
2.3 Costs of Quality				**CO2**
2.4 Quality System Standards				
2.5 ISO 9000 clauses and its interpretations				
2.6 ISO TS16949 clauses and interpretation				
3.MODERN MANAGEMENT TOOLS AND TECHNIQUES		**18**	**12**	
3.1 Introduction to Modern Management Techniques				
3.2 5s concepts				**CO2**
3.3 Kaizen techniques				**CO3**
3.4 Six sigma methodologies				
3.5 Quality circles				
3.6 Taguchi loss function				
3.7 POKE –YOKE Techniques				
3.8 TPM				
4. ISO TS16949 TOOL AND TECHNIQUES		**15**	**08**	
4.1 Advanced Product Quality Planning (APQP)				**CO2**
4.2 Design Failure Mode Effects Analysis				**CO3**
4.3 Process Failure Mode Effects Analysis				
4.4 Production Part Approval Process (PPAP)				
5. QUALITY TOOLS		**12**	**9**	
5.1 Concepts of SPC detection vs. Prevention				
5.2 Data collection methods				**CO2**
5.3 Measures of central tendency and dispersion (Simple numericals) Mean, Median, Mode, Range, Standard deviation and Variance				**CO4**
5.4 Statistical Tools i. Flow chart ii. Histogram iii. Cause and Effect diagram iv. Check sheet v. Control Charts vi Pareto charts				
Total		**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and tutorials.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Basic Concepts of Quality	9	12
2	Quality Management Systems	10	18
3	Modern Management Tools and Techniques	12	18
4	ISO TS16949 Tool And Techniques	8	15
5	Quality Tools	9	12
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS.

No	Practical	Marks
1	With suitable case study demonstrate concepts of quality management and improvement.	
2	Case study to understand the role of technology, managers, employees, and customers in developing a quality-based workplace.	
3	Case study demonstrating the application of Modern Management Tools and Techniques.	
4	Demonstrate data gathering and analysis tools and prepare a report.	
5	Demonstrate Quality Tools.	
6	Case study to understand the ethical issues as related to quality of services and products.	
7	Field visit to identify current trends and benchmark organizations related to Quality Management.	
	Total	25

9. LEARNING RESOURCES

9.1Text Books

S.No.	Author	Title of Books	Publishers
1	David Hoyle,	Automotive quality system Handbook	Butterworth – Heinemann ltd, secondedition,oxford,2000
2	William M Feld	"Lean Manufacturing: Tools, Techniques and How to Use Them"	APICS, 2001

9.2 Reference Books for further study

S.No.	Author	Title of Books	Publishers
1	Montgomery Douglas C	Introduction to Statistical Quality Control	John Wiley and Sons, New Delhi,2007.
2	Logo Thetis N	Managing for Total Quality – From Deming to Taguchi and SPC	Prentice Hall of India, Private Limited, New Delhi, 1997
3	NIL	Advanced product quality planning and control plan	2nd Edition ,Standards media (2008)

(CC503) RENEWABLE ENERGY SYSTEMS AND ENERGY MANAGEMENT

1. COURSE OBJECTIVES:

To compare the different conventional energy sources with renewable energy sources. This course will also provide valuable insight on different energy conservation devices and its applications in the real world. It will also help to conduct energy audits using energy management techniques for energy conservation.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
CC503 RENEWABLE ENERGY SYSTEMS AND ENERGY MANAGEMENT	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

CC503CO1: List the various renewable and non-renewable sources of energy.

CC503CO2: Describe the principle and applications of energy conservation.

CC503CO3: Explain the construction, working and applications of various alternate energy devices

CC503CO4: Apply the knowledge of energy conservation and energy management techniques to conduct energy audits.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	2	2	2	1	1
CO2	2	1	2	1	2	2	2	2	2
CO3	2	2	2	2	2	3	2	2	2
CO4	2	2	3	3	3	2	2	2	3

