

# IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

## Scheme & Syllabus

### Mechanical Engineering Department

#### Honor's in Automobile Engineering

(To be offered to students of Mechanical Engineering Department)

S. No.	Semester	Subject Code	Subject Name	Contact Hours Per Week			Total Credits
				L	T	P	
1	V		Automotive Chassis System	3	0	2	4
2	VI		Automotive transmission, sensors and fuel ignition systems	3	0	2	4
3	VII		Vehicle Dynamics	3	0	2	4
4	VIII		Electric and Hybrid Electric Vehicles	3	0	2	4
<b>Total</b>				<b>12</b>	<b>0</b>	<b>8</b>	<b>16</b>
<b>Total Academic Engagement and Credits</b>				<b>20</b>			<b>16</b>

\*L: Lecture, T: Tutorial, P: Practical

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## Scheme & Syllabus

### Mechanical Engineering Department

ME	Automotive Chassis System	3L : 0T :1P (4 Hrs)	04 Credits
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#### Course Objective's:

Study of the Constructional details and Theory of important Chassis, brake, suspension system, of Automobiles.

#### Course Content:

##### Module 1

(08 hrs)

**Automotive LMV Chassis:** Classification of vehicle based on body types, Types of LMV bodies, Integral body construction details: Load and capacity, front overhang and rear overhang demotions. Force on the body by Static , Acceleration and Braking, Moments and Torque due to driving conditions (torsion and bending moments), Types of materials used in body construction, Body sub frame and under-floor structure .

##### Module 2

(08 hrs)

**Automotive HMV & Bus Chassis:** Types, Truck and Bus : Bus body layout ,Bus and Truck chassis ,multi-axle bus, articulated bus, bus body layout, classification of chassis according to floor height and engine location, ergonomics of passenger seat and driver's cabin design , front overhang and rear overhang demotions. Weight distribution front and back of chassis.

##### Module 3

(10hrs)

**Braking systems & Components Function:** Introduction, principles of braking; classification; brake actuating mechanisms; Drum brake- theory; principle; construction; working; Disc brake- theory, principle, construction, working; Parking brake- theory, principle; construction, types; Hydraulic system theory, principles, master-cylinder basics, wheel-cylinder basics, tubing & hoses, valves & switches, brake fluid; Power brake- theory, vacuum-booster basics, hydraulic-booster basics, electro-hydraulic booster basics; Advanced brake theories; Exhaust brake; ABS & EBS technology; factors affecting brake performance operating temperature, area of brake lining, clearance.

##### Module 4

(08 hrs)

**Suspension System & Components Function:** Need; factors influencing ride comfort; types; suspension springs-leaf spring, coil spring & torsion bar; spring materials; independent suspension; rubber suspension, pneumatic suspension; hydraulic suspension, shock absorbers-liquid & gas filled. ECAS system

##### Module 5

(08 hrs)

**Wheel:** Forces acting on wheels, construction of wheel assembly, types- spoke, disc & built-up wheels; wheel balancing; wheel alignment; Tyres: Static & rolling properties of tyres, construction details, types of tyres- pneumatic & hydraulic; types of tyre-wear & their causes; tyre rotation; Bearings: Functions; classification of bearings; bearing materials; automotive bearings.

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### **Mechanical Engineering Department**

#### **Course Outcome:**

After completion of the course student will be able:

1. Develop the basics of chassis layout of LMV
2. Develop the basics of chassis layout of Bus and Truck Chassis
3. Develop the concept of brake system.
4. Understand the function & terminology Suspension system
5. Understand the terminology of tyres and wheel

#### **List of Text Books**

1. Giancarlo Genta ,Lorenzo Morello The Automotive Chassis Springer
2. Kripal Singh, Automotive Engineering Khanna Pub.
3. Don Knowles; Automotive Suspension & Steering Systems; Today's Technician

#### **References:**

1. Giri NK; Automobile Technology; Khanna Publishers
2. Reimpell/Stoll/Betzler; The Automotive Chassis; SAE
3. Thomas W Birch- Delmar; Automotive Chassis Systems; Cengage Learning
4. Halderman/Mitchell; Automotive Technology; Prentice Hall
5. Jack Erjavec- Delmar; Automotive Technology; Cengage Learning

#### **List of Experiments:**

1. Study of types of chassis layouts.
2. Study of steering linkages.
3. Study of rigid axle suspension system.
4. Study of independent suspension system.
5. Study of disc & drum brake assemblies.

