

**Vocational Higher Secondary
Education (VHSE)**

Second Year

AUTOMOBILE TECHNOLOGY

Reference Book - Teachers' Version



Government of Kerala
Department of Education

State Council of Educational Research and Training (SCERT),
KERALA
2016

Foreword

Dear Teachers

This reference book (**Teachers' Version**) is intended to serve as a transactional aid to facilitate classroom transaction and as a ready reference for teachers of Vocational Higher Secondary Schools. It offers some guidelines for the transaction of the course content and for undertaking the practical work listed in the course content. As the curriculum is activity based, process oriented and rooted in constructivism focusing on the realisation of learning outcomes, it demands higher level proficiency and dedication on the part of teachers for effective transaction.

In the context of the Right- based approach, quality education has to be ensured for all learners. The learner community of Vocational Higher Secondary Education in Kerala should be empowered by providing them with the best education that strengthens their competences to become innovative entrepreneurs who contribute to the knowledge society. The change of course names, modular approach adopted for the organisation of course content, work-based pedagogy and the outcome focused assessment approach paved the way for achieving the vision of Vocational Higher Secondary Education in Kerala. The revised curriculum helps to equip the learners with multiple skills matching technological advancements and to produce skilled workforce for meeting the demands of the emerging industries and service sectors with national and global orientation. The revised curriculum attempts to enhance knowledge, skills and attitudes by giving higher priority and space for the learners to make discussions in small groups, and activities requiring hands-on experience.

The SCERT appreciates the hard work and sincere co-operation of the contributors of this book that includes subject experts, industrialists and the teachers of Vocational Higher Secondary Schools. The development of the teachers' version of reference books has been a joint venture of the State Council of Educational Research and Training (SCERT) and the Directorate of Vocational Higher Secondary Education.

The SCERT welcomes constructive criticism and creative suggestions for the improvement of the book.

With regards,

Dr. J. Prasad
Director
SCERT, Kerala

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ABOUT THE COURSE

In the Vocational Higher secondary Education (VHSE) system the department offers two courses related to automobile industry. They are Maintenance and Repairs of Two Wheelers and Three wheelers (MRTWTW) and Maintenance and Repairs of Automobile (MRA). Currently these two courses are merged and renamed as Automobile Technology (AT). This endeavor will definitely enhance the job opportunities of our students. Moreover the higher educations at this diploma and degree level are based on automobile technology. In the new curriculum, we have tried to incorporate the Concept and ideas of modern systems and components of automobile.

Automobile industry is a fast developing field all over the world. Automobile technology has much scope in India. This is one of the fastest growing engineering sectors. On the increasing demand of cars, bike and other automobile vehicles, the companies show their full interest to set up companies in various states of India. Many foreign car companies are competing each other to set up their firms in India. As India is the second largest country in population of the world, it gives a huge marketing scope. The different types of millions of vehicles have to be maintained in trouble less smooth condition. It gives plenty of job opportunities. As a fast growing country India is facing acute shortage of large number of skilled workers. After completing automobile technology course in vocational higher secondary, the students will get easily access in the various posts of industry in automobile sector. The course is designed to grab opportunities in the present global crisis situation.

Students having a basic knowledge and practice in Automobile Engineering will have a lot of opportunities in India and abroad. Automobile Technology is a course which is designed to expertise the students in the service and maintenance of automobile. This course has four modules and each module helps the student to understand the various areas of an automobile. Each module is designed to acquire some specific skills as per the Industrial need. The duration of one module is 340 hours, thirty percentages is allotted to theory and seventy percentages to practical. Moreover four weeks OJT is also facilitated to our students for acquiring the strategies and skills of a real work situation. Due to the growth in automobile sector, the job opportunities are also growing. There are lots of opportunities in the area of Manufacturing, service station, transport companies, defense service, private sector and so on. The Automobile Technology course is designed as per NSQF norms. Moreover it covers all basic Automobile Technologies in foreman skill level. It is specially designed to support the students especially those who are going for higher education.

Automobile Technology

JOB ROLES (CAREER PATH)

The Automobile Technology course offers plenty of job opportunities in different sectors of industry, like Automotive Mechanic, Auto Electrician Diesel Mechanic, etc. Some of them are listed below

GOVT/SEMI GOVT SECTOR	PRIVATE SECTOR	SELF EMPLOYMENT
<ol style="list-style-type: none"> 1. Motor Mechanic 2. Lab Technical Assistant 3. Mechanic - KSRTC 4. Diesel Mechanic - KSRTC 5. Auto Electrician- KSRTC 6. Technical Assistant KSRTC 7. Mechanic in KSEB 8. Mechanic Tractor 9. Road Roller Driver- PWD 	<ol style="list-style-type: none"> 1. Automotive Electrician 2. Service Mechanic 3. Spare parts operator Executive 4. Auto service Technician 5. Customer relation Executive 6. Auto engine Technician 7. Automobile sales executives 8. Tyres retreading operator 9. Diesel fuel calibration Technician 10. Survey Assistant 11. Automobile body work 12. Automobile painting workshop 13. Wheel balancing center 14. Sales Consultant 15. Service Marketing Executive 16. Accessory fitter 17. Maintenance Technician 18. Finance, Insurance coordinator 	<ol style="list-style-type: none"> 1. Service Centre 2. Auto Electrical service Centre 3. Spare parts Centre 4. Automobile Consultant 5. Automobile sale Consultant 6. Tyres Puncture repair shop 7. Tyres retreading 8. Body workshop 9. Upholstery work 10. Water service center 11. Wheel balancing center 12. Auto paint shop 13. Accessory sales and service

Automobile Technology

MAJOR SKILLS

After the completion of the course the students are expected to achieve the following skills

- Automotive Chassis Maintenance Skill
- Automotive Engine Mechanic
- Automotive Transmission Troubleshooting Skill
- Automotive Electrician

SUB SKILLS

- Draftsman skill
- Suspension repair skill
- Wheel Alignment
- Tyre puncture repairing
- Brake mechanic
- Diesel mechanic
- Petrol mechanic
- Calibration technician
- Radiator repairing
- Transmission repairing
- Wiring skill
- Battery maintenance
- Pollution testing skill

LEARNING OUTCOME OF THE COURSE

After completing the course the learner can perform as

- ❖ Engine Mechanic
- ❖ Service Technician
- ❖ Transmission Technician
- ❖ Radiator Technician
- ❖ Auto Electrician
- ❖ Technician in Wheel alignment and wheel balancing centre
- ❖ Brake Repairer
- ❖ Technician in tyre Vulcanizing centre
- ❖ Assistant Technician in Calibration centre
- ❖ Sales Consultant
- ❖ Accessories sales Executive

All the posts mentioned above in job role chart.

