Program : **Diploma in Mechanical Engineering**	
Course Code :**4023**	Course Title: **Automobile Engineering**
Semester : **4**	Credits: **4**
Course Category: **Program Core**	
Periods per week: **4 (L:3, T:1, P:0)**	Periods per semester: **60**

Course Objectives:

- To acquire knowledge about the classification and basic structure of an automobile, IC engine, Cooling system, lubrication system and fuel system, Ignition system and Governing system.
- Transmission system in Automobiles.
- To familiarize with the working of suspension system, steering mechanism, and braking system of Automobile.
- To identify the basic idea of Electric, Hybrid-Electric and Plug in Hybrid vehicles.
- To familiarize with the Indian motor vehicle Act.

Course Prerequisites:

Topic	Course Code	Course Name	Semester
Basic Physics		Applied Physics I & II	1 &2
Electrical & Electronics Engineering		Fundamentals of Electrical Engineering	3

Course Outcomes:

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

COn	Description	Duration (Hours)	Cognitive Level
CO1	Describe the classification and basic structure of an automobile**,** Basic engine component, Cooling systems, Lubrication systems, Fuelsystems, Ignition systems and Governing systems.	18	Understanding
CO2	Explain the Transmission system in Automobiles	17	Understanding

CO3	Explain the working of Ignition, suspension, steering and braking system of Automobile	15	Understanding
CO4	Compare Electric, Hybrid-Electric and Plug in Hybrid vehicles, Emission Control and review Indian motor vehicle Act.	10	Understanding

CO-PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3						
CO2	3						
CO3	3						
CO4	3				2		2

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Describe the classification and basic structure of an automobile, Basic engine components, Cooling, lubrication**, Fuel, **Ignition and Governing system.**		
M1.01	Explain the classification and basic structure of an automobile**,** Basic engine components; Explain the major parts of an IC engines.	5	Understanding
M1.02	Classify cooling systems of IC engine.	1	Understanding
M1.03	Illustrate the components of water-cooling system	2	Understanding
M1.04	Explain lubrication system and its classification.	1	Understanding
M1.05	Compare fuel systems for petrol and diesel engines	3	Understanding
M1.06	Explain ignition system and types.	1	Understanding
M1.07	Show the Construction and working of lead acid battery; Elements of charging system, Elements of starting system.	3	Understanding

M1.08	Explain Governing system and types	2	Understanding

Contents:

Introduction to classification and basic structure of an automobile, Basic engine components; Cylinder block; Cylinder head; Gaskets; cylinder liners, types of cylinder liners; Piston and piston pin; piston rings; Connecting rod; Crank shaft; Cam shaft; Crankcase; Engine valves- valve operating mechanism-overhead and side valve engines only; Flywheel and Governor. The necessity of **cooling system**; Types of cooling system -air cooling and liquid cooling; Air cooling system; Types of liquid-cooling system – Thermo siphon system and pump circulation system; The components of water-cooling system –fan, radiator, pump and thermostat; The necessity of **lubrication system**, Types of lubrication system- splash system; forced system and (mist)/ petroil system; **Fuel system**: Working of A.C mechanical pump; Working of simple carburetor; Bosch Fuel Pump; Fuel Injector; Single point and multi point fuel injection systems; working of CRDI and MPFI. Fuel filters; **Ignition system:** Introduction to ignition system; Battery Ignition systems and Electronic Ignition systems; Construction and working of lead acid battery; Elements of charging system; Elements of starting system; **Governing system**: Types of governing system – Quantity; Quality; hit and miss.

CO2	**Explain the Transmission system in Automobiles**		
M2.01	Illustrate the Transmission systems in automobile	1	Understanding
M2.02	Explain the working of clutch and gear box in automobile with schematic diagram	11	Understanding
M2.03	Illustrate the working of differential, propeller shaft and axle.	5	Understanding
	Series Test – I		

Contents:

Transmission systems in automobile - working - clutch functions - requirements of clutch - single plate - multi plate - diaphragm -centrifugal clutch, Fluid coupling. - Gear box - functions-working- types- sliding mesh - constant mesh - synchromesh — epicycle gear box -CVT- torque converter- over drive. Propeller shaft - universal joint - final drive - differential.

