Unit 7

Innovation and Development in Automobiles

Introduction

Innovation leads to development of new technologies, with which the customers get benefits in terms of comfort and safety. Sometimes, innovation also helps in lowering the cost of the product. The automobile sector is witnessing a lot of development in terms of innovations, as a result of which new automobile models are being launched in the market.

Innovation has also been noticed in the field of passenger safety. A number of devices, such as air bags, are now provided in cars so that in case of an accident, the passengers can be saved. There is a lot of research going on in the area of alternative fuels due to economic reasons and environmental concerns. Even solar energy based cars have been designed these days, which can run up to 80 kms in a day. Some cars have been designed which use electrical energy. A combination of electrical and petrol energy has been used in cars, which are called 'hybrid' cars. Technological developments of design and innovation and chassis have led to the development of MPFI (Multi Point Fuel Injection) system which gives more mileage per litre of fuel.

Nowadays, innovation has become more predictable. It is a detailed method for achieving objectives of better designs, lower costs, different fuels, etc. In major auto companies of the world, there are large teams working on new developments and innovations. It is a continuous process involving lots of experimentation by highly qualified engineers and scientists. In this Unit, you will understand the new innovations and developments taking place these days.

Session 1: Innovation and Development

You may have seen some old cars running on roads in your village, town or city. Some old models like Ambassador cars can still be seen but their number is reducing day by day. You would have also noticed more stylish cars on the roads nowadays. Same is the case with scooters and motorcycles. Even buses and trucks look different today. Can you name a famous car innovation by an Indian company a few years ago? It was the Tata Nano car manufactured by Tata Motors. It is one of the smallest as well as lowest-powered cars in the world. It was designed to be the cheapest car in India aimed mainly at the lowest price segment in the country (Fig. 7.1).

Fig. 7.1: Tata Nano

Apart from looks and style, one important challenge among car manufacturers is the use of alternate fuel, as both petrol and diesel are a limited resource. A lot of research has been done in this field, and some companies are even working on a project to run vehicles on water or air only!

Some of the technologies being incorporated into new automobile designs include gas-electric hybrids, fuel cells and biomass fuel sources including methane.

Electric Car

An electric car is an automobile that is propelled by one or more electric motors, using electrical energy stored in

batteries or another energy storage device. Electric cars are pollution free and have zero tail pipe emission. Such a car helps in reducing urban air pollution. Electric cars are generally more expensive than petrol, the primary reason being the high cost of car batteries (Fig. 7.2).

Fig. 7.2: Electric car

Hybrid Vehicle

It is a vehicle that uses two or more distinct power sources to move the vehicle. A hybrid vehicle is also known as Hybrid Electric Vehicle (HEV). This vehicle combines an internal combustion engine and electric motor. Although electric cars have been around since the inception of the automobile, a new breed of gas-electric hybrid autos were introduced in the United States of America several years ago. Most of the major automobile manufacturers including General Motors, Honda, Toyota, Ford and Diamler-Chrysler have either introduced or are planning to introduce new hybrid models during the next several years. New car sales on hybrids have increased by approximately 36 per cent in the U.S. Fig. 7.3 shows Toyota Prius which is the world's top selling hybrid car, with a cumulative global sales of 2.5 million units by February 2016.

Fig. 7.3: Hybrid vehicle

Fuel Cells

Automobile fuel cell technology is under development and has not been marketed yet. However, this innovative energy technology has the potential to revolutionise transportation. Fuel cell car technology under development creates electricity through a chemical reaction between hydrogen and oxygen (air). The reaction creates heat which is stored in batteries to power the car. The reaction creates only water and heat and may offer a solution to our energy and environmental situations (Fig. 7.4).

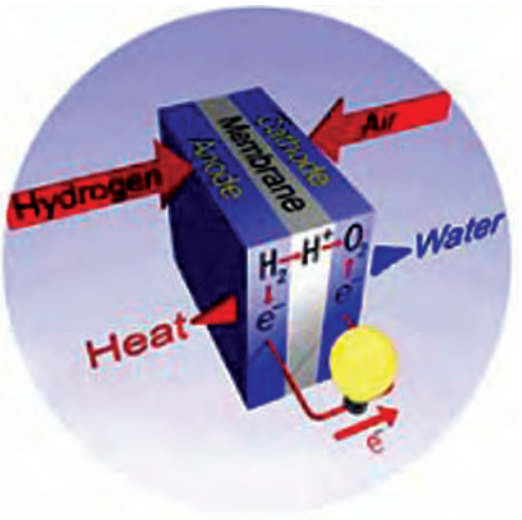

Fig. 7.4: Fuel cells

General Motors introduced a fuel cell stack that is 60 per cent more powerful than any competitor, and has launched a fuel cell car called HydroGen3 to the public.

