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EXCITING WORLD OF

AUTOMOBILES

STUDENT WORKBOOK

Curriculum :AUTO-SRV *L2-NQ*^{2012}

Unit :AUTO-SRV *L2U5*

Innovation and Development

Vocational Learning Material for Schools

PSS Central Institute of Vocational Education

Bhopal

PREFACE

Improving the parity of esteem between the general academic education and vocational education, is the policy priority of the Government of India. The National Vocational Education Qualification Framework (NVEQF) developed by the Ministry of Human Resource Development (MHRD), Government of India, is a descriptive framework that provides a common reference for linking various qualifications. It will be used for setting common principles and guidelines for a nationally recognized qualification system covering Schools, Vocational Education and Training Institutions, Technical Education Institutions, Colleges and Universities. The NVEQF will act as a translation device to make qualifications more understandable to employers, students and institutions. It will promote transparency of qualifications and facilitate learner's mobility between different qualifications, thus encouraging lifelong learning. PSSCIVE has taken lead in development of learning material for the Automobile Sector for all level in collaboration with the Automobile Skill Development Corporation (ASDC).

The present material contains activity related to Level L-2 for the Automobile service sector. This will fulfill the needs of the students willing to learn activities relating to the Automobile Service Sector. Any student/ entrepreneur willing to start an Automobile Service Sector can acquire the desired competencies with the help of this book.

The book has been written by experts but reviewed by all the members of the group. I am grateful to the authors for the development of this book and to the members of the Working Group for their candid suggestions, during the development and review. Their names are given elsewhere.

I appreciate efforts put in the by Dr. Saurabh Prakash, as the Project Coordinator of the Working Group in planning and organizing Meetings which led to the final form of this title.

I shall be grateful to receive suggestions and observations from readers, which would help in bringing out a revised and improved version of this book.

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June, 2012

This student workbook was developed, with active involvement of the Automobile Skill Development Council (ASDC) keeping in view the National Occupation Standard (NOS) for Service Technician L4 developed by ASDC.

This project for development of the student workbook was coordinated by the PSS Central Institute of Vocational Education, a constituent unit of National Council of Educational Research and Training, which is under Ministry of Human Resource Development, Government of India.

Student Details

Student Name: _____

Student Roll Number:_____

Batch Start Date: _____

Contents

About this Workbook

This workbook is to assist students with completing the Auto Sector **L2U5-NQ2012** unit of competency: **Innovation and Development**. Students should study the workbook in class or in their own time.

This workbook contains sessions for imparting knowledge & skills on various aspects of the unit of competency. The workbook also includes information, exercises, and assessment activities to complete. The assessment plan has been included in the workbook to assist you in scheduling your time for completing the assignments. Each assessment activity is followed by a checklist for meeting the assessment criteria. The criteria will help you to ensure that you have fulfilled all of the assessment requirements to receive a 'competency' grading/Certification by ASDC.

Unit Information

Unit name: Innovation and Development
Unit code: Auto L2U5-NQ2012
Unit descriptor:

This unit provides introductory knowledge & related skills covering innovation and developments taking place in the automobile sector.

Resource Required:

- Notebooks, Pen, Pencil, Eraser, Computer, Open Source Software for making digital presentation, LCD projector. Pictures, sketches, drawings & posters for building awareness about various types of innovations and new technology. Animation and videos depicting new technology & innovations.

Nominal hours: 10 hours

Elements and Performance Criteria

- Elements define the critical learning outcomes of a unit of competency.
- Performance criteria specify the level of performance required to demonstrate the achievement of the Competency Element.

Element of knowledge	Performance Criteria
• Importance of innovation and development	• Able to identify major areas of innovations taking place in automobiles. • Able to broadly describe major new developments

Relevant Knowledge and Skills

1. Relevant Knowledge

- Innovation in automobile,
- Development in automobile,

2. Skills

Able to describe role of

- Innovation in automobiles,
- Development in automobiles,

Assessment Plan

Session No.	Assessment method	Due Date	Completion Date
1.	Fill in the Blanks		
2.	Fill in the Blanks		
3.	Fill in the Blanks		

Introduction

As you know whenever there is a demand of any item, then innovation takes place. Innovation leads to development of a technology. With the development of new technologies, the customers get benefits in term of comfort and safety. Sometimes, innovations also results in lowering costs. The Automobile sector is also witnessing lot of innovations and development due to which new automobile models are being launched in the market.