Stub axle - types of live rear axle - semi floating - three quarter floating and full floating axles

CO3	**Explain the working of suspension, steering and braking system of Automobile**		
M3.01	Illustrate the working of different suspension systems with figure.	2	Understanding
M3.02	Interpret **Steering** wheel - steering column steering gears - worm and worm sector - rack and pinion –re circulating ball - power steering etc. Analyze	6	Understanding

	camber -caster -king pin inclination - toe in and toe out of wheels. Ackerman steering mechanism.		
M3.03	Understand wheels &tyres. Types of wheels - Disc wheels - cast wheels - size of wheel and Tyre-tubeless tyres and tubed tyres -tyre material.	3	Understanding
M3.04	Illustrate the working of Braking system with neat figure.	4	Understanding
Contents: **Ignition system:** Introduction to ignition system; Battery Ignition systems and magneto Ignition system; Electronic Ignition system; Construction and working of lead acid battery; Elements of charging system; Elements of starting system; Types of lights used in the automobile: **Suspension systems** -Types and components- leaf spring – coil spring- spring shackle - air suspension **Steering** wheel - steering column steering gears - worm and worm sector - rack and pinion –re circulating ball - power steering - camber -caster -king pin inclination - toe in and toe out. Ackerman steering mechanism. **wheels & tyres:** Types of wheels - Disc wheels - cast wheels - size of wheel and Tyre -tubeless tyres and tubed tyres -tyre material. **Brakes**, Types - mechanical - hydraulic -air brake - master cylinder- disc brake –working of ABS and EBD.			
CO4	**Compare Electric, Hybrid-Electric and Plug in Hybrid vehicles. Review of Indian motor vehicle Act.**		
M4.01	Illustrate the working and components of electric vehicles.	1	Understanding
M4.02	Outline the Basics – Types, Parameters – Capacity, Technical characteristics, precautions, and Properties of Batteries	2	Understanding
M4.03	Contrast Fuel cells: principles of operation, Fuel cell storage system, Strategy for controlling hybrid fuel cell system.	2	Understanding
M4.04	Explain Flywheel energy storage characterization. Regenerative Braking system.	1	Understanding
M4.05	Show hybrid electric vehicles and its systems.	1	Understanding
M4.06	Interpret Plug-in Hybrid Electric Vehicles PHEV and its configurations.	1	Understanding
M4.07	Emission Standards – BS IV & VI	1	Understanding
M4.08	Review of Indian motor vehicle Act.	1	Understanding
	Series Test – II		

Contents:
Electric vehicles (EV): - Introduction, Components, precautions, Propulsion System
Batteries and Energy Storages Basics – Types- Lithium iron (Li-On) and Nickel-Metal Hybrid (NiMH), Parameters – Capacity, Technical characteristics, Properties of Batteries, precautions. Fuel cells: principles of operation, Flywheel energy storage characterization. Regenerative Braking system.
Hybrid Electric Vehicles (HEV): Types – series, parallel and series, parallel configuration – Drive train, Advantages, and challenges in EV design. **Plug-in Hybrid electric Vehicles** PHEV configurations. Emission Control; BS 4 & BS6.**Review of Indian motor vehicle Act.**

Text/ Reference

T/R	Book Title/Author
T1	Automobile Engineering vol. I&2 - Kirpal Singh
T2	Automobile Engineering - K.Ramalingam.
T3	Automobile Engineering -R.K.Rajput.
T4	Hybrid, Electric and Fuel-Cell Vehicles- jack Erjavec & Jeff Arias
T5	"Electric & Hybrid Vehicles – Design Fundamentals", Iqbal Hussain, Second Edition, CRC Press, 2011.
R1	Automobile Engineering - R.B.Gupta , Khanna Publishers
R2	Automotive Technology – James D Halderman
R3	Automotive Mechanics – Joseph Heitner
R4	Automotive engines - Crouse & Anglin

Online Resources

Sl.No	Website Link
1	https://www.springer.com/journal/12239
2	http://www.ijat.net/
3	https://industrytoday.com/modern-technology-in-the-automotive-industry/
4	https://www.cars24.com/blog/latest-car-technology-innovations/
5	https://www.newgenapps.com/blog/tech-trends-solutions-in-automobile-industry/
6	https://carbuzz.com/features/evolution-of-car-technology-and-features
7	http://nptel.ac.in/courses/108103009/
8	https://www.omazaki.co.id/en/electric-car-batteries-and-their-characteristics/
9	https://afdc.energy.gov/vehicles/electric_batteries.html

10	https://nptel.ac.in/content/storage2/courses/108103009/download/M3.pdf
11	https://www.sciencedirect.com/topics/engineering/plug-in-hybrid-electric-vehicle
12	https://www.sciencedirect.com/topics/engineering/regenerative-braking
13	https://www.acko.com/auto/difference-between-bsiv-bsvi-engine-bs4-bs6-performance/
14	https://legislative.gov.in/sites/default/files/A1988-59.pdf
15	https://egazette.nic.in/WriteReadData/2019/210413.pdf