COURSE STRUCTURE

This course consists of 4 modules such as:-

MODULE 1	AUTOMOTIVE CHASSIS
MODULE 2	AUTOMOTIVE ENGINES
MODULE 3	AUTOMOTIVE TRANSMISSION SYSTEMS
MODULE 4	AUTOMOTIVE ELECTRICAL SYSTEMS

SYLLABUS

MODULE 3: AUTOMOTIVE TRANSMISSION SYSTEMS

3.1 CLUTCH

(80 Periods)

Purpose of clutch- Functions of clutch-Requirements of clutch-Types of clutch-Single plate clutch, multi plate clutch, centrifugal clutch, diaphragm spring clutch, semi centrifugal clutch –dry and wet clutches- construction and working of single plate(thrust spring type and diaphragm spring type), multi- plate, centrifugal clutch - Clutch actuating mechanisms-mechanical, hydraulic, electromagnetic, vacuum and clutch-by-wire- Clutch components-clutch disc, clutch facing, pressure plate, springs, bearings-clutch free pedal play adjustment.

3.2 MANUAL TRANSMISSION

(96 Periods)

Types of gears- straight spur gear, helical spur gear, bevel gear, spiral bevel gear, hypoid gear- Gear ratio-function and necessity of transmission-resistance on moving vehicle- necessity of providing gear box- types of gear box-sliding mesh, constant mesh, synchromesh gear box- construction and working of constant mesh gear box and synchromesh gear boxes-synchronizing unit-selector mechanisms--gear box lubrication-transfer box-transaxles

3.3 AUTOMATIC TRANSMISSION

(74 Periods)

Semi- automatic- fully automatic – epicyclic gear box- free wheel unit –fluid flywheel -torque converter-overdrive- continuously variable transmission (CVT)- automated manual transmission(AMT)-types of AMT-modern shift control techniques-select shift manual(SSM) and auto shift manual (ASM) modes

3.4 DRIVE LINE

(90 Periods)

Drive line- propeller shaft-universal joints-hooks joint(variable velocity), rzeppa joints(constant velocity)- slip joint- - final drive- types of crown wheel and pinion drive-straight bevel gear, spiral bevel gear, hypoid gear- construction and working of differential -limited slip differential–types of rear axle casing-rear axle drives-rear axle shaft supporting- semi- floating axle, full floating axle and three quarter floating axle

MODULE 4 AUTOMOTIVE ELECTRICAL SYSTEMS

4.1 AUTOMOTIVE BATTERY

(60 Periods)

Function-types of battery-lead acid, alkaline battery, zinc-air battery, nickel- metal hydride battery, lithium- ion battery-construction and working of lead acid battery-characteristics of battery - cell voltage, battery capacity ,battery rating-battery charging methods- slow rate charging, quick rate charging, trickle charging - battery testing-specific gravity test, open volt test, high discharge test, cadmium test- care and maintenance of battery

4.2 CHARGING SYSTEM

(50 Periods)

Function- requirements-charging circuit- generator principle-faraday's law of electromagnetic induction-alternator- construction and working of alternator-alternator regulation- comparison between DC generator and alternator

4.3 STARTING SYSTEM

(40 Periods)

Function-starting circuit-starting motor- construction and working of starting motor-starting drives-bendix drive, overrunning clutch or pre engaged type drive, dycer drive-construction and working of standard bendix drive, construction and working of over running clutch drive - construction and working of solenoid switch- electronic starter control

4.4 LIGHTING SYSTEMS AND ELECTRICAL EQUIPMENTS

(58Periods)

Electrical symbols-wire color codes- lighting circuits- head lamp circuit, tail lamp circuit, stop light circuit, parking light circuit, number plate light circuit, instrument panel light circuit, interior light circuit -types of head lamps- incandescent lamps, halogen lamps, high intensity discharge (HID) lamps, LED lamps-lighting switches- light switch, dimmer switch, stop light switch-instrument panel indicating lights-main beam warning lights, ignition warning lights, flashing indicator warning light, oil pressure warning light, charge indicator light-direction indicator circuit-flashing indicator- horn circuit-construction and working of electric horn- horn relay- wind screen wiper-speedometer and odometer- central locking-power window- - seat belts –pre tensioner and load limiter-air bags

4.5 IGNITION SYSTEM

(82 Periods)

Function of ignition system-types of ignition system-battery coil ignition system- magneto ignition system-electronic ignition system- working of battery coil ignition system with circuit diagram – working of magneto ignition system with circuit diagram- components of ignition system- battery, ignition coil, contact breaker, condenser, distributor, spark plug , magneto – construction and working of ignition coil, spark plugs – function and working of distributor – concept and function of centrifugal and vacuum advance systems -comparison between battery coil and magneto ignition systems

Basic electronics-semi-conductors, diodes, transistors, thyristor-Electronic ignition systems-basic distributor type, distributor less type-capacitor discharge ignition (CDI) -coil on plug – timers- pulse generator, hall-effect switch, optical switch

4.6 EMISSION CONTROL

(50 Periods)

Necessity of emission control-sources of automotive emission-charts showing Euro norms of Bharat Stage 3and 4 of passenger cars, Heavy duty diesel vehicles and 2 wheeler-implementation schedule of euro norms in India- positive crank case ventilation- vapour recovery system- EGR system- air injection system- pulse air- injection reactor (PAIR) system-catalytic converters- two way and three way catalytic converters

LIST OF PRACTICAL ACTIVITIES

MODULE 3: AUTOMOTIVE TRANSMISSION SYSTEMS

3.1 CLUTCH

1. Study the various complaints that may be produced on clutches, give their causes and suggest the remedies.
2. Remove, Dismantle, inspect, service and assemble the single plate clutch (Thrust spring type)
3. Remove, Dismantle, inspect, service and assemble the single plate clutch (Diaphragm spring type)
4. Remove, Dismantle, inspect, service and assemble the Multi plate clutch
5. Inspect, service and adjust the clutch linkage
6. Inspect and service the release bearing and flywheel

3.2 MANUAL TRANSMISSION

1. Study possible complaints that may be produce on the gear box, give the causes and suggest the remedies.
2. Remove, dismantle, inspect, assemble and refit the constant mesh gear box.
3. Remove, dismantle, inspect, assemble and refit the synchromesh gear box.
4. Remove, dismantle, inspect, assemble and refit the transaxle.
5. Remove, dismantle, inspect, assemble and refit the gear selector mechanism.
6. Change the gear oil from the gear box.

3.3 AUTOMATIC TRANSMISSION

1. Check the fluid in automatic transmissions and transaxles and inspect fluid leakage
2. Study various troubles and remedies in automatic transmission and transaxles
3. Perform the linkage and band adjustments
4. Changing the fluid and filters
5. Adjusting neutral safety switch
6. Overhauling automatic transmission
7. Dismantle, inspect, service and assemble the torque converter.

8. Dismantle, inspect, service and assemble the planetary gears.

3.4 DRIVE LINE

1. Remove, inspect, service and refit the universal joint.
2. Dismantle, inspect, service and refit the propeller shaft.
3. Dismantle, inspect, service, assemble and refit the differential unit.
4. Dismantle, inspect, service, assemble and refit the limited slip differential.
5. Remove, inspect, service and refit rear axle bearings and seals
6. Calculate the gear ratio of final drive.

