GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3140203

BASICS OF AUTOMOTIVE SYSTEMS

B.E. 4thSEMESTER

Type of course: Basic Science

Prerequisite: Nil

Rationale:

The subject is designed to provide understanding of different automotive systems. The course is essential to build higher skills by studying different automobile systems such as transmission drive lines, braking, steering, and suspensions.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Automobile Basics:** Generation of automobiles, Classification, Layouts of automobiles, Front engine & front wheel drive, front engine & rear wheel drive, rear engine & rear wheel drive, Four wheel drive. **Performance of Vehicle:** Vehicle motion, Resistances during motion, Power required for acceleration and constant velocity motions, Tractive efforts and draw bar pull, Power required and engine characteristics, Motion on gradient. **Chassis Frames and Body**: Layout of chassis and its main components, Types of Chassis frames & body, Material, Unitized construction, design considerations,	**12**
2	**Transmission:** Purpose and necessity of gear box, classification, construction and working of different types of gear box, Gear selector mechanism, Heavy vehicle gear boxes, lubrication, Torque convertors, overdrive, operational problems and fault finding. **Semi –Automatic and Automatic transmission :** Hydraulic control systems, Electro hydraulic control systems, Automatic lay shaft gear boxes, Dual mode transmission with sequential gear change, Direct shift gear boxes, Over drive gears, Continuously variable transmissions **Electric drives :** General arrangement and description of electric transmissions, Working principle and control, advantages and limitations of electric drives	**12**
3	**Drive lines:** Drive Lines, Universal joints, Constant velocity joints, Propeller shaft construction, Drive line arrangement, Rear-wheel drive and front-wheel drive layouts, Front-wheel drive shafts, Tandem axle drive for heavy vehicles, Drive lines for public service vehicles.	**05**
4	**Final drive and rear axles:** Final drive and its types, Differential gears, Differential-All types, Rear axle construction, Heavy vehicle rear axle.	**05**
5	**Braking System:** Braking System: Requirements and classification, brake efficiency and stopping distance, Hydraulic brakes, Master cylinder, dual braking, power brake, Parking brakes, Antilock brake, bleeding of brake, maintenance of braking system.	**14**

	Suspension System: Basic ride considerations, Types of suspension systems, Types of suspension spring, Tandem axle suspension, torsion bar, Shock dampers, Adaptive suspension systems, air suspension, Active roll control systems	
6	**Steering systems :** Principles and layout, types of steering gears, Front end geometry and wheel alignment, steering ratio, power steering, Steering axles for heavy vehicles, Hydraulic power-assisted steering, Electro-hydraulic power-assisted steering, Electrical power-assisted steering, Types of four-wheel steering. **Tyres, wheels**: Introduction to wheels, wheel balancing, tyres, classification, construction, Tread patterns, Cross ply, Radial & tubeless tyres, specifications of tyres, Tyre inflation, effects of tyre pressure on tyre performance. Tyre wear patterns and their causes.	**12**

Suggested Specification table with Marks (Theory):

R Level	U Level	A Level	N Level	E Level	C Level
25	25	25	20	5	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create 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. Light and Heavy Vehicle Technology, M.J. Nunney, Elsevier, Fourth Edition.
2. Automotive Technology, Jack Erjavec, Cengage Learning, Fifth Edition.
3. Automotive Braking, Thomas W. Birch, Cengage Learning, Third Edition.
4. Motor Automotive technology, Anthony E. Schwaller, Delmar, Third Edition.
5. Automotive suspension and steering systems, Thomas W. Birch, Delmar Cengage Learning, Third Edition.
6. Automobile Engineering Vol-1, 2 Kirpal Singh, Standard Publishers
7. A text book of Automobile Engineering, R.K. Rajput, Laxmi Publication

Course Outcome: After learning the course the students will able to:

Sr. No.	CO statement	Marks % weightage
CO-1	evaluate performance of an automobile due to various resistance, demonstrate selection of chassis frame of automobile body.	17
CO-2	classify and compare different braking and suspension system of automobile.	21
CO-3	illustrate working and functions of various automotive transmission system.	24
CO-4	performance assessment and selection of braking, suspension system of automobile.	21
CO-5	examine steering system and selection of automobile wheel and tyre.	17

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List of Experiments

1. Study of different layout of transmission system for a front wheel drive, rear wheel drive and a four wheel drive arrangement
2. Study of manual type gearbox and its Trouble shooting.
3. Study of typical car body construction and propose new design sketches.
4. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
5. Study and measurement of the chassis frames of a Heavy / light duty vehicle frame (Leyland, Tata, Maruti, etc.)
6. Study, dismantling and assembling of Front Axle and Rear Axle
7. Study of braking system of an automobile
8. Study of suspension system of two wheeler and four wheeler vehicle.
9. Study effect of tyre pressure on vehicle performance.

Major Equipment: Heavy / light duty vehicle chassis frame (Leyland or Tata) , Front axle, Rear axle, Steering system , Hydraulic brake system. Leaf spring, coil spring, torsion bar , Hydraulic shock absorber . Gear box (light duty, heavy duty) ,Transfer case,

List of Open Source Software/learning website:

1. http://nptel.ac.in