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**			
Unit		**M**	**Thr**	**CO**
Unit 1 INTRODUCTION TO ENERGY SOURCES		**10**	**06**	**CO1**
1.1 Energy Scenario				
1.2 Need of Alternate energy sources.				
1.3 Types of Renewable energy sources - Basic concepts of Solar energy, Wind Energy, Tidal energy, Biomass Energy, Fuel Cell				
Unit 2 SOLAR ENERGY SYSTEMS		**16**	**10**	**CO1 CO2 CO3**
Solar Energy				
2.1 Principle of conversion of solar energy into heat and electricity				
2.2 Solar Radiation: Solar Radiations at earth's surface				
2.3 Solar Radiation Geometry: Declination angle, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle				
2.4 Charactersitics of PV cell and concept of MPPT				
2.5 Construction and working of typical flat plate collector and solar concentrating collectors and their applications, advantages and limitations				
2.6 Space heating and cooling.				
2.7 Solar distillation, Solar cooking and furnace.				
2.8 Main applications of wind energy for power generation and pumping.				
Unit 3 WIND ENERGY SYSTEMS		**16**	**10**	**CO1 CO2 CO3**
3.1 Basic Principle of wind energy conversion.				
3.2 Advantages and limitations of wind energy conversion.				
3.3 Classification of wind mills				
3.4 Construction and working of horizontal and vertical axis wind mills, their comparison				
3.5 Main considerations in selecting a site for wind mills.				
3.6 Wind turbine Efficiency, Wind turbine control parameters- Yaw angle, Pitch angle, hub height, Solidity				
Unit 4 APPLICATIONS OF SOLAR AND WIND ENERGY SYSTEMS		**18**	**12**	**CO2 CO3**
4.1 PV system for street lights				
4.2 Design of PV system for domestic load.				
4.3 PV water pumping system				
4.4 Design of household thermal heating system				
4.5Design of micro wind turbine for domestic load.				
Unit 5 ENERGY MANAGEMENT		**15**	**10**	**CO4**
5.1 Energy scenario in various sectors and Indian economy				
5.2 Need and importance of energy conservation and management				
5.3 Principles of energy conservation.				
5.4 Concept of Energy audit				
5.5 Types of Energy Audit				
5.6 Energy Conservation – Case study of Domestic system				
5.7 Energy Conservation – Case study of Industrial system				
Total		**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction To Energy Sources	06	10
2	Solar Energy Systems	10	16
3	Wind Energy Systems	10	16
4	Applications of Solar and Wind energy systems	12	18
5	Energy Management	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Collect information about Indian energy market and prepare a report.	
2.	Study the construction and working of photo voltaic cell.	
3.	Study the construction, working of a solar cooker.	
4.	V-I, P-V Characteristics of Photovoltaic panel	
5.	Case Study on a nearest wind farm.	
6.	Visit to plant of solar heating system for hotel/hostel/railway station etc. and prepare a report.	
7.	Perform energy audit for workshop/Office/Home/SSI unit.	
8.	Study of various waste heat recovery devices.	
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	DrB.H.Khan	Non-conventional	Tata McGraw Hill
2	S. P. Sukhatme	Energy Resources	Tata McGraw Hill
3	Arrora	Solar energy	Dhanpat Rai & co.
4	Domkundwar	Power plant engineering	Wiley Press
5	Gilbert M Masters	Renewable and Efficient Electric Power Systems	Wiley Interscience, New Jersey, 2004
6	Chetan Singh Solanki	Solar Photovoltaics; Fundamentals, Technologies and applications	PHI

(AU620) AUTOMOTIVE POLLUTION & CONTROL

1. COURSE OBJECTIVES: The purpose of this course is to impart adequate knowledge on automotive emission formation & its effect on the environment. This course also provides valuable insight into the various emission control systems used in an SI and CI engines. Students will also gain knowledge on emission standards followed and instruments used for measurement of emissions.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
AU620	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
AUTOMOTIVE POLLUTION & CONTROL	**3**	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

3. COURSE OUTCOMES:

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

AU620CO1: Understand the fundamentals of automotive pollution and control.

AU620CO2: Describe automotive emissions and its effects.

AU620CO3: Explain the function, working principle and construction of various automotive emission control systems.