MODULE 4: AUTOMOTIVE ELECTRICAL SYSTEM

4.1 AUTOMOTIVE BATTERY

1. Removing and installing lead acid battery from a vehicle.
2. Cleaning battery top, terminals, cable clamps and apply petroleum jelly on terminals.
3. Conduct different battery testing
 - a. Specific gravity test
 - b. Open voltage test
 - c. Load test.
 - d. High rate discharge test.
 - e. Cadmium test
4. Charging of battery
 - a. Constant voltage
 - b. Constant current
 - c. Booster charging

4.2 CHARGING SYSTEM

1. Study the charging circuit and its various components.
2. Remove, Dismantle, inspect, service and refit the alternator.
3. Replace the drive belt of alternator and adjust the tension of belt.
4. Checking of output current and voltage from alternator, check the condition of current and voltage regulator and also check the cutout relay.

4.3 STARTING SYSTEM

1. Study the starting circuit and its various components
2. Inspect the circuit of starting system.
3. Study the trouble shooting of starting system.
4. Remove, dismantle, inspect, service and refit starting motor
5. Model test connection between booster battery and dead battery for jump starting
6. Familiarize the components of solenoid switch; inspect and service it.

4.4 LIGHTING SYSTEMS AND ELECTRICAL EQUIPEMENTS

1. Do the wiring circuit of:
 - a) Head lamp, park lamp and tail lamp
 - b) Horn
 - c) Indicators
 - d) Wind shield wiper
2. Replacing of head lamp, tail lamp, park lamp, indicator etc..
3. Focusing of head lamp
4. Diagnose and repair horn and tuning it.
5. Servicing and repairing of wind shield wiper and motor.
6. Service and repairing of indicator lamp circuit.
7. Servicing and repair of speedometer and odometer
8. Servicing and repair of fuel gauge
9. Servicing and repair of oil pressure gauge
10. Servicing and repairing of temperature gauge
11. Servicing and repairing of power window
12. Servicing and repairing of various accessories like fog lamp, music system, defogger, power mirror etc..

4.5 IGNITION SYSTEM

1. Do the wiring of various ignition system
2. Remove and inspect spark plug, clean and adjust the gap

3. Check and adjust the contact point of distributor
4. Remove, dismantle, inspect, service and refit the various types of ignition system.
5. Setting of ignition timing with timing light
6. Check and service the distributor.

4.6 EMISSION CONTROL

1. Diagnosis and service positive crankcase ventilation(PCV)
2. Diagnosis and service air injection system
3. Diagnosis and service of EGR
4. Diagnosis and service catalytic converter
5. Diagnosis and service evaporative control system
6. Checking the crankcase ventilation by PCV vacuum tester
7. Remove and service oxygen sensor

LEARNING OUTCOMES

After the completion of third and fourth modules the learner will be achieve the following learning outcomes.

MODULE 3: AUTOMOTIVE TRANSMISSION SYSTEMS

UNIT 3.1 CLUTCH

The learner is able to

- 3.1.1 Understand the purpose, functions and requirements of clutch.
- 3.1.2 Classify different types of clutch
 - Single plate clutch
 - Multi plate clutch
 - Centrifugal clutch
 - Diaphragm spring clutch
 - Semi- centrifugal clutch
 - Wet type
 - Dry type
- 3.1.3 Explain the construction and working of single plate clutch (thrust spring and diaphragm spring type)
- 3.1.4 Explain the construction and working of multi-plate clutch

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- 3.1.5 Explain the construction and working of centrifugal clutch
- 3.1.6 Identify, locate and explain the function of clutch components
- Clutch plate
 - Clutch facing
 - Pressure plate
 - Release bearing
- 3.1.7 Explain the working of clutch actuating mechanisms
- Mechanical
 - Hydraulic
 - Electromagnetic
 - Vacuum
 - Clutch- by- wire
- 3.1.8 Carryout clutch free pedal play adjustment

UNIT 3.2 MANUAL TRANSMISSION

The learner is able to

- 3.2.1 Identify different types of gears
- Straight spur gear
 - Helical spur gear
 - Bevel gear
 - Spiral bevel gear
 - Hypoid gear
- 3.2.2 Calculate gear ratio
- 3.2.3 Describe various resistances on a moving vehicle
- 3.2.4 Explain the necessity of gear box
- 3.2.5 Classify different gear boxes
- Sliding mesh
 - Constant mesh
 - Synchromesh
- 3.2.6 Explain the working of constant mesh gear box
- 3.2.7 Explain the working of synchromesh gear box
- 3.2.8 Explain the working of synchronizing unit
- 3.2.9 Explain the construction and working of selector mechanisms
- 3.2.10 Describe the necessity of gear box lubrication
- 3.2.11 Describe the function of transfer box
- 3.2.12 Explain the working of transaxle.

UNIT 3.3 AUTOMATIC TRANSMISSION

The learner is able to

- 3.3.1 Differentiate semi- automatic and fully automatic transmission system

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3.3.2 Explain the construction and working of epicyclic gearbox

3.3.3 Explain the concept and working of free wheel unit

3.3.4 Explain the working of fluid flywheel

3.3.5 Explain the construction and working of torque converter

3.3.6 Explain the working of overdrives

3.3.7 Explain the principle and working of CVT

3.3.8 Explain the concept of AMT and its type.

- Single –sided clutch transmission(SSCT)
- Double –sided clutch transmission(DSCT)
- Dual clutch transmission(DCT)

3.3.9 Explain the concept of modern shift control techniques

- Select shift manual(SSM) mode
- Auto shift manual (ASM) mode

UNIT 3.4 DRIVE LINE

The learner is able to

3.4.1 Define drive line

3.4.2 Explain the construction and working of propeller shaft

3.4.3 Explain the necessity, construction and working of universal joints

- Variable velocity joint(hook's joint, flexible ring universal joint)
- Constant velocity joint (rzeppa joint)

3.4.4 Explain the function of final drive

3.4.5 Differentiate various crown wheels and pinion drive gearing

- Straight bevel gear
- Spiral bevel gear

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- Hypoid gears

3.4.6 Explain the necessity, construction and working of differential

3.4.7 Explain the necessity of limited slip differential

3.4.8 Classify rear axle casing

- Split type
- Banjo or separate carrier type
- Salisbury or Integral carrier type

3.4.9 Explain the construction and working of rear axle drives

- Hotchkiss drive
- Torque tube drives

3.4.10 Explain the construction and working of rear axle shaft supporting

- Semi- floating axle
- Full floating axle
- Three quarter floating axle

MODULE 4: AUTOMOTIVE ELECTRICAL SYSTEM

UNIT 4.1 AUTOMOTIVE BATTERY

The learner is able to

4.1.1 Explain the function of battery

4.1.2 Classify different types of battery

- Lead acid battery
- Alkaline battery
- Zinc-Air battery
- Nickel-metal hydride battery
- Lithium –ion battery

4.1.3 Explain the construction and working of lead acid battery

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4.1.4 State and define the cell voltage, capacity and battery rating