Biomass Fuel

Fig. 7.5: Biomass fuel

Biomass automotive fuels and lubricants have been gaining acceptance over the past several years, primarily as a result of environmental concerns. Biomass fuels are typically generated through the decay of organic matter. For the past several years, ethanol and di-methyl ether produced from biomass have been added to oxygenate fuels and reduce emissions. Biomass fuel can also produce hydrogen which can be used in fuel cell vehicles. Methane created from biomass is also being explored as a transportation fuel alternative (Fig. 7.5).

Biofuel

Have you heard about the jatropha plant? The jatropha plant seeds are very rich in oil (40 per cent). Jatropha oil has been used in India for several decades as biodiesel for the diesel fuel requirements of remote rural and forest communities. Jatropha oil can be used directly after extraction (i.e., without refining) in diesel generators and engines.

The former President of India, Dr Abdul Kalam strongly advocated jatropha cultivation for production of biodiesel. In our country, out of the 6,00,000 km² of wasteland that is available in India over 3,00,000 km² is suitable for jatropha cultivation. Once this plant is grown, the plant has a useful lifespan of several decades. During its life, jatropha requires very little water when compared to other cash crops. Jatropha oil is being blended with diesel and used in Indian vehicles.

New Developments

Car Technology: The Latest Innovations in Engine Development and Safety

Car technology is focussing increasingly on safety, efficiency and the environment. Some of the major innovations are given below.

(a) Engine development

Carbon emissions have become an issue of contention for new and used car owners. Motorists are being encouraged by both politicians and the media to downsize their vehicles and reduce their carbon footprint. Many manufacturers have changed their engine and reduced carbon dioxide emissions—tail piece emission. BMW, Mini Cooper Diesel, Mercedes, Mercedes Benz and many more have adopted new technologies in there engine.

(b) Convenience and safety

(i) *Automatic parking:* The wheel scuffer's dream will soon be possible in a whole range of luxury cars. One will have to simply drive along a row of parked cars and the system would detect a space big enough for the vehicle to squeeze into. No intervention would be required from the driver's end. The driver could even take their hands and feet off everything, and watch in astonishment as the car parks itself.

(ii) *Pre-scan technology:* This technology was also showcased in the Mercedes F700 concept, where lasers scan the road surface before the car drives over it. This prepares the suspension to react to the terrain accordingly and ensures peerless ride comfort.

(iii) *Saab Alcokey:* Saab helps reduce the number of alcohol-related road incidents with this device by fitting it as standard—apparently, one in three traffic accidents in Europe are alcohol-related. This fully integrated system requests the driver to blow into a wireless handheld unit before driving the car. The breath is then analysed and if the blood-alcohol limit is exceeded, a red LED appears and the engine does not start.

(iv) *Volvo sleep detection:* Volvo has introduced both Driver Alert Control (DAC) as well as a Lane Departure Warning (LDW) system as a £500 option on some of its higher-priced models. LDW uses cameras located between the windscreen and the rear-view mirror and monitors the car's position between the road markings. Only after a certain speed is reached does the system become active.If the car then wanders across any lane markings without using an indicator, the driver is audibly alerted.

(v) *Collision warning system:* Swedish car maker Volvo is also developing a collision warning system which uses radar technology with a wide-angle search area to detect objects in front of and around the car. If the car approaches a pedestrian, a red warning light comes on the windscreen's head-up display and a warning signal sounds. This helps the driver to react and, in most cases, avoid an accident. If the risk of a collision increases, assisted panic braking is activated to provide more pressure when the brakes are applied, but if the driver still doesn't apply brake and a collision is imminent, the car's brakes are activated automatically.

This system can even be expanded to incorporate collision avoidance programming, where the car could actually perform a direct input to the steering wheel and to the direction of travel if an imminent crash is detected.

(vi) *Vehicle to vehicle technology:* This hi-tech system is being developed by General Motors and uses wireless technology to allow a driver in one car to receive information from another car further ahead on the same road—suppose the other driver has come across an obstacle or has slammed on the brakes. This system allows the other driver to receive this information in sufficient time to react and therefore avoid any accident.

(vii) *Driverless cars:* These 'intelligent vehicles' are capable of taking a person from one point to another without any driver. Providing a 'taxi-like' experience to the passengers, these vehicles would navigate the roads on their own. Also called as autopilot, autonomous

vehicle or auto-drive car. An example of such smart cars is the 2getthere passenger vehicle based on the FROG navigation technology that originated in The Netherlands, DARPA Grand Challenge (from USA) and AGRO research project (from Italy).

(viii) *Emission standards:* With the help of automotive technologies, a check can be put on the emission of harmful pollutants, such as NO_2, particulate matter (PM) or soot, carbon monoxide (CO) or volatile hydrocarbons. As a result, it would reduce the pollution level and save the planet from global warming.

