

# GUJARAT TECHNOLOGICAL UNIVERSITY

## AUTOMOBILE ENGINEERING

**SUBJECT CODE: 2181915**

**BE SEMESTER: 8**

**Type of course:** Undergraduate

**Prerequisite:** Zeal to learn the Subject

**Rationale:** The aim is to introduce students to the vehicle structure and associated systems. Fundamentals related to vehicle and its systems' layouts, basic design of vehicle body structure and selection of systems components are introduced.

### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
				PA	ALA	ESE	OEP			
3	0	2	5	70	20	10	20	10	20	150

### Content:

Sr. No.	Content	Total Hrs	% Weightage
<b>1</b>	<b>Introduction to Automotive Systems</b> Vehicle body classification and specification: Body construction type, Location of engine and Drive system types and arrangement, specification of vehicles; Functional requirements of vehicle body, Body trim and fittings, Overview of various systems including safety features, steering system types, Tire construction and types.	<b>7</b>	<b>15%</b>
<b>2</b>	<b>Body Load Analysis:</b> Vehicle Loads: Static load, Load due to Acceleration and Braking, Moments and Torque due to driving conditions, resistance to motion and aerodynamic load, Types of materials used in body construction, Analysis and Selection of body member sections, Body sub frame and underfloor structure, car front and rear end structure, Vehicle Structure Analysis by Simple Structural Surface (SSS) Method: Saloon and simple van.	<b>9</b>	<b>20%</b>
<b>3</b>	<b>Transmission and Driveline systems</b> Constructional features and working of clutches*, Gear Train: sliding mesh, constant mesh and synchromesh gear boxes with related components, Propeller and drive shaft, universal joints, Rear wheel drive arrangements, Rear axle final drive, the differential, rear axle, Simple problems in all mentioned topics, Automatic Transmission and CVT.	<b>7</b>	<b>20%</b>
<b>4</b>	<b>Suspension, Steering and Braking systems</b> Types of suspension systems, Functional requirements of suspension systems, Front suspension system and Steering: Types, Definitions for wheel orientation and its effect, Types and Constructional features of Front Suspension, , Steering layout, types of steering gears, steering linkages, steering mechanism, definitions and significance of camber, caster and king pin inclination, toe in and toe out on turn, measurement and adjustment of various steering system	<b>14</b>	<b>25%</b>

	layouts, steering ratio, under steering and over steering, steering geometry; Rear suspension system: Types, Factors affecting design and selection; Performance Analysis of Suspension system: Mobility, kinematic / graphical analysis, Roll centre analysis, and force analysis  Brake system components and configurations, Fundamentals of braking: braking distance, braking efficiency, weight transfer, wheel skidding, Brake proportioning and adhesion utilization, ABS and Electronic Braking system: Working principles, Features and advantages.		
<b>5</b>	<b>Electrical and Electronics:</b> Electrical and electronic components of vehicle, fundamentals of engine electricals, Lighting and Indicators: Features, Requirements and typical settings, Body electrical and electronic systems, Monitoring and Instrumentation.	<b>5</b>	<b>20%</b>
<b>6</b>	<b>Modern Vehicles:</b> Introduction to electric vehicles & hybrid vehicles.	<b>2</b>	<b>5 %</b>

\* To be covered during laboratory sessions.

#### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

**Legends: R: Remembrance; U = Understanding; A = Application and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

#### Reference Books:

1. Motor Vehicle Structures: Concepts and Fundamentals, Jason C. Brown, A. John Robertson, Stan T. Serpento, Butterworth Heinemann, 2002.
2. Handbook of Vehicle Design Analysis, John Fenton (Editor), Mechanical Engineering Publications Limited, London and Bury St Edmunds, UK, 1996.
3. Automobile Technology, N.K. Giri, Khanna Publishers, 2011.
4. An Introduction to Modern Vehicle Design, Julian Happian-Smith, Butterworth- Heinemann, 2002.
5. Theory of Ground Vehicles, J.Y. Wong, John Wiley and Sons, 2001.
6. Automobile Mechanical and Electrical Systems Automotive Technology: Vehicle Maintenance and Repair, Tom Denton, Butterworth Heinemann, 2011.
7. Clutches and Brakes, W C Orthwein, Marcel Dekker.
8. Automotive Mechanics by William H Crouse.
9. Advanced Vehicle Technology by Heinz and Heisler

#### Course Outcome:

After learning the course the students should be able to:

1. Understand the construction details of types of vehicle and functions of various systems.
2. Analyse and select components of various systems of vehicle.

**List of Experiments:**

1. Study constructional features of vehicle body, various layouts, vehicle classifications and specifications.
2. Load analysis of two to three different classes of four wheelers.
3. Study vehicle Aerodynamics: Vehicle features and Loading.
4. Study components of transmission system.
5. Study constructional features and working of clutches and automatic transmission system.
6. Develop mathematical model of a suspension system and analyse the same.
7. Study different types of steering systems, constructional features and related configurations.
8. Study different types of braking systems, their constructional features and typical layout for hydraulic pneumatic and electronic brakes.
9. Study features, requirement and components of electrical and lighting system.
10. Study electronic systems of a vehicle along with different types of sensors, safety features and their integration.

**Design based Problems (DP)/Open Ended Problem:**

1. Develop mathematical model of a suspension system write a code to study its performance with variation of parameters.
2. For a vehicle, carryout braking force analysis and compare your design against the parameters of existing system in the vehicle.
3. Understand the concept of friction to transmit the power between two shaft (Clutch)
4. Advanced suspension with variable stiffness. (air suspension)
5. Design Gear box in Final drive to vary the gear ratio and compare expected performances.

**Major Equipment:**

1. Frames of different types of vehicles.
2. Section model of different types of transmission systems.
3. Working models of vehicle systems.
4. Educational cut section models of all the modules are required.

**List of Open Source Software/learning website:**

[www.nptel.ac.in](http://www.nptel.ac.in)

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.