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## Scheme & Syllabus

### Mechanical Engineering Department

ME	Automotive Electrical , Electronics & Cooling System	4L : 0T :0P (4 Hrs)	04 Credits
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#### Course Objective's:

- To know about the working of Automotive Electrical, Electronics & cooling System.

#### Course Content:

##### Module 1 (08hrs)

**Starter and charging systems:** Requirements; principle, construction & working of starter motor; starting motor drive mechanisms; starter switch; starting system faults; Generating system: Working principle of dc generator & ac alternator; armature reaction; cut-out relay; voltage & current regulator systems.

##### Module 2 (08 hrs)

**Lighting and auxiliary systems:** Development of lighting technology; principle of automobile illumination; head lights; tail lights; traffic lights; Auxiliary systems: Speedometer; electric horn; wind screen wipers; alarm systems; central locking system; immobilizer system; power windows; different types of gauges.

##### Module 3 (10 hrs)

**Electronic engine control and sensors:** Need of electronic engine control; engine functions & control; electronic fuel control system; basic sensor arrangement; sensors & actuators; types of sensors-oxygen sensor, vehicle speed sensor, detonation sensor, maf sensor, map sensor, rpm sensor, throttle position sensor, temperature sensor.

##### Module 4 (08 hrs)

**Electronic fuel injection and ignition systems:** Introduction; fuel back carburetor system; throttle body injection; multi point fuel injection; Robert Bosch gasoline fuel injection system; ford electronic gasoline fuel injection system; injection system controls; Ignition systems: Introduction; advantages of electronic ignition systems; principle, operation & types of solid state ignition system, electronic spark timing control.

##### Module 5 (07 hrs)

**Cooling system in Automobiles;** Air and Water cooled engines; Radiator and radiator circuit line, Intercooler Lubricants system; lubrication of piston rings, piston pin and crank pin; silencers and control of combustion noise;

#### Course Outcome:

After completion of the course student will be able:

- Understand the Starter and charging systems
- Understand the Lighting and auxiliary systems
- Understand the function of engine control and sensors

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## **Scheme & Syllabus**

### **Mechanical Engineering Department**

4. Understand the fuel injection and ignition systems.
5. Understand the Cooling system in Automobiles

#### **List of Text Books**

1. BOSCH-SAE; Automotive Electrics & Electronics-
2. Kripal Singh, Automotive Engineering Khanna Pub.

#### **References:**

1. Norm Chapman Delmar; Principles of Electricity and Electronics for Automotive; Cengage
2. William B Ribbens- Newnes; Understanding Automotive Electronics-
3. Tom Denton; Automobile Electrical and Electronic Systems; SAE
4. Kanemitsu Nishio; Fundamentals of Automotive Engine Control Sensors; Fontis Media

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## Scheme & Syllabus

### Mechanical Engineering Department

ME	Vehicle Dynamics	3L : 0T :1P (4 Hrs)	04 Credits
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#### Course Objective's:

To understand the principle and performance of vehicle in various modes such as longitudinal, vertical and lateral directions and identify the various forces and loads and performance under acceleration, ride and braking.

#### Course Content:

##### Module 1 (08 hrs)

**Introduction to Vehicle Dynamics:** Definition by SAE; vehicle control loop; mathematical modeling methods; multi-body system approach, Newtonian and Lagrangian formulation, method of Investigation, stability concepts.

##### Module 2 (08 hrs)

**Mechanics of Pneumatic Tires:** Tires construction; physics of tire; traction on dry and wet surfaces, tire forces and moments, SAE recommended practice; rolling resistance of Tire Model; ride properties of Tires.