Innovation has also been seen in the field of passenger safety. A number of devices are now provided in the cars so that in case of any accident air bags come into the operation to save the passenger. There is a lot of research going on in the area of alternative fuels due to economic and environmental concern. Even solar energy based cars have been designed these days. And these cars can go up to 80 km in a day. Some cars have been designed to use electrical energy. A combination of electrical and petrol energy have been used in cars called 'hybrid' cars. Technological developments of design and innovation and chassis have led to the development of MPFI system which gives more mileage per liter of fuel.

In earlier times innovations happened less by planning and more by chance. However, in recent decades innovation processes haves 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. Very highly qualified engineers and scientists work on such projects. In this Unit, you will develop an understanding of the new innovation and development taking place these days.

Session 1: Innovation and Development
Relevant Knowledge

How innovation takes place

You must have seen new innovations and developments taking place day by day. New models of four and two wheeler are coming in the market with new design. You may think why it is happening and how these developments takes place. There are many reasons for the developments of innovations, One reason is fierce marketplace competition. Company R&D is a highly valuable intellectual property and so engineers work under top-secret security as the first company to come to market with a new technology can gain market share. Now let us try to observe and understand how innovation happens in the auto industry.

It can take 5-10 years or more to bring advanced technologies to market. That's why companies are planning now for 2017.

- It all starts with an idea...followed by years of research, computer simulations, product development, laboratory testing, road testing, durability trials, consumer testing, certification and more.
- Today's high-tech automobile is 3,000 parts all performing specialized functions in carefully specified ways. So before any auto technology goes on sale, it must pass through a series of advanced test facilities operated by thousands of auto engineers and scientists.
- An auto must function in the harshest climate conditions, from freezing cold to 100% humidity to desert temperatures...running on the roughest roads, from urban potholes to unpaved country roads. Performing at highway speeds...for as much as a 150,000-mile lifetime...while meeting thousands of regulatory standards.

An automobile purchased today is the product of years of ongoing R&D and investments.

- Innovations requires lead-time. Bringing a new model to market typically requires 5-7 years in laboratories, proving grounds and production facilities, while a brand new technology takes longer.
- Innovation requires large investments. Developing a new power train typically costs $1 billion over 5-8 years. That's one reason why

manufacturers traditionally rank at the top of R&D funding lists for all industries, including computers and pharmaceuticals.

The automobile has very high quality control standards compared to other high tech industries.

- The useful life of consumer electronics is typically 3-5 years, compared to 15+ years for autos.
- Microprocessors in autos must withstand temperature swings from -40 degrees to 130 degrees--double the temperature specs for consumer electronics.

Meeting the test of time is a huge challenge. Your car performs multiple complex tasks in less than the blink of any eye, but researchers must spend years making a vehicle able to operate within seconds.

- When it comes to safety, speed is critical. Autos operate in "milliseconds," or thousands of seconds. Front airbags have about 30 milliseconds to sense an impact, analyze incoming data (from brakes or the steering wheel), decide whether to deploy the airbags - and at what level - and inflate in time to shield occupants. Side airbags deploy three times faster.
- Every few milliseconds, the engine control computer must decide how much fuel to inject into the engine and when to ignite the spark plug in order to optimize fuel economy and minimize emissions, and all this occurs while the driver is directing the vehicle to perform in different ways, such as accelerating onto a highway.

Crash testing helps make vehicles safer through months of different tests and analysis.

- A crash test may only take two-fifths of a second, but the computer sensors can generate a stream of 4,000 data sets...and engineers need many weeks to analyze all that information
- In an auto test facility, a new model of vehicle undergoes testing for about 30 different crash conditions, including side impact, front impact and more.
- As many as 25 crash test dummies may be used for testing just one model. Each high-tech dummy, which typically costs $100,000, is wired with sensors connected to a computer.

Testing in advanced weather facilities is needed to gauge performance under extreme conditions.