AU620CO4: Explain the principle of operation of emission measuring instruments and emission test procedures.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	2	2	1	2	2
CO2	2	0	1	0	2	2	2	2	2
CO3	3	2	2	2	2	2	3	3	3
CO4	3	3	3	3	2	3	3	3	3

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**			
Unit		**M**	**Thr**	**CO**
Unit I: EMISSIONS AND STANDARDS		**09**	**06**	
1.1 Vehicle Population Assessment in Metropolitan Cities and Contribution to Pollution.				**CO1 CO2**
1.2 Effects On Human Health and Environment, Global Warming.				
1.3 Types of Emission, Transient Operational Effects on Pollution.				
1.4 Emission Standards, Driving Cycles - USA, Japan, Euro and India.				
Unit-2 EMISSIONS FROM SI ENGINES AND THEIR CONTROL		**18**	**11**	
2.1 Emission formation in SI engines (CO, HC and NOx)				**CO1 CO2 CO3**
2.2 Effect of design and operating variables on emission formation				
2.3 Control techniques -Thermal reactor, exhaust gas recirculation				
2.4 Three-way catalytic convertor and Charcoal canister control for evaporative emission				
2.5 Positive crank case ventilation for blow by gas control.				
Unit 3 EMISSIONS FROM CI ENGINES AND THEIR CONTROL		**18**	**11**	
3.1 Emission formation in CI engines (HC, CO, NOx, aldehydes, smoke and particulates)				**CO1 CO2 CO3**
3.2 Effect of design and operating variables on emission formation				
3.3 Control techniques, exhaust gas recirculation, NOx selective catalytic reduction, diesel oxidation catalytic convertor.				
3.4 Diesel particulate filter, NOx versus particulates –trade off				
Unit 4 EMISSION AND NOISE POLLUTION CONTROL		**12**	**08**	
4.1 Engine Noise Emissions, Types of Catalytic Conversion				**CO1 CO2 CO3**
4.2 Open Loop and Closed Loop Operation to The Oxidizing Catalytic Converter				
4.3 Evaporative Emissions				
4.4 Internal and External Noise, Identification of Noise Sources.				
4.5 Noise Control Techniques.				
Unit 5 EMISSION MEASURING INSTRUMENTS AND TEST PROCEDURES		**18**	**12**	
5.1 Principle of operation of emission measuring instruments used in SI and CI engines, Measurement of CO2 and CO by NDIR 5.2 Hydrocarbon emission by FID, Chemiluminescent analyser for NOx, Liquid and Gas chromatograph.				**CO1 CO4**
5.3 Spot sampling and continuous indication type smoke meters (Bosch and AVL smoke meters) emission test procedures – FTP, Euro and Bharat norms.				
Total		**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Emissions And Standards	06	09
2	Emissions From SI Engines And Their Control	11	18
3	Emissions From CI Engines And Their Control	11	18
4	Emission And Noise Pollution Control	08	12
5	Emission Measuring Instruments And Test Procedures	12	18
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Case Study: Vehicle Population Assessment in the nearest city.	
2.	Measure CO, HC from the S.I. engine exhaust using gas analyzer & compare it with pollution norms.	
3.	Measure particulate matter, from C.I. engine exhaust using smoke meter & compare it with pollution norms.	
4.	Case study: Air pollution due to automobiles at different places in your city.	
5.	Case study : Measure noise level in your city at different places like Bus stand, Railway station, Airport, Hospitals, Schools, Traffic jam conditions etc. & prepare a report on it.	
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Ganesan V,	"Internal combustion engines"	4th edition, Tata McGraw Hill Education, 2012
2	Rajput R. K	"A textbook of Internal Combustion Engines"	2nd edition, Laxmi Publications (P) Ltd, 2007
3	Paul Degobert	"Automobiles and Pollution"	SAE International ISBN-1-56091-563-3, 1991
4	SAE Transactions	"Vehicle Emission"	1982 (3 volumes).

(AU614) GARAGE ORGANISATION & VEHICLE LAWS

1. COURSE OBJECTIVES:

Organisation and management of any garage and application of the motor vehicle act forms a very important activity for any automobile engineer. A clear idea of organisational structure, policies and procedures will result in effective handling of personnel and activities within the organisation, which will ultimately result in overall development of an undertaking. An in depth Knowledge of the motor vehicle act aids in assisting the public to have a disciplined traffic. This course provides sufficient insight in this area.

2. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
AU614 GARAGE ORGANISATION & VEHICLE LAWS	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

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

AU614CO1: Understand basic concepts of garage organisation, costing, motor vehicle act and safe driving techniques.
AU614CO2: Explain garage operation procedures, motor vehicle act and driving rules.
AU614CO3: Plan a layout of a garage.
AU614CO4: Apply motor vehicle act.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	3	1	1	2	2	1	2	1	1
CO2	2	1	1	1	2	2	2	1	1
CO3	2	3	3	2	2	3	3	2	2
CO4	2	3	3	3	3	2	3	2	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 LOCATION AND LAYOUT OF GARAGE.	**15**	**09**	
1.1 Types of Garages			**CO1**
1.2 Location of a Garage			**CO2**
1.3 Layout of a Garage			**CO3**
1.4 Functions of a Garage			
1.5 Personnel required in a Garage			
1.6 Safety procedures of Garages and Service stations			
2 GARAGE PROCEDURES	**12**	**08**	
2.1 Diagnostic sheets			
2.2 Estimate of repairs			
2.3 Job card			**CO1**
2.4 Job loading			**CO2**
2.5 Time booking			**CO3**
2.6Inspection			
2.7 Final report			
2.8 Billing of repairs			
2.9 Feedback.			
2.10Types of Spares			
2.11 Purchase Procedures			
2.12Stock records & Inventory Control			
2.13Economics of rebuilding.			
3 COSTING	**12**	**08**	
3.1 Job costing			
3.2Unit costing			**CO1**
3.3 Batch costing			**CO2**
3.4Process costing			
3.5Marginal costing.			
4 DRIVING SKILLS	**12**	**08**	
4.1 Instructions in driving of motor vehicle : Driving theory, traffic education, light vehicle driving practice, Vehicle mechanism & repair, Public relations for drivers, Fire hazards, vehicle maintenance, first aid.			
4.2 Traffic signs: Mandatory signs, Cautionary signs, Informatory signs. Traffic signals.			**CO1** **CO2**
4.3 Causes of accident and remedies.			
4.4 Measures to avoid accidents			
4.5 Defensive driving : Rain and flood, fog and mist, snow and ice,			
4.6 Fitness to drive : Driving and age, stress due to traffic jam, night driving.			
5 MOTOR VEHICLE ACT	**24**	**15**	
5.1 Licensing of Drivers of Motor Vehicle: Necessity, Age limit, Responsibility of owners, Restriction on holding a driving license, General, Preliminary test and driving test.			
5.2 Conductor's license: Necessity, Eligibility, Documents required and rules for conductors.			

5.3 Registration of Vehicles: Necessity, Where to be made, How to be made, Temporary registration, Production of vehicle at the time of registration, Form and manner of display of registration mark, Size of letters and numerals of registration mark, Transfer of Ownership of Motor Vehicle.			**CO1** **CO2** **CO4**
5.4 Control of Transport: Transport authorities, Difference between STA & RTA, Necessity of Permit, All types of Permit, Transfer of permit, Temporary permit, Tourist permit, National permit. Speed limits.			
5.5 Construction of Motor Vehicle: Overall dimensions, General provision regarding construction and maintenance of motor vehicle. Power of central government to make rules.			
5.6 Taxation: Objectives, Basis of taxation, Methods of levying tax, Tax exemption.			
5.7 Insurance: Motor Vehicle Insurance, No-fault liability, Procedure for accident claim.			
Total	**75**	**48**	**-**

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Location and layout of garage	09	15
2	Garage procedures	08	12
3	Costing	08	12
4	Driving Skills	08	12
5	Motor Vehicle Act	15	24
	Total	**48**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Draw a layout of a garage	
2.	Prepare a report showing different road signs and signals	
3.	Study, fill up, highlight the important points & prepare report on following forms under M V rules -- a. Medical certificate b. Learner's license. c Driving license. d. Addition of license. e. Renewal license f. Registration of vehicle. g. Transfer of vehicle.	
	Total	**25**

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	-	Motor Vehicles Act 1988	Home Department (M.S.)
2	-	Central M.V.Rules 1989	Home Department (M.S.)