(ix) *Suspension technology:* The suspension system comprises springs, shock absorbers and linkages. This system connects the vehicle to its wheels. The main function of a suspension system is to minimise jerks and provide comfort to the occupants of the vehicle. With the advancement of technology, gas-filled shock absorbers have been developed which are much more responsive than the spring absorbers.

Apart from the above-mentioned technologies, steering technology and safety technologies have also helped the automotive industry in a big way to reach great heights.

Innovative Car Safety Technologies in New Honda City

Car safety technologies have gained prominence in recent years with the growing number of road accidents. Modern-day cars are well equipped with safety devices compared to the older ones. The New Honda City recently launched by Honda Seil Cars India in the Indian car market is a perfect example of safety.

Trinity of Braking System

Trinity of braking system is one of the most significant safety systems in the new Honda City. The trinity comprises the Anti-lock Braking (ABS), Electronic Brakeforce Distribution (EBD) and Brake Assist. The combination of these advanced safety technologies sets a new standard in car safety feature.

ABS uses a system of sensors, an electronic control unit and a hydraulic control unit. All these work in

association with each other to monitor the movement of car wheels and prevent wheel lock up. When any of the car wheels is about to lock while braking, the sensors sense the situation and the electronic unit or the ABS computer sends the signal to the hydraulic unit. After receiving the signal, the system modulates the braking pressure of the corresponding wheel and prevents lock up. The key motive of the ABS system is to help car drivers maintain steering control during hard braking, especially in case of slippery road conditions.

The introduction of EBD with the ABS, holds its own significance in improving safety standards. The system works in conjunction with the anti-lock brakes to electronically distribute the braking pressure between front and rear wheels. It optimises the braking performance by maintaining the pressure balance between both front and rear wheels based on road conditions, car weight, car speed and the available traction. This balance is very important as the car would otherwise spin if the rear wheels lock up before the front wheels.

The Brake Assist system also plays a key role in ensuring faster and safer braking in association with the other two members of the trinity. This system monitors the use of brake pedal and automatically senses the need to stop the car in case of an approaching accident or as a result of panic.

G-Force Control Technology (G-CON)

G-CON or the G-force control technology is one of Honda's best innovations designed in response to the need to control or absorb the crash force in event of an unavoidable accident.

This technology helps to reduce the impact of collision from all directions on the car body. The all-new Honda City is designed with the same impact absorbing body structure along with a strong survival zone to cocoon its passengers in case of an accident. It is believed that the car is estimated to withstand a fixed-barrier frontal collision at around 55 km/hr, a side collision at around 50 km/hr, and a rear impact at around 50 km/hr.

Pedestrian Safety

Honda's commitment to safety also includes the safety of common people who walk on roads. Safety of pedestrians has always been a key concern for Honda. With this concern, the company first studied the dynamics of pedestrian collision according to which when a person is stuck by an oncoming car, they are thrown up onto the car hood before rolling on the street. Keeping this in mind, the company introduced pedestrian safety dummies known as POLAR II.

POLAR II is believed to be the most advanced test dummy that was designed with realistic human structure along with sensors to measure the impact of energy on a human body during a car accident. Data received after crash testing these dummies has been used to re-evaluate the shape and design of the vehicles.

The New Honda City is also designed in accordance to the data received after conducting a crash test with the POLAR II. In the event of an accident with the new Honda City, the bonnet and front wings of the car deform on contact with a pedestrian. Even the hinges on the car bonnet and wiper pivots are designed in such a way that they bend, break or absorb energy so that head injuries to the pedestrian can be minimised. These developments are continuous and helpful to the passenger.

Practical Exercises

Activity 1

List the types of innovation that have come up in the automobile sector.

S. No.	Name of innovation
1.	
2.	
3.	
4.	

Check Your Progress

A. Fill in the blanks

1. A hybrid vehicle is a vehicle that uses two or more distinct _____ sources to move the vehicle
2. Biomass fuels are typically generated through the _____ of organic matter.
3. Old technology vehicles are outdated because they are more _____.
4. G-CON technology helps to reduce the impact of collision from _____ directions on the car body.

B. Multiple choice questions

1. Up to how many kms can solar energy-based cars travel in a day?
   (a) 80 km (b) 30 km
   (c) 40 km (d) 60 km
2. The vehicle which combines an internal combustion engine and electric motors is a_____.
   (a) hybrid vehicle
   (b) electric car
   (c) fuel cells car
   (d) biomass fuel car
3. The full form of ABS is _____ _____.
   (a) Anti-lock Bike System
   (b) Anti-brake System
   (c) Anti-lock Braking System
   (d) None of the above
4. Which of these personalities was a former President of India and a strong advocator of jatropha cultivation for production of biodiesel?
   (a) Mrs Pratibha Devi Patil
   (b) Dr K R Naraynan
   (c) Dr Abdul Kalam
   (d) Mr Pranab Mukherjee

C. Short answer questions

1. What is a hybrid vehicle?
2. What is the use of ABS?