##### Module 3 (10 hrs)

**Handling and stability:** Characteristics of road vehicle; steering geometry, steady state handling characteristics; steady state response to steering input; transient response characteristics; direction stability effects of tire; effect of mass distribution and engine location on stability and handling.

##### Module 4 (10 hrs)

**Vehicle Ride Characteristics:** Human response to vibration, vehicle ride models, road surface profile as a random function, frequency response function, evaluation of vehicle vertical vibration to ride comfort criterion.

##### Module 5 (10 hrs)

**Two Wheeler Dynamics:** Stability & handling, vehicle motion ride control, various vehicle models, gyroscopic effect and effect of Tire and vehicle parameters on stability and handling characteristics.

#### Course Outcome:

After completion of the course student will be able:

1. Understand the function of vehicle control loop
2. Develop the basic concept of forces on tire.
3. Understand the steady state response and transient response characteristics of steering.
4. Understand the vehicle ride models, road surface profile as a random function of vehicle.
5. Understand the two wheeler dynamic stability.

#### List of Text Books

1. Giancarlo Genta ,Lorenzo Morello The Automotive Chassis Springer
2. Kripal Singh, Automotive Engineering Khanna Pub.

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### **Mechanical Engineering Department**

#### **References:**

1. Wong; Theory of Ground Vehicle; John Willey & Sons
2. Clark S.K; Mechanics of Pneumatic Tire; NBS Monograph
3. Sohlenien W; Dynamics of High Speed Vehicles; Springer N.Y.
4. Ellis J.E.R; Vehicle Dynamics; Business Book London
5. Ramalingam KK; Automobile engineering; Scitech pub

#### **List of Experiments:**

1. Study of static and dynamic properties of tires
2. Study of effect of braking system on car speed down, stopping and stability.
3. Study effect of vibration and noise on human comfort
4. Study effect of engine location on stability and dynamics
5. Study the location & height of Centre of gravity (C.G) of a motorcycle.
6. Study geometry of motorcycles as well as various types of forces faced by the motorcycle & its rider.

Note: List of experiment can be expandable

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### Mechanical Engineering Department

ME	Electric and Hybrid Electric Vehicles	3L : 0T :1P (4 Hrs)	04 Credits
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#### Course Objective's:

To present a comprehensive overview of Electric and Hybrid Electric Vehicles

#### Course Content:

##### Module 1 (10 hrs)

**Introduction:** : Chassis & Body Engineering Technical details of commercial vehicles, types of chassis, layout, types of frames , Steering System front axle beam, stub axle, front wheel assembly, principles of types of wheel alignment, front wheel geometry viz. camber, Kingpin inclination, castor, toe-in and toe-out Transmission System: Function of clutches, single plate, multi-plate clutch, types of gear boxes, differential gear box, Suspension system : Basic suspension movements, Independent front & rear suspension, shock absorber

##### Module 2 (08 hrs)

**Introduction to Hybrid Electric Vehicles:** History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

##### Module 3 (10 hrs)

**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. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

##### Module 4 (08 hrs)

**Energy Storage:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

##### Module 5 (08 hrs)

**Electric Propulsion:** Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives

#### Course Outcome:

After completion of the course student will be able:

1. Understand the anatomy and functions of conventional vehicle system
2. Understand importance of Hybrid & Electric Vehicles on environmental
3. Develop basic concept of electric vehicles and hybrid electric vehicles drive train.
4. Choose proper energy storage systems for vehicle applications



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### **Mechanical Engineering Department**

5. Develop basic concept of Configuration and control of DC Motor drive

#### **List of Text Books:**

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003
2. Kripal Singh, Automotive Engineering Khanna Pub.

#### **List of Reference Book:**

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
3. Joseph Heitner, Automotive Mechanics, Principles and Practices, CBS Pub

#### **List of Practical:**

1. Study of Steering, Gear Box, Suspension and Differential Mechanism
2. Study of Electric vehicle drive train
3. Study of Hybrid vehicle drive train
4. Study of battery system & HV and LV line
5. Study of cooling system in Electric & Hybrid vehicle

Note: List of experiment can be expandable