

**EXCITING WORLD OF
AUTOMOBILES**



STUDENT WORKBOOK

Curriculum :AUTO-SRV L1-NQ²⁰¹²

Unit :AUTO-SRV L1U5

Automobile and Environment

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-1 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.

Bhopal
June, 2012

Prof. R.B. Shivagunde
Joint Director
Pandit Sunderlal Sharma
Central Institute of Vocational Education

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This student workbook was developed, with active involvement of 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: _____

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About this Workbook

This workbook is to assist students with completing the Auto Sector **L1U5-NQ2012** unit of competency: **Automobile and Environment**. 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: Automobile and Environment

Unit code: Auto L1U5-NQ2012

Unit descriptor:

This unit provides introductory knowledge & skills covering automobile and its impact on environment. Students will be given a broad view of important issues like our environment, air Pollution, auto emissions as well as Standards like EU/ BS, PUC Certification and ways to control pollution.

Resource Required:

- Notebooks, Pen, Pencil, Eraser, Computer, Open Source Software for making digital presentation, LCD projector. Sketches, pictures, animation and videos depicting air Pollution, auto emissions, Standards like EU/ BS, PUC Certification. Posters for building awareness about these topics.
- **Nominal hours:** 20 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	Performance Criteria
<ul style="list-style-type: none">• Air pollution	<ul style="list-style-type: none">• Able to list sources of air pollution• Able to identify air pollution caused by poorly maintained automobiles.
<ul style="list-style-type: none">• Auto emissions and EU/ BS Standards	<ul style="list-style-type: none">• Able to identify various Standards like EU/ BS
<ul style="list-style-type: none">• PUC Certification	<ul style="list-style-type: none">• Able to describe about PUC Certification process.

Relevant Knowledge and Skills

1. Relevant Knowledge

- Air Pollution,
- Auto emissions,
- Standards like EU/ BS,
- PUC Certification and
- Ways to control pollution

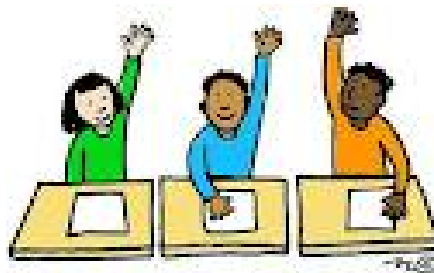
2. Skills

Able to describe about

- Air Pollution,
- Auto emissions,
- Standards like EU/ BS,
- PUC Certification and
- Ways to control pollution

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

Pollution is of great concern to the human race. As we know that we are not able to conserve our environment properly. If we don't start conserving our environment then our natural resources will be depleted / finished soon. Pollution in any form is dangerous. Pollution of air, water, noise has to be controlled to save our environment. It is necessary for us to adopt national and international emission standards which ensure better utilization of resources. These standards help in controlling the pollution. Governments all over the world are now serious about environment. Therefore, we get emission standards to follow in design & maintenance of automobiles. All the product and services have to follow national standards. Now day's strict measures are being taken by car designers to adopt Bharat Standard (BS). You must have noticed BSIV written on vehicles. This is the latest version of emission standards to be followed in India. Similarly all the vehicles are supposed to carry PUC certificate so that pollution is controlled. You should visit a nearby petrol pump and observe how they check pollution coming out of an automobile.

In this Unit, you will develop an understanding of the air pollution, auto emissions, Standards like EU/BS, PUC Certification and ways to control pollution.

Session 1: Air Pollution

Relevant Knowledge

Air Pollution

Human population size has grown enormously over the last hundred years. This means increase in demand for food, water, home, electricity, roads, automobiles and numerous other commodities. These demands are exerting tremendous pressure on our natural resources, and are also contributing to pollution of air, water and soil. The need of the hour is to check the degradation and depletion of our precious natural resources and pollution without halting the process of development.

Pollution is an undesirable change in physical, chemical or biological characteristics of air, land, water or soil. Agents that bring about such an undesirable change are called **pollutants**. In order to control environmental pollution, the Government of India has passed the **Environment (Protection) Act, 1986** to protect and improve the quality of our environment (air, water and soil).

AIR POLLUTION AND ITS CONTROL

We are dependent on air for our respiratory needs. Air pollutants cause injury to all living organisms. They reduce growth and yield of crops and cause premature death of plants. Air pollutants also deleteriously affect the respiratory system of humans and of animals. Harmful effects depend on the concentration of pollutants, duration of exposure and the organism.

Smokestacks of thermal power plants, smelters and other industries release particulate and gaseous air pollutants together with harmless gases, such as nitrogen, oxygen, etc. These pollutants must be separated/filtered out before releasing the harmless gases into the atmosphere.



Fig : Photograph of Air Pollution

Automobiles are also a major cause for atmospheric pollution at least in the metro cities. Actually it is the badly designed and badly maintained automobiles that are a major cause of air pollution. You must have seen on roads a bus or truck or car or tempo releasing black smoke. This is because of poor maintenance of the vehicle. This happens when engine is not burning

the fuel completely or properly. It can also happen because of improper mixture of air and fuel or perhaps the poor quality of fuel could be the reason. As the number of vehicles increase on the streets, this problem is now shifting to the other cities also. Proper maintenance of automobiles along with use of lead-free petrol or diesel can reduce the pollutants they emit. Catalytic converters, having expensive metals namely platinum-palladium and rhodium as the catalysts, are fitted into automobiles for reducing emission of poisonous gases. As the exhaust passes through the catalytic converter, unburnt hydrocarbons are converted into carbon dioxide and water. Also, carbon monoxide and nitric oxide are changed to carbon dioxide and nitrogen gas, respectively. Motor vehicles equipped with catalytic converter should use unleaded petrol because lead in the petrol reduces effectiveness of the catalyst.

Controlling Vehicular Air Pollution: A Case Study of Delhi

With its very large population of vehicular traffic, Delhi leads the country in its levels of air-pollution – it has more cars than the states of Gujarat and West Bengal put together. In the 1990s, Delhi ranked fourth among the 41 most polluted cities of the world. Air pollution problems in Delhi became so serious that a public interest litigation (PIL) was filed in the Supreme Court of India. After being censured very strongly by the Supreme Court, under its directives, the government was asked to take, within a specified time period, appropriate measures, including switching over the entire fleet of public transport, i.e., buses, from diesel to **compressed natural gas (CNG)**.

It was nice that the government of Delhi decided to convert all the buses of to run on CNG by the end of 2002. This resulted in dramatic improvement in the pollution levels.

You may ask the question as to why CNG is better than diesel. The answer is that CNG burns most efficiently and completely. On the other hand petrol or diesel are partly left un burnt. Moreover, CNG is cheaper than petrol or diesel, cannot be siphoned off by thieves and cannot be adulterated like petrol or diesel. The main problem with switching over to CNG is the difficulty of laying down pipelines to deliver CNG through distribution points/pumps and ensuring uninterrupted supply. Therefore you may have noticed long queues at the CNG stations.

Simultaneously parallel steps are also being taken for reducing vehicular pollution include phasing out of old vehicles, use of unleaded petrol, use of low-sulphur petrol and diesel, use of catalytic converters in vehicles, application of stringent pollution level norms for vehicles, etc.

The Government of India through a new auto fuel policy has made a plan to cut down vehicular pollution in Indian cities. More stringent norms for fuels means steadily reducing the sulphur and aromatics content in petrol and diesel fuels. Euro II norms, for example, stipulates that sulphur be controlled at 350 parts-per-million (ppm) in diesel and 150 ppm in petrol. Aromatic hydrocarbons are to be contained at 42 per cent of the concerned fuel. The goal, according to the roadmap, is to reduce sulphur to 50 ppm in petrol and diesel and bring down the level to 35 per cent. Corresponding to the fuel, vehicle engines will also need to be upgraded.

All automobiles and fuel-petrol and diesel – were to have met the Euro III emission specifications in these 11 cities from April 1, 2005 and have to meet the Euro-IV norms by April 1, 2010. The rest of the country will have Euro-III emission norm compliant automobiles and fuels by 2010. Thanks to the efforts made, the air quality has significantly improved in some cities like Delhi. According to an estimate, a substantial fall in CO₂ and SO₂ level has been found in Delhi between 1997 and 2005. This has been possible by introducing CNG buses on the roads.

Session 1: Air Pollution

Exercise: Assignment

- List the reasons for air pollution.

S.No.	Reasons for air pollution
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

2. Observe and identify air pollution poster in your school and draw their diagrams



Session 1: Air pollution

Answer the following questions

(Use additional sheets of paper if necessary)

Fill in the blanks

1. Need of the hour is to check the _____ and _____ of our precious natural resources and pollution.
2. In order to control environmental pollution, the Government of India has passed the _____) Act, 1986 to protect and improve the quality of our _____(air, water and soil).
3. Air pollutants deleteriously affect the _____ system of humans and of animals.
4. Full form of CNG is _____.
5. Automobiles are a major _____for atmospheric pollution
6. Euro II norms, for example, stipulate that sulphur be controlled at _____ parts-per-million (ppm) in diesel and _____ ppm in petrol.

Session 1: Air pollution

Checklist for Assessment Activity

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

Part A

- Share importance of air pollution.

Part B

- Discussed in class the following:
 1. Why control of air pollution is necessary?
 2. What is the role of convertor in automobile?
 3. Case study of pollution control in Delhi
 4. Importance of using CNG.
 5. Which first city has followed strictly air pollution norms?

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to explain reason of air pollution		
Able to explain measure to control air pollution		

Session 2: Auto Emissions and EU/ BS Standards

Relevant Knowledge

Sometimes you must have seen black or white smoke coming from car, scooter, tempo or truck. This smoke is a byproduct of combustion process and from evaporation of fuel itself. This smoke is called pollution. It is also known as auto emission.

Auto Emissions

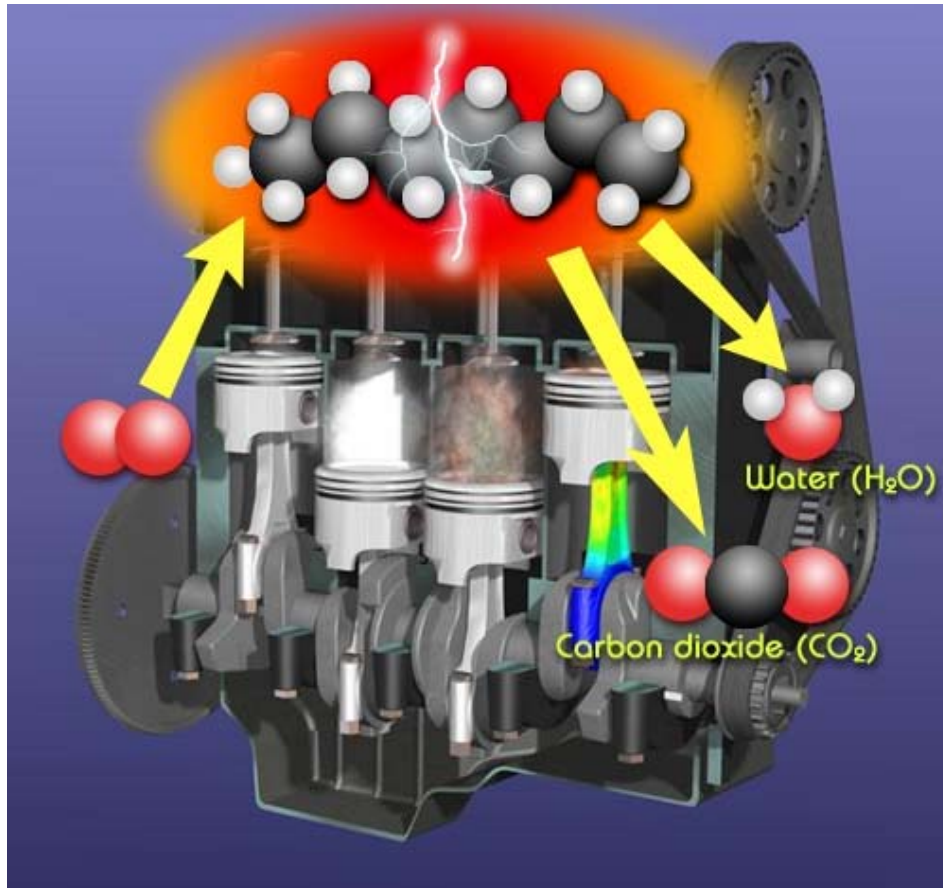
When emission from automobiles carry unburnt hydrocarbons it causes air pollution. Pollution from cars comes from by-products of this combustion process (exhaust) and from evaporation of the fuel itself.



Fig : Photograph of Automobile Emission

The Combustion Process

Petrol and diesel fuels are mixtures of hydrocarbons, compounds which contain hydrogen and carbon atoms. In a “perfect” engine, oxygen in the air would convert all the hydrogen in the fuel to water and all the carbon in the fuel to carbon dioxide. Nitrogen in the air would remain unaffected. In reality, the combustion process cannot be “perfect,” and automotive engines emit several types of pollutants.



Emission Standards

Governments and regulatory bodies all over the world sit down with Automobile companies and list down requirements that set specific limits to the amount of pollutants that can be released into the environment. Many emissions standards focus on regulating pollutants released by automobiles (motor cars) and other powered vehicles but they can also regulate emissions from industry, power plants, small equipment such as lawn mowers and diesel generators. Frequent policy alternatives to emissions standards are technology standards (which mandate Standards generally regulate the emissions of nitrogen oxides (NO_x), sulfur oxides, particulate matter (PM) or soot, carbon monoxide (CO), or volatile hydrocarbons (see carbon dioxide equivalent).

Emission Norms in India

With more and more vehicles coming on the roads there is possibility of large scale pollution caused by these vehicles. However, if vehicles are designed and maintained as per regulations then this danger will be reduced considerably.

It was only in 1991 that the first stage emission norms came into force for petrol vehicles and in 1992 for diesel vehicles. From April 1995 mandatory fitment of catalytic converters in new petrol passenger cars sold in the four metros of Delhi, Calcutta, Mumbai and Chennai along with supply of Unleaded Petrol (ULP) was affected. Availability of ULP was further extended to 42 major cities and now it is available throughout the country.

The emission reduction achieved from pre-1989 levels is over 85% for petrol driven and 61% for diesel vehicles from 1991 levels.

In the year 2000 passenger cars and commercial vehicles started meeting Euro I equivalent India 2000 norms, Euro II equivalent Bharat Stage II norms are in force from 2001 in 4 metros of Delhi, Mumbai, Chennai and Kolkata.

India is still behind Euro norms by few years. These are standards followed by European countries. However, with many vehicles manufactured in India now being exported a beginning has been made, and emission norms are being aligned with Euro standards and vehicular technology is being accordingly upgraded. Indian Vehicle manufactures are also working towards bridging the gap between Euro standards and Indian emission norms.

Bharat stage emission standards are emission standards instituted by Government of India to regulate the output of air pollutants from internal combustion engine equipments, including motor vehicles. The standards and the timeline for implementation are set by the Central Pollution Control Board under the Ministry of Environment & Forests.

Now a days India has adopted Bharat stage –IV norms in automobile sector. For metro cities it has become compulsory to use standard product.

The implementation schedule of EU emission standards in India is presented here in Table 1.

Table 1

Indian Emission Standards (4-Wheel Vehicles)

Standard	Reference	Date	Region
India 2000	Euro 1	2000	Nationwide
Bharat Stage II	Euro 2	2001	NCR*, Mumbai, Kolkata, Chennai
		2003.04	NCR*, 11 Cities†
		2005.06	Nationwide
Bharat Stage III	Euro 3	2005.06	NCR*, 11 Cities†
		2010.14	Nationwide
Bharat Stage IV	Euro 4	2010.14	NCR*, 11 Cities†

* National Capital Region (Delhi)

† Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Secunderabad, Ahmedabad, Pune, Surat, Kanpur and Agra

The above standards apply to all new 4-wheel vehicles sold and registered in the respective regions. In addition, the National Auto Fuel Policy introduces certain emission requirements for interstate buses with routes originating or terminating in Delhi or the other 10 cities.

For 2-and 3-wheelers, Bharat Stage II has been applicable since April 1, 2005 and Stage III standards came in force from April 1, 2010.

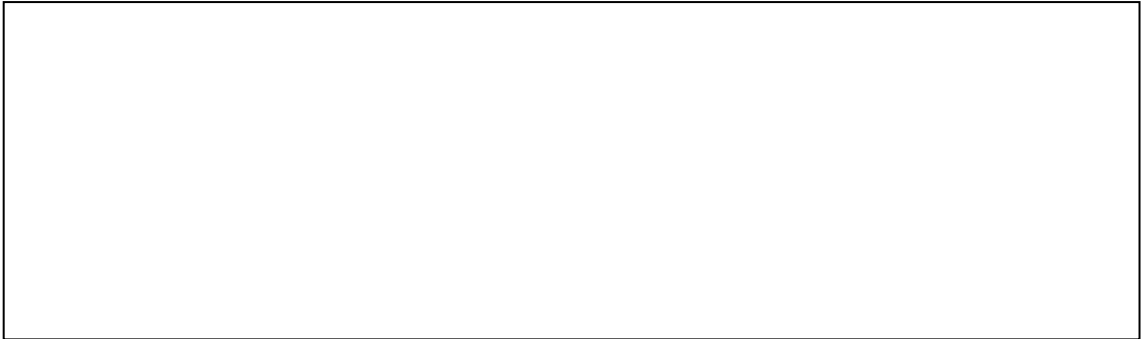
Session 2: Auto Emissions and EU/ BS Standards

Exercise: Assignment

- List the reasons for auto emission pollution.

S.No.	Reasons for emission
1.	
2.	
3.	
4.	

2. Observe and identify auto emission of vehicle in your area and make sketches of your observations.



Session 2: Auto Emissions and EU/ BS Standards

Answer the following questions

(Use additional sheets of paper if necessary)

Fill in the blanks

1. Burning of fuel takes place in the _____ of automobile to give power to vehicle.
2. Smokes are byproduct of _____ process (exhaust) and from _____ of fuel itself.
3. First stage emission norms came into force for petrol vehicles in the year_____.
4. Emission reduction achieved from pre-89 levels is _____ for petrol driven and _____ for diesel vehicles from 1991 levels.
5. Euro II equivalent Bharat Stage II norms are in force from 2001 in 4 metros of _____, _____, _____ and_____.

Session 2: Auto Emissions and EU/ BS Standards

Checklist for Assessment Activity

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

Part A

- Share role of emission in air pollution.

Part B

- Discussed in class the following:
 1. Why emission control of air pollution is important ?
 2. What is Bharat standards/Euro standard in automobile?
 3. How control of emission help

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to explain importance of emission norms		
Able to discuss about bharat standards		

Session 3: PUC Certification

Relevant Knowledge

In this chapter you have learnt about various aspects of automobile pollution and measures taken to control pollution.

Adulteration of fuel leads to the weak combustion process and ultimately leads to pollution. You must have read in newspaper that some petrol pump owner's adulterate petrol with kerosene to get higher margin of profit. They should not do this because it causes incomplete combustion which leads to air pollution from vehicles using adulterated petrol. Steps have also been taken to improve the quality of fuel. Proper maintenance of vehicle keeps pollution check by reducing the emission. Gradually, new measures like lead free fuel, CNG fuel, biofuel etc are also being adopted in automobile sector.

Hence quality of fuel is very important. The Fuel Quality plays a very important role in meeting the stringent emission regulation. The fuel specifications of petrol and diesel have been aligned with the Corresponding European Fuel Specifications for meeting the Euro II, Euro III and Euro IV emission norms.

As you have learnt that the use of alternative fuels has been promoted in India both for energy security and emission reduction. Delhi and Mumbai have more than 100,000 commercial vehicles running on CNG fuel. Delhi has the largest number of CNG commercial vehicles running any where in the World. India is planning to introduce Biodiesel, Ethanol Gasoline blends in a phased manner and has drawn up a road map for the same.

The Indian auto Industry is working with the authorities to facilitate introduction of alternative fuels. India has also setup a task force for preparing the Hydrogen road map. The use of LPG has also been introduced as an auto fuel and the oil industry has drawn up plans for setting up of Auto LPG dispensing station in major cities.

Pollution Under Control (PUC) Certificate

Presently, all vehicles need to undergo a periodic emission check (3 months/ 6 months) at PUC Centers at Fuel Stations and Private Garages which are authorised to check the vehicles. It is mandatory for every vehicle owner to carry a valid Pollution Under Control (PUC) Certificate and maintain the vehicle within prescribed emission norms.

You must have seen at a nearby petrol pump the Computerised facilities for checking of pollution levels and issue of PUC Certificates (to vehicles meeting emission standards). These authorised Pollution Checking Centres are spread in all cities. At present, number of Centres for petrol driven vehicles and the diesel driven vehicles are functioning. These centres issue Pollution Under Control Certificates (PUC) if the vehicle is found meeting prescribed emission norms. In case the vehicle is found polluting beyond prescribed norms, necessary repairs/ tuning in the vehicle would be required.

If a vehicle is not having the valid PUC pollution certificate, then is liable to be prosecuted under Section 190(2) of the Motor Vehicles Act. A penalty of Rs.1000/- for first offence and Rs.2000/- for every subsequent offence of violation has been provided.

Fees for pollution checking are fixed by state transport department and it is very nominal like:-

Petrol / CNG / LPG vehicle Rs.25

Diesel vehicle Rs.50

Minor adjustment (Carbureted petrol vehicles only) Rs.5

If any vehicle is found polluting although it is carrying a valid PUC certificate then The PUC Certificate of vehicle shall be cancelled and you will be directed (under Rule 116 of CMV Rules) to produce a fresh PUC Certificate within seven days. The failure to comply with this direction would result in prosecution under section 190(2) of the Motor Vehicles Act.. if vehicle is not polluting and PUC Certificate has expired or I do not have a PUC Certificate then also offence of not having a PUC Certificate also attracts prosecution under section 190(2) of the Motor Vehicles Act

There are regulations also that require, transport vehicles to undergo an annual fitness check carried out by RTOs for emissions, safety and road

worthiness. Now the government is also preparing plans for compulsory inspection of vehicles after a certain number of years

Some other way to control pollution is to

Keep car one day off in a week
 Pool the car for going to office
 Use bicycle for short distances
 Keep your vehicle properly maintained
 Delhi metro is best example of controlling pollution and providing comfort to the public.



Session 3: Pollution Control and PUC Certification

Exercise: Assignment

1. List the reasons for controlling pollution

S.No.	Reasons for air pollution

2. Prepare a poster depicting controlling of air pollution by better Designed and better maintained automobiles

Session 3: Pollution control and PUC Certification

Answer the following questions

(Use additional sheets of paper if necessary)

A. Fill in the blanks

1. New alternate fuel used in Delhi is_____.
2. Meaning of PUC is _____,
3. PUC is checked at_____.
4. Full form of CNG is _____.

Session 3: Pollution control and PUC Certification

Checklist for Assessment Activity

Use the following checklist to see if you've met all the requirements for pollution control.

Part A

- Share importance of air pollution.

Part B

- Discussed in class the following:
 1. Why control of pollution is necessary ?
 2. What is the purpose of PUC?
 3. Important tips about controlling pollution
 4. Delhi metro is successful model of controlling pollution.

Performance standards/criteria covered by this assessment

Performance standards	Yes	No
Able to explain importance of pollution control		
Able to discuss about role of PUC		

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	Rajput R K,	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

www.automobileindia.com/consumer-guide/automobile-technology

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www.bikeadvice.org

www.wikipedia.com

List of Contributors

1. Mr. Sunil K. Chaturvedi, CEO, Automotive Skills Development Council, Core 4-B 5th Floor India Habitat Centre, Lodhi Road, New Delhi – 110 003
2. Mr. A.C. Deb, Sr. Lecturer, (Auto) – HOD, PUSA Polytechnic PUSA, New Delhi -12
3. Mr. Vikas Gautam, S.B.V. NO.1, Morigate, Delhi – 06,
4. Prof. A.P. Verma, Ex-Prof. & HOD, PSSCIVE, Bhopal.
5. Sh. Deepak Shudhalwar, Assistant Professor, E & T Division, PSSCIVE, Bhopal
6. Dr. Saurabh Prakash, Associate Professor, E & T Division, PSSCIVE, Bhopal – Programme Coordinator