4.1.5 Explain different battery tests

- Specific gravity test
- Open volt test
- High discharge test
- Cadmium test

4.1.6 Describe different charging methods

- Slow rate charging
- Quick rate charging
- Trickle charging

4.1.7 Explain the care and maintenance of battery

UNIT 4.2 CHARGING SYSTEM

The learner is able to

4.2.1 Describe the function and requirements of charging system

4.2.2 Draw and explain the charging circuit

4.2.3 Explain the construction and working of electromagnet

4.2.4 State faraday's law of electromagnetic induction

4.2.5 Explain the construction and working of alternator

4.2.6 Describe alternator regulation

4.2.7 Differentiate DC generator and alternator

UNIT 4.3 STARTING SYSTEM

The learner is able to

4.3.1 Describe the requirement of starting system

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4.3.2 Draw and explain the starting circuit

4.3.3 Explain the construction and working of starting motor

4.3.4 Classify different starting drives

- Bendix drives
 - ❖ Standard bendix drive
 - ❖ Follow thru bendix drive
 - ❖ Compression spring type bendix drive
 - ❖ Rubber spring type bendix drive
- Overrunning clutch or pre engaged type drive
- Dyer drive

4.3.5 Explain the construction and working of standard bendix drive

4.3.6 Explain the construction and working of over running clutch drive

4.3.7 Explain the construction and working of solenoid switch

4.3.8 Explain the functions of electronic starter control

UNIT 4.4 LIGHTING SYSTEMS AND ELECTRICAL EQUIPEMENTS

The learner is able to

4.4.1 Identify electrical symbols and wire color codes

4.4.2 Draw and explain lighting circuit

- Head lamp circuit
- Tail lamp circuit
- Stop light circuit
- Parking light circuit
- Number plate light circuit
- Instrument panel light circuit
- Interior light circuit

4.4.3 Classify head lamps

- Incandescent lamp
- Halogen lamps
- High intensity discharge lamp(HID)
- LED lamps

4.4.4 Locate and explain the function of lighting switches

- Light switch
- Dimmer switch
- Stop light switch

4.4.5 Explain the functions of different instrument panel indicating lights

- Main beam warning light
- Ignition warning light
- Flashing indicator warning light
- Oil pressure warning light
- Charge indicator light

4.4.6 Draw and explain direction indicator circuit

4.4.7 Draw the horn circuit

4.4.9 Explain the construction and working of electric horn and horn relay

4.4.10 Explain the construction and working of wind shield wiper

4.4.11 Explain the function of speedometer

4.4.12 Explain the function of central lock

4.4.13 Explain the function of power window

4.4.12 Explain the working of air bag

4.4.13 Explain the function and working of seat belts

- Pre tensioner
- Load limiter

UNIT 4.5 IGNITION SYSTEM

The learner is able to

4.5.1 Explain the purpose of ignition system

4.5.2 Classify different types of ignition system

- Battery coil ignition system
- Magneto coil ignition system
- Electronic ignition system

4.5.3 Draw and explain the working of battery coil ignition system

4.5.4 Draw and explain the working of magneto ignition system

4.5.5 List the components of ignition system and mention its function

- Battery
- Ignition coil
- Contact breaker
- Condenser
- Distributor
- Spark plug
- Magneto

4.5.6 Explain the construction and working of ignition coil

4.5.7 Explain the construction and working of spark plug

4.5.8 Explain the function and working of distributor

4.5.9 Describe the concept and function of centrifugal and vacuum advance system

4.5.10 Compare battery coil ignition system and magneto coil ignition system

4.5.11 Explain the concept and function of semiconductors, diodes, transistor, thyristor

4.5.12 Classify electronic ignition system

- Basic distributor type

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- Distributor less type
- Capacitor discharge ignition (CDI) system
- Coil on plug

4.5.13 Draw the circuit diagram and explain the working of basic distributor type ignition

4.5.14 Draw the circuit diagram and explain the working of distributor less ignition system

4.5.15 Explain the working of CDI and coil on plug ignition system

4.5.16 Explain the working of different timers used in basic distributor type ignition

- Pulse generator
- Hall effect switch
- Optical switch

UNIT 4.6 EMISSION CONTROL

The learner is able to

4.6.1 Describe the necessity of emission control

4.6.2 Identify the sources of automotive emission

4.6.3 State the EURO III and IV norms of petrol and diesel vehicles and the implementation year in India

4.6.4 Explain the working of positive crankcase ventilation

4.6.5 Explain the working of vapour recovery system

4.6.6 Explain the working of Exhaust gas recirculation system

4.6.7 Explain the working of air injection system

4.6.8 Explain the working of pulse air injection reactor (PAIR) system

4.6.9 Explain the working of two way and three way catalytic converter

SCHEME OF WORK

Month	Name of Unit	Periods
June	Clutch	68
July	Clutch	12
	Manual Transmission	56
August	Manual Transmission	40
	Automatic Transmission	28
September	Automatic Transmission	46
	Drive Line	22
October	Drive Line	68
November	Automotive Battery	60
	Charging System	8
December	Charging System	42
	Starting System	26
January	Starting System	14
	Lighting System And Electrical Equipment	54
February	Lighting System And Electrical Equipment	4
	Ignition System	64
March	Ignition System	18
	Emission Control	50

STRUCTURE OF MODULES

MODULE 3: AUTOMOTIVE TRANSMISSION SYSTEMS

UNIT NO	NAME OF UNIT	PERIODS
3.1	CLUTCH	80
3.2	MANUAL TRANSMISSION	96
3.3	AUTOMATIC TRANSMISSION	74
3.4	DRIVE LINE	90

30%Theory and 70% Practical

MODULE 4: AUTOMOTIVE ELECTRICAL SYSTEM

UNIT NO	NAME OF UNIT	PERIODS
4.1	AUTOMOTIVE BATTERY	60
4.2	CHARGING SYSTEM	50
4.3	STARTING SYSTEM	40
4.4	LIGHTING SYSTEMS AND ELECTRICAL EQUIPEMENTS	58
4.5	IGNITION SYSTEM	82
4.6	EMISSION CONTROL	50

30%Theory and 70% Practical

CLASSROOM ACTIVITIES

- Product presentation through PowerPoint
- Exhibitions
- Charts
- Diagrams
- Animated CDs

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- Group Discussions
- Debate
- Seminar
- Prepare questionnaire
- Assignment
- Interview
- Project
- Demonstration
- Quiz

Practical activities

- Material handling and safety precautions
- Field visit

MODULE 3 - AUTOMOTIVE TRANSMISSION SYSTEMS

OVERVIEW

The power developed by the engine has to reach the road wheels for moving the vehicle. Transmission system deals this objective. It transmits power to wheels as and when required by varying speed and torque. The unit comprises different components depending upon the purpose. Sometimes we do not have to transmit power; we have to vary the torque and speed, transmit power at varied angle and length, and have to transmit more power to outer wheels than the inner wheels while taking a turn. These different functions and situations are tackled by this system.