- Testing centre have built high-tech test chambers so engineers can evaluate products in different environments, ranging from -40F degrees to 130F degrees.
- Researchers test vehicle performance in special facilities built to mimic monsoon rains and windstorms.
- A model may spend 200 hours in a wind tunnel as researchers and stylists work to lower wind resistance and improve mileage. Aerodynamic drag accounts for about 20% of the energy a vehicle needs just to move through normal air resistance.

Durability testing is important to ensure vehicles meet tough consumer use.

- Even the seats are tested for durability. Using robots, automakers research how people of all shapes and sizes affect the upholstery, seat cushions and seat structures over the life of the vehicle.
- High performance extends to car doors too. It takes 84,000 open-and-close cycles to simulate 10 years of customer use on a car door. This testing happens in a wide range of temperatures, just like real life.
- Manufacturer test and perfect their products at huge, company-owned proving grounds, which include roads designed to replicate real-world conditions...with potholes, bumps and all.

Despite the fastest computers and sophisticated test chambers, a model still needs to be tested in the real world.

- Many operations of a vehicle can be simulated by computer, but engineers need to understand how different systems in an auto interact, and often that can only be done through actual use.
- To test for durability, an automaker can easily rack up 2 million miles of on-road and track testing on a single model of vehicle. That equates to 80 trips around the world.
- It’s a global industry, and testing is worldwide too. A model may be driven in extreme conditions like the jungles of Brazil and the mountains of New Zealand. Research in the southern hemisphere for tests can extend the seasons for testing and help speed up development.

As one of the most regulated products in the marketplace, the automobile undergoes rigorous processes to become certified according to engineering and regulatory standards.

- Through the Society of Automotive Engineers (SAE), 14,000 mobility experts in 100+ countries have provided data resulting in more than 2,600 globally recognized standards for motor vehicle transport.
- An auto must meet more than 200 government safety and environmental regulations in the U.S. alone. Title 40 of the Code of Federal Regulations, which is the section addressing environment, is actually longer than the U.S. tax code.
- Substantial changes to the federal law on occupant crash protection (FMVSS 208) added 50 tests to the auto development cycle, including new crash tests, new test dummies and new airbag requirements. Results from any one of these tests can require vehicle changes, from simple recalibrations to significant re-design and re-testing.
- The road to market can be long. An auto must meet exacting specifications over a long series of tests. If a model doesn't perform as expected on test #37, it may need to be re-engineered...and go back to test #1.

In a way, our assembly lines cover the entire country.

- Often, innovation is the result of collaboration among automakers, diverse suppliers from many industries, universities and federal labs.
- Automakers depend on more than 30,000 suppliers based in all 50 states. Changes to a model can impact many suppliers and their production processes.
- Lead-time is needed in production, too. Process quality control is a priority, because an automotive product needs to be built the same way every time, from all levels of the supply base through to the assembly facility.

So you must have understood how tedious is to develop a new model

Top 10 Innovations

The automobile has gone through many innovations, ranging from radios to fuel injection. But what are the top 10 innovations in recent times? Going back 30-ish years, here's what we've come up with:

1. Antilock brakes

Time frame: While there were some electronic braking systems as far back as the 1960s, Mercedes-Benz was reportedly the first to install ABS on production cars, in '78.

The innovation: They help maintain control while stopping, as well as throw the door open to stability control and roll mitigation technologies.
What we did before: Purists will say "stopped in less distance," but "plowed into objects when the steering locked up" is more accurate.
Which cars have them: Most models offer ABS.

2. Airbag advancements

Fig : Side curtain airbags in the Mercedes-Benz S-Class.

Time frame: The first cars with airbags debuted in the early '70s; Chrysler was the first to make them standard in cars, in 1988.
The innovation: Airbags have graduated from things that simply blast out of the dashboard to more advanced devices that protect you in a rollover, cushion your knee and adjust for smaller drivers. They can also determine the severity of the impact, your seat position and whether you're wearing a seat belt.

What we did before: Relied on seat belts, if we wore them, to protect us.
Which cars have them: All cars must have front airbags.

3. Key fobs

Fig : Chevrolet Malibu key fob.

Time frame: Chevy's '93 Corvette featured General Motors' first Passive Keyless Entry system.

The innovation: Fobs now unlock doors, set off the horn and lights if you lose the car in the MegaMart parking lot and, in some cases, mean you don't have to use a key at all. The latest systems can be programmed to remember how you like your seat and mirror and adjust them accordingly. We should be driving jet cars by now. Failing that, not having to fumble with keys, seats and mirrors will have to do.

What we did before: Expended needless mental energy remembering where we parked and exhausted ourselves by unlocking doors manually. **Which cars have them:** Most do.

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4. Fold-flat rear seats

Fig : Fold-flat seats in the Honda Odyssey

Time frame: The first folding rear seats debuted in the '60s, but Honda's fold-away seats in the late-90s Odyssey, later adopted by several automakers, took the concept to a new level.

The innovation: Seats that tuck out of the way are so much easier to deal with than those that have to be removed.

What we did before: Searched for a place in the garage to stow our van's seats then risked a hernia by removing the heavy, awkward things.
Which cars have them: Most sedans have fold-down rear seats; most of the best-selling minivans have the fold-flat third row.

5. Electronic stability systems

Time frame: BMW and Mercedes-Benz introduced them in '95 models.
The innovation: A computerized system that applies the car's brakes or cuts the throttle, or a little of both, to keep the car going where you want it to.
What we did before: Sometimes drove beyond our, or our car's, capabilities.
Which cars have them: Many models offer these systems.

6. DVD players

Fig : Saturn Vue DVD screen

Time frame: Honda and Saturn first offered them as options in 2002 models.
The innovation: They shrunk the DVD player and TV you had in the family room and stuck it in a vehicle. What's so innovative about that? If you have to ask, you must do not have kids.

What we did before: Hated life.

Which cars have them: Many minivans, wagons and SUVs have them as an option; some cars do as well.

7. Heated and cooled seats

Time frame: Heated seats have been around for a while, but cooled seats debuted in the mid-90s.

The innovation: Electric coils warm the seat, air circulates to cool it.
What we did before: Froze ourselves or walked around with sweaty, slimy grimy shirts plastered to our backs.

Which cars have them: Many cars offer heated seats. Cars with cooled seats include the Audi A8; BMW 760, 750 and M5; Bentley Continental Flying Spur; Buick Lucerne; Cadillac DTS, Escalade, STS, XLR and DTS; Ford Expedition and GT; Infiniti M35 and M45; Lexus ES, GS, IS and LS; Lincoln LS, Navigator and MKZ; Maserati Quattroporte; Maybach 57 and 62; Mercedes-Benz S, SL, CL, CLK, CLS, E and SLR; Mercury Monterey; Saab 9-5; Toyota Avalon; and VW Phaeton.

8. Tilt/telescoping steering wheels and adjustable pedals

Time frame: Tilt steering wheels have been around for a long time, but telescoping steering wheels and adjustable pedals only became common in the last 10 years.

The innovation: You need to sit at least 10 inches from airbags to avoid injury when they deploy, but shorter folks sometimes can't easily reach the car's controls if they do that.

What we did before: Sat too close to the airbag, hurt our backs with bad posture and generally were uncomfortable, and possibly unsafe, behind the wheel.

Which cars have them: Many offer them as an option

9. Navigation systems

Fig : Lincoln navigation screen.

Time frame: There are debates over who was first, but Honda claims the first nav system, in the 1990 Acura Legend.

The innovation: Going beyond paper maps, these systems can act as a co-pilot, telling you where to go and recalibrating themselves if you miss a turn.

What we did before: Refused to ask for directions.

Which cars have them: Many offer them as an option.

10. Hybrid drive trains

Time frame: While electric cars go back to the early days of the automobile, Honda's Insight was the first mass-produced hybrid sold in the U.S., in the 2000 model year.

The innovation: Hybrid drivetrains combine gas engines with electric motors for power. While some systems are tuned to deliver more performance, the real news is in going farther on a gallon of gas ... and being able to drive a partially electric car without plugging it in.

What we did before: Plugged in our electric cars, or bought smaller, lighter vehicles to save gas.

Which cars have them: Many offer them as an option.

5 New Innovations in Car Safety Technologies

Our cars are becoming chicer, more fuel efficient and safer every day, as car manufacturers search for ways to satisfy our desire for the best and the safest.

Today's vehicle effortlessly blend comfort, performance and safety, thereby offering car buyers more than they've ever had before in terms of features and styling. Cutting-edge safety technology has also grown by leaps and bounds, especially over the past few years. Technology continues to produce the best safety features that are designed to protect ourselves, our passengers and other motorists and pedestrians.

Top five best new innovations in cars safety technology:

1. Tyre pressure monitoring systems – Tyre pressure monitoring systems provide the latest and greatest technology for eliminating low tyre pressure on our cars, which can result in an accident or simply poor gas mileage. A tire pressure monitoring system can also alert us in seconds to a flat tyre, thereby reducing the chances of becoming involved in a car accident due to a flat tyre.

2. Blind-spot detection – Finally! There now is a system for alerting us if we attempt to make a turn and an object or car is in our blind spot. This technology responds as soon as the driver puts on the turn signal, thereby preventing a collision caused by the driver's blind spot.

"If you are making a turn too fast and the car senses a potential rollover, the rollover prevention system will apply the brakes and modulate the throttle as needed to help you maintain control of the vehicle."

3. Rollover prevention – Most of the newer SUVs are equipped with electronic stability control systems, but rollover prevention systems take the concept one step further. If you are making a turn too fast and the car senses a potential rollover, the rollover prevention system will apply the brakes and modulate the throttle as needed to help you maintain control of the vehicle. Ford calls it Roll Stability Control, while GM calls it Proactive Roll Avoidance.

4. Sensitive air bag systems – In older model cars, the airbag deploys when a front-end crash occurs. However, many of today's vehicles come equipped with more sensitive air bag systems, which sense the difference in the size and weight of the occupants and deploys the air bags accordingly. This technology may even be able to detect that an individual is not wearing a seat belt or that he or she is positioned abnormally in the seat and compensate the air bag deployment to accommodate this.

5. Night vision assist – Properly operating a vehicle takes on a whole new meaning during the night time hours. Some of the newest vehicle technology allows drivers to see further down the road, courtesy thermal-imaging cameras, thereby allowing them to spot animals, pedestrians and other vehicles that they normally would not have seen.

These cutting-edge safety technologies will offer drivers not only added safety when behind the wheel, but may also offer them discounts on their car insurance. Many car insurance companies will offer drivers of safe vehicles, such as those with newer safety technology, discounts on their car insurance, thereby saving money while at the same time protecting themselves, their passengers, and other motorists and pedestrians. The safety technology of today and tomorrow is far-reaching and impressive, to say the least.

These developments are continuous and helpful to passenger. All the big auto manufacturers have Research and Development centres and contribute large amount of funds towards it. As per a report on R&D spending in 2005, the automotive industry invested EUR 68 billion in research & development. Through 2015, this number will rise to EUR 800 billion.(80000 crore)

Session 1: Innovation and developments

Exercise: Assignment

1. List the top 10 top innovations in the automobile sector.

S.No.	Name of Innovation
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Session 1: Innovation and developments

Answer the following questions
(Use additional sheets of paper if necessary)

A. Fill in the blanks

1. Innovations are important for _____ .
2. Navigation systems is used for_____,
3. New technology helps in _____.
4. Electronic stability systems help in_____.

Session 1: Innovation and Development

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for Assessment Activity.

Part A

- Differentiate between old and new technology.

Part B

Discussed in class the following :

- Why vehicle manufacturers invest in Research and Development in for vehicle.?
- What are the different types innovations used in automobiles?
- What are advantages of using new innovations?
- How innovation takes place in auto sector.

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to understand innovation		
Able to recall new innovations in automobiles.		

Suggested Reading

Books

Title	Author	Publisher
Automobile Engineering Vol I	Kirpal Singh	Standard Publishers
Automobile Engineering Vol II	Kirpal Singh	Standard Publishers
Text Book of Automobile Engineering	R K Rajput	Laxmi Publications
Automobile Engineering	R K Singal	S. K. Kataria and Sons
Automobile Engineering Theory	Kapil Dev	Computech Publications
Automobile Engineering,	K. M. Moeed	S. K. Kataria and Sons

Websites

auto.indiamart.com/auto-technology

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www.wikipedia.com

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