This module also deals the most modern concepts of transmission system. It describes the function, construction and working of automatic transmission. Transmission system is the biggest system in automobile. Varieties of job role are offering by this module.

UNIT 3.1 CLUTCH

INTRODUCTION

The engine power does not have to transmit to road wheels while shifting gears and starting the engine. A mechanism is essential for this. Clutch serves this purpose. The unit describes the function, purpose, types of clutch, construction and working of different types of clutch, clutch actuating mechanism etc. Different clutch troubles; their causes and remedies, clutch adjustment, dismantling and assembling of different clutches are also deal in this unit.

UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Purpose of clutch <u>Skills</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Analysis Skill ➤ Familiarizing skill 	Understand the purpose of clutch	Demonstration through multimedia	Activity log
Function of clutch <u>Skills</u> <ul style="list-style-type: none"> ➤ Analysis Skill ➤ Observation skill ➤ Familiarizing skill 	Understand the function of clutch	Demonstration through multimedia	Activity log
Requirements of clutch <u>Skills</u> <ul style="list-style-type: none"> ➤ Analysis Skill ➤ Observation skill ➤ Familiarizing skill 	Understand the requirements of clutch	Group discussion	Activity log
Types of clutch <ul style="list-style-type: none"> • Single plate clutch • Thrust spring clutch • Diaphragm spring 	Classify different types of clutch <ul style="list-style-type: none"> • Single plate clutch • Thrust spring clutch 	Discussion Demonstration using multimedia Classification chart	Activity log Chart Project report

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<ul style="list-style-type: none"> clutch • Multi plate clutch • Semi centrifugal clutch • Centrifugal clutch • Wet type • Dry type <p>Skills</p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill ➤ Classification Skill ➤ Analysis skill ➤ Comparative skill 	<ul style="list-style-type: none"> • Diaphragm spring clutch • Multi plate clutch • Semi centrifugal clutch • Centrifugal clutch • Wet type • Dry type 	Project	
<p>Construction and working of single plate clutch</p> <ul style="list-style-type: none"> • Thrust spring type • Diaphragm spring type <p>Skills</p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Analyzing skill ➤ Familiarizing skill ➤ Classification skill ➤ Comparative skill ➤ Drawing skill ➤ Diagnosing skill 	<p>Explain the construction and working of single plate clutch</p> <ul style="list-style-type: none"> • Thrust spring type • Diaphragm spring type 	Demonstration using multimedia Practical demonstration	Activity log Portfolio (Diagram)
<p>Construction and working of Multi plate clutch</p> <p>Skills</p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill ➤ Familiarizing skill ➤ Diagnosing skill 	<p>Explain the construction and working of Multi plate clutch</p>	Demonstration using multimedia Practical demonstration	Activity log Portfolio (Diagram)
<p>Clutch components</p> <ul style="list-style-type: none"> • clutch plate • clutch facing • pressure plate • Bearings <p>Skills</p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill ➤ Classification skill ➤ Comparative skill 	<p>Identify, locate and explain the function of clutch components</p> <ul style="list-style-type: none"> • Clutch plate • Clutch facing • pressure plate • Release bearing 	Group discussion Demonstration Videos Project Work	Activity log Project Evaluation
<p>Clutch actuating mechanisms</p> <ul style="list-style-type: none"> ➤ Mechanical ➤ Hydraulic ➤ Electromagnetic 	<p>Explain the working of clutch actuating mechanisms</p> <ul style="list-style-type: none"> • Mechanical • Hydraulic 	Actual demo Demonstration with multimedia Discussion Practical	Activity log

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<u>Skills</u> <ul style="list-style-type: none"> ➤ Vacuum ➤ Clutch- by- wire ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Diagnosing skill 	<ul style="list-style-type: none"> • Electromagnetic • Vacuum • Clutch- by- wire 		
Clutch free pedal play adjustment <u>Skills</u> <ul style="list-style-type: none"> ➤ Practical skill ➤ Observation skill ➤ Diagnosing skill 	Carryout clutch free pedal play adjustment	Actual demo Demonstration with multimedia Discussion Practical	Activitylog

Assessment activities

1. Ask the students to complete the blank point in each columns of the chart given below. In first column they have to write the purpose and the other situations when clutch uses in automobile, in second column the requirements of clutch and in third types of friction clutches. Give one score for each correct point

Complete the blank column

Usage and purpose of clutch	Requirements of clutch	Types of friction clutch
1. While starting the engine 2. 3.	1. Gradual engagement 2. 3. 4. 5.	1. Single plate clutch 2. 3. 4. 5.

2. Role play of working of single plate clutch

Here we are trying to demonstrate the concept on working of single plate clutch. Ask any three students to come forward to participate in the roll play. Let one student act as flywheel, the other one as clutch disc and the third one as pressure plate. The students play as clutch components which explain the working of single plate clutch during engage and disengage. Make the remaining students into 3 groups. Let one group prepare a chart showing the figure of a single plate clutch and explain its working, second group also explain the working but by using an actual clutch and the third group explain the function of each components of clutch. The teacher can evaluate each student according to their performance

3. Clutch actuating mechanism

Divide the students into four groups and assign them to explain the working of one clutch actuating mechanism. They can use chart showing figure, actual components, videos etc.

Teacher evaluates each student by using some definite parameters.

Group	Clutch actuating mechanism
I	Mechanical
II	Hydraulic
III	Electromagnetic
IV	Vacuum

4. Class test
5. Assignment on single plate clutch and Centrifugal clutch
6. Debate on multi plate clutch is better than single plate clutch
7. Seminar on clutch actuating mechanism

List of items in portfolio

1. Activity log
2. Clutch classification chart
3. Assignment
4. Seminar report on clutch actuating mechanism
5. Debate report
6. Project report
7. Answer sheet

3.2 MANUAL TRANSMISSION

INTRODUCTION

After the clutch transmission or gearbox is the component in the transmission system. The torque and speed of the vehicle have to change depending upon the various requirements of the vehicle. Sometime we have to move the vehicle reverse direction. The gear box serves all these function. Various types of gear boxes, construction and working, gear ratio etc. are deeply elaborated in this unit. Dismantling and assembling, diagnosis of gear box troubles their causes and remedies etc. are also make expertise the students in this areas.

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UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Types of gears <ul style="list-style-type: none"> • straight spur gear • helical spur gear • Bevel gear • Spiral bevel gear • Hypoid gear <u>Skills</u> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	Identify different types of gears <ul style="list-style-type: none"> • Straight spur gear • Helical spur gear • Bevel gear • Spiral gear • Hypoid gear 	Multimedia Demonstration	Activity log Classification Chart
Gear ratio <u>Skill</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Arithmetical skill ➤ Analysis skill ➤ Measuring skill ➤ Calculating skill 	Calculate gear ratio	Demonstration	Activity log
Resistance on moving vehicle <ul style="list-style-type: none"> • Wind resistance • Gradient resistance • Miscellaneous <u>Skills</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Analysis skill 	Describe various resistances on a moving vehicle <ul style="list-style-type: none"> • Wind resistance • Gradient resistance • Miscellaneous 	Group Discussion Multimedia Presentation seminar	Discussion points Presentation points Seminar report
Necessity of gear box <u>Skills</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill ➤ Familiarizing skill 	Explain the necessity of gear box	Group discussion Demonstration Videos	Discussion points Activity log
Types of gear box <ul style="list-style-type: none"> • Sliding mesh • Constant mesh • Synchromesh <u>Skills</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill ➤ Classification Skill ➤ Comparative skill 	Classify different gear boxes <ul style="list-style-type: none"> • Sliding mesh • Constant mesh • Synchromesh 	Survey Data collection Demonstration	Survey report Data points Activity log
Construction and working of	Explain the working of	Demonstration	Activity log

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<p>constant mesh gear box</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	constant mesh gear box	Multimedia presentation Practical activity	Diagrams
<p>Construction and working of synchromesh gear box</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	Explain the working of synchromesh gear box	Demonstration Multimedia presentation Practical activity	Activity log Diagrams
<p>Construction and working of synchronizing unit</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	Explain the working of synchronizing unit	Demonstration Multimedia presentation Practical activity	Activity log Diagrams
<p>Selector mechanisms</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	Explain the construction and working of selector mechanisms	Demonstration Multimedia presentation Practical activity	Activity log Diagrams
<p>Gear box lubrication</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill 	Describe the necessity of gear box lubrication	Discussion Demonstration	Discussion note Activity log
<p>Transfer box</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	Describe the function of transfer box	Group discussion Demonstration	Activity log
<p>Transaxle</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	Explain the concept and working of transaxle	Demonstration Multimedia presentation Practical activity	Activity log Diagrams

Assessment activities

- a) Teacher shows different types of gears like spur gear, helical gear, bevel gear, hypoid gear and spiral bevel gear. Ask the student to identify the gear and its function.
- b) Complete the blank points in the chart with correct words

Function of transmission	1. To vary the torque 2. 3.
Total resistance	1. 2. 3.
Find gear ratio	1. 12 teeth gear rotate 36 teeth gear 2. if the small gear rotate at 750 rpm, what will be the speed of large gear

Give one score to each point, two score for gear ratio point 2

- c) Divide the students into 4 groups and assign each group as follows

First group	-	Constant mesh gear box
Second group	-	synchromesh gear box
Third group	-	Synchronizing unit
Forth group	-	selector mechanism

Let each group prepare a chart showing the construction of components and explain its working. If possible, let them use multimedia facility. Teacher can evaluate the student through different parameters like

- Preparation of chart

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- Knowledge level
 - Communicative skill
 - Content transaction
- d) Assignment on Transaxle
- e) Class test

List of items in portfolio

1. Activity log
2. Classification chart
3. Assignment
4. Seminar report
5. Debate report
6. Project report
7. Answer sheet

3.3 AUTOMATIC TRANSMISSION

INTRODUCTION

This is the new trend in transmission system in Indian automobile vehicles. Most of the new vehicles use automatic transmission. The unit gives the students the function and concept of semi-automatic and fully automatic transmission. It deals the construction and working of epicyclic gear box, freewheel unit, fluid flywheel and torque converter. It also describes the concept of automated manual transmission (AMT) and modern shift control technique.

UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Semi - automatic and fully automatic transmission <u>Skills</u> <ul style="list-style-type: none">➤ Observation skill➤ Presentation skill➤ Classification Skill➤ Analyzing skill➤ Familiarizing skill	Differentiate semi – automatic and fully automatic transmission	Discussion Demonstration through multimedia	Discussion points Activity log
Epicyclic gearbox <u>Skills</u>	Explain the construction and working of epicyclic gearbox	Discussion Demonstration through	Discussion points Activity log

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<ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 		multimedia Practical activity seminar	Seminar report
Free wheel unit <u>Skills</u> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 	Explain the concept and working of free wheel unit	Discussion Demonstration through multimedia Practical activity Assignment	Discussion points Activity log Assignment
Fluid flywheel <u>Skills</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	Explain the working of fluid flywheel	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
Torque converter <u>Skills</u> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 	Explain the construction and working of torque converter	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
Overdrives <u>Skills</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	Explain the working of overdrives	Discussion Demonstration through multimedia Practical activity Assignment	Discussion points Activity log Assignment
Continuously Variable Transmission <u>Skill</u>	Explain the principle and working of CVT	Discussion Demonstration through	Discussion points Activity log

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<ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 		multimedia	
<p>Automated Transmission</p> <ul style="list-style-type: none"> • Single –sided clutch transmission(SSCT) • Double –sided clutch transmission(DSCT) • Dual clutch transmission(DCT) <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	<p>Manual</p> <p>Explain the concept of AMT</p> <ul style="list-style-type: none"> • Single sided clutch transmission(SSCT) • Double sided clutch transmission(DSCT) • Dual clutch transmission(DCT) 	<p>Practical activity</p> <p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p>	<p>Discussion points</p> <p>Activity log</p>
<p>Modern shift control techniques</p> <ul style="list-style-type: none"> • Select shift manual(SSM) mode • Auto shift manual (ASM) mode <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the concept of modern shift control techniques</p> <ul style="list-style-type: none"> • Select shift manual(SSM) mode • Auto shift manual (ASM) mode 	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p>	<p>Discussion points</p> <p>Activity log</p>

ASSESSMENT ACTIVITIES

1. Conduct a field visit to a reputed workshop

Make the students into small groups. Tell the students to prepare a detailed report about function, construction, working and advantages of work assigned to them. The following are the list of works

- Torque convertor

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- Epicyclic gear box
- Over drive
- Free wheel unit
- CVT
- AMT

Teacher can evaluate the student through the following indicators

- Content depth
- Completion and neatness
- Knowledge level
- Viva voce

2. Class test

List of items in portfolio

1. Activity log
2. Classification chart
3. Assignment
4. Seminar report
5. Debate report
6. Project report
7. Answer sheet

3.3.4 DRIVE LINE

INTRODUCTION

This unit shows how the powers flow from gearbox to road wheels. The unit describes the necessity, function and construction and working of universal joint and slip joint. It also deals the construction and working of differential, Types of crown wheel and bevel pinion, rear axle casing, rear axle drives and rear axle shaft supporting methods. The students will be able to dismantle, assemble and diagnose the troubles in drive line.

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UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Driveline <u>Skills</u> ➤ Observation skill	Define drive line	Discussion	Activity
Propeller shaft <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill	Explain the construction and working of propeller shaft	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
Universal joint <ul style="list-style-type: none"> • Variable velocity joint(hook's joint, flexible ring universal joint) • Constant velocity joint(rzeppa joint) <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill	Explain the necessity, construction and working of universal joints <ul style="list-style-type: none"> • Variable velocity joint(hook's joint, flexible ring universal joint) • Constant velocity joint(rzeppa joint) 	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
Slip joint <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill	Explain the necessity, construction and working of slip joint	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
Final drive <u>Skills</u>	Explain the functions of final drive	Group discussion Demonstration	Activity log

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<ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 			
<p>Type Crown wheel and pinion drive</p> <ul style="list-style-type: none"> • Straight bevel gear • Spiral bevel gear • Hypoid gears <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Differentiate various crown wheels and pinion drive gearing</p> <ul style="list-style-type: none"> • Straight bevel gear • Spiral bevel gear • Hypoid gears 	<p>Discussion</p> <p>Demonstration through multimedia</p>	<p>Discussion points</p> <p>Activity log</p>
<p>Differential</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 	<p>Explain the necessity, construction and working of differential</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>Limited slip differential</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	<p>Explain the necessity of limited slip differential</p>		
<p>Types of rear axle casing</p> <ul style="list-style-type: none"> • Split type • Banjo or separate carrier type • Salisbury or Integral carrier type <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	<p>Classify rear axle casing</p> <ul style="list-style-type: none"> • Split type • Banjo or separate carrier type • Salisbury or Integral carrier type 	<p>Discussion</p> <p>Demonstration using multimedia</p> <p>Classification chart</p> <p>Project</p>	<p>Activity log</p> <p>Chart</p> <p>Project report</p>

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➤ Classification Skill			
<p>Rear axle drive</p> <ul style="list-style-type: none"> • Hotchkiss drive • Torque tube drives <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the construction and working of rear axle drives</p> <ul style="list-style-type: none"> • Hotchkiss drive • Torque tube drives 	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>Rear axle</p> <ul style="list-style-type: none"> • Semi- floating axle • Full floating axle • Three quarter floating axle <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the construction and working of rear axle shaft supporting</p> <ul style="list-style-type: none"> • Semi- floating axle • Full floating axle • Three quarter floating axle 	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>

Assessment activities

1. Assignment on construction and working of differential
2. Seminar on limited slip differential
3. Seminar on rear axle shaft supporting
4. Class test

List of items in portfolio

1. Activity log
2. Classification chart
3. Assignment
4. Seminar report
5. Debate report
6. Project report
7. Answer sheet

Module 4 AUTOMOTIVE ELECTRICAL SYSTEMS

OVER VIEW

The automobile uses variety of electrical accessories for different purposes. It describes the construction and working of battery which is the source of electricity in automobiles. The module enable the students to trace different electrical circuits like lighting circuit, direction indicator circuit, brake light circuit, horn circuit etc. For starting we have to crank the engine by using starting motor, for igniting the fuel in the engine an electric spark is used, for charging the battery in the vehicle the charging system is must. The module deals all these areas in detail.

The module also explains the emission control system used in automobiles which is most relevant nowadays. The concepts of euro norms implementation in India and different emission control systems used for minimizing pollution are explained in this module. The safety features commonly used in automobiles like air bags, seat belts etc. are also mentioned in this module. The module automotive electrical system provides a wide range of job opportunities in automobile industry.

4.1 AUTOMOTIVE BATTERY

INTRODUCTION

Battery is the heart of automobile electrical system. It is the source of electricity. It is a rechargeable battery that supplies electric energy to an automobile. The unit elaborates the type, construction and working of battery. Care and maintenance, characteristic of battery, charging methods and battery testing are another attractive area of this unit.

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UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Function of battery <u>Skills</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	Explain the function of battery	Group discussion Demonstration	Activity log
Types of Battery <ul style="list-style-type: none"> • Lead Acid battery • Alkaline battery • Zinc-air battery • Nickel-metal hydride battery • Lithium –ion battery <u>Skills</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	Classify different types of battery <ul style="list-style-type: none"> • Lead acid battery • Alkaline battery • Zinc-Air battery • Nickel-metal hydride battery • Lithium –ion battery 	Discussion Demonstration using multimedia Classification chart Project	Activity log Chart Project report
construction and working of lead acid battery <u>Skills</u> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 	Explain the construction and working of lead acid battery	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
cell voltage, battery capacity, battery rating <u>Skill</u> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	State cell voltage, capacity and battery rating	Discussion Demonstration through multimedia Practical activity	Discussion points Activity log
battery charging methods	Describe different charging methods	Discussion	Discussion points

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<ul style="list-style-type: none"> • Slow rate charging • Quick rate charging • Trickle charging <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<ul style="list-style-type: none"> • Slow rate charging • Quick rate charging • Trickle charging 	<p>Demonstration through multimedia</p> <p>Practical activity</p>	<p>Activity log</p>
<p>battery testing</p> <ul style="list-style-type: none"> • specific gravity test • open volt test • high discharge test • cadmium test <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	<p>Explain different battery tests</p> <ul style="list-style-type: none"> • Specific gravity test • Open volt test • High discharge test • Cadmium test 	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p>	<p>Discussion points</p> <p>Activity log</p>
<p>care and maintenance of battery</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	<p>Explain the care and maintenance of battery</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p>	<p>Discussion points</p> <p>Activity log</p>

Assessment activity

1. Demonstrate each component of lead acid battery to students individually and tell them to identify and explain the function of each component.

Teacher can evaluate the students as follows

Identifying one component	-	1 score	} 2 score
Function of that component	-	1 score	

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For 5 components - $2 \times 5 = 10$

2. Assignment on characteristics of battery
3. a) Seminar on battery testing
f) Class test

List of items in portfolio

1. Activity log
2. Classification chart
3. Assignment
4. Seminar report
5. Debate report
6. Project report
7. Answer sheet

UNIT 4.2 CHARGING SYSTEM

INTRODUCTION

The battery used in an automobile has to be charged by the vehicle itself. A charging system is used in every vehicle. Alternator or magneto is used for this purpose. The unit describes the basic principle of Faraday's law of electromagnetic induction. It also deals the construction, working and testing of alternator. The students can able to differentiate alternator and dynamo. They are also able to service the charging system.

UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Functions and requirements of charging system <u>Skills</u> ➤ Observation skill ➤ Presentation skill	Describe the function and requirements of charging system	Group discussion Demonstration	Activity log
charging circuit <u>Skills</u>	Draw the charging circuit	Discussion Demonstration through	Activity log Circuit diagram

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<ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill ➤ Classification Skill ➤ Drawing skill 		<p>multimedia</p> <p>Diagram</p>	
<p>Generator principle</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 	<p>Explain the generator principle</p>	<p>Discussion</p> <p>Demonstration through multimedia</p>	<p>Discussion points</p> <p>Activity log</p>
<p>faraday's law of electromagnetic induction</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	<p>State faraday's law of electromagnetic induction</p>	<p>Recollection</p> <p>Discussion</p>	
<p>construction and working of alternator</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 	<p>Explain the construction and working of alternator</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>alternator regulation</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	<p>Describe alternator regulation</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p>	<p>Discussion points</p> <p>Activity log</p>
<p>comparison between DC generator and alternator</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	<p>Differentiate DC generator and alternator</p>	<p>Discussion</p> <p>Demonstration through multimedia</p>	<p>Discussion points</p> <p>Activity log</p>

Assessment activity

1. Assignment on construction and working of alternator
2. Debate on 'alternator is better than dynamo'
3. Class test

List of items in portfolio

1. Activity log
2. Classification chart
3. Assignment
4. Seminar report
5. Debate report
6. Project report
7. Answer sheet

UNIT 4.3 STARTING SYSTEM

INTRODUCTION

For starting the engine initially we have to crank the engine. Starting system is used for this purpose. The unit illustrates the circuit of system. It deals the construction and working of starting motor and also describes the type of bendix drive and working. The students are able to know the construction and working of solenoid switch and also able to service the starting system.

UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Functions of starting system <u>Skills</u> ➤ Observation skill ➤ Presentation skill	Describe the functions of starting system	Group discussion Demonstration	Activity log
starting circuit <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill	Draw and explain the starting circuit	Discussion Demonstration through multimedia Diagram	Activity log Circuit diagram

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<p>construction and working of starting motor</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 	<p>Explain the construction and working of starting motor</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>starting drives</p> <ul style="list-style-type: none"> • Bendix drives <ul style="list-style-type: none"> ❖ Standard bendix drive ❖ Follow thru bendix drive ❖ Compression spring type bendix drive ❖ Rubber spring type bendix drive • Overrunning clutch or pre engaged type drive • Dyer drive <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Classify different starting drives</p> <ul style="list-style-type: none"> • Bendix drives <ul style="list-style-type: none"> ❖ Standard bendix drive ❖ Follow thru bendix drive ❖ Compression spring type bendix drive ❖ Rubber spring type bendix drive • Overrunning clutch or pre engaged type drive • Dyer drive 	<p>Discussion</p> <p>Demonstration using multimedia</p> <p>Classification chart</p> <p>Project</p>	<p>Activity log</p> <p>Chart</p> <p>Project report</p>
<p>construction and working of standard bendix drive</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill 	<p>Explain the construction and working of standard bendix drive</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>

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➤ Presentation skill		Seminar	
Construction and working of overrunning clutch type starter drive <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill	Explain the construction and working of overrunning clutch type starter drive	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
construction and working of solenoid switch <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill	Explain the construction and working of solenoid switch	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
electronic starter control <u>Skills</u> ➤ Observation skill ➤ Presentation skill	Explain the functions of electronic starter control	Group discussion Demonstration	Activity log

Assessment activity

1. Seminar on construction and working of starting motor
2. Assignment on standard bendix drive and over running clutch drive
3. Class test

List of items in portfolio

1. Activity log
2. Classification chart
3. Assignment
4. Seminar report
5. Debate report
6. Project report
7. Answer sheet

UNIT 4.4 LIGHTING AND ELECTRICAL EQUIPEMENTS

INTRODUCTION

Automobile uses different types of lights like head light, park light, stop light, number plate light, interior light etc. These lights have to blow as and when required. Separate circuits are necessary for this purpose. The unit illustrates various lighting circuits and their working. Students can identify various head lamps, lighting switches and warning lights. It also describes the circuit diagram of directional indicator and horn. Unit also deals the construction and working of electric horn, wind shield wiper and function of speedometer, odometer, Centre lock and power windows.

UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Electrical symbols and wire color codes	Identify electrical symbols and wire color codes	Chart	Chart
lighting circuit <ul style="list-style-type: none"> • head lamp tail lamp • stop light • parking light • number plate light • instrument panel light • interior light <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	Draw and explain lighting circuit	Discussion Demonstration through multimedia Diagram	Activity log Circuit diagram
types of head lamps <ul style="list-style-type: none"> • Incandescent lamp • Halogen lamps • High intensity discharge lamp(HID) • LED lamps 	Classify head lamps <ul style="list-style-type: none"> • Incandescent lamp • Halogen lamps • High intensity discharge lamp(HID) • LED lamps 	Discussion Demonstration using multimedia Classification chart Project	Activity log Chart Project report

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<p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 			
<p>lighting switches</p> <ul style="list-style-type: none"> • Light switch • Dimmer switch • Stop light switch <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill 	<p>Locate and explain the function of lighting switches</p> <ul style="list-style-type: none"> • Light switch • Dimmer switch • Stop light switch 	<p>Group discussion Demonstration</p>	<p>Activity log</p>
<p>instrument panel indicating lights</p> <ul style="list-style-type: none"> • Main beam warning light • Ignition warning light • Flashing indicator warning light <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the functions of different instrument panel indicating lights</p> <ul style="list-style-type: none"> • Main beam warning light • Ignition warning light • Flashing indicator warning light • Oil pressure warning light • Charge indicator light 	<p>Group discussion Demonstration</p>	<p>Activity log</p>
<p>direction indicator circuit</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 	<p>Draw and explain direction indicator circuit</p>		

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➤ Classification Skill			
flashing indicator <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill	Explain the function and working of flashing indicators	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
horn circuit <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill	Draw and explain the horn circuit		
construction and working of electric horn and horn relay <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill	Explain the construction and working of electric horn and horn relay	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
wind screen wiper <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill	Explain the construction and working of wind shield wiper	Discussion Demonstration through multimedia Practical activity Seminar	Discussion points Activity log Seminar report
speedometer and odometer <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill	Explain the function of speedometer and odometer	Group discussion Demonstration	Activity log

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➤ Classification Skill			
central locking <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill	Explain the function of central lock	Group discussion Demonstration	Activity log
power window <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill	Explain the function of power window	Group discussion Demonstration	Activity log
Air bag	Explain the working of air bag	Group discussion Demonstration	Activity log
Seat belts • Pre tensioner • Load limiter	Explain the function and working of seat belts in conjunction with air bags	Discussion Demonstration through multimedia Seminar	Discussion points Activity log Seminar report

Assessment activity

1. Teacher shows the chart of electrical symbols to students individually. Tell them to identify the symbol and their function.
2. Seminar on different lighting circuit
3. a) Assignment on directional indicator circuit and horn circuit
g) Viva voce about different types of lighting switches, instrument indicating lights, function of Speedo meter and odometer
h) Class test

List of items in portfolio

1. Activity log
2. Classification chart
3. Assignment
4. Seminar report
5. Debate report
6. Project report
7. Answer sheet

UNIT 4.5 IGNITION SYSTEM

INTRODUCTION

Ignition system is the most important electrical system used in petrol vehicles. The system serves to give electric spark for igniting the compressed air fuel mixture in the cylinder. The unit describes the type of ignition system, their circuits, the function of components, concept of ignition advance etc. in detail. The concepts of basic electronics like semiconductors, diodes, transistor, thyristor etc. are included. The advanced electronic ignition system, their types and working are also elaborated in this unit. After completion of this unit the student can diagnose the various troubles, their causes and remedies, maintenance and service of ignition system.

UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Function of ignition system <u>Skills</u> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	Explain the purpose of ignition system		
types of ignition system <ul style="list-style-type: none"> • Battery coil ignition system • Magneto coil ignition system • Electronic ignition system <u>Skills</u> <ul style="list-style-type: none"> ➤ Drawing skill 	Classify different types of ignition system <ul style="list-style-type: none"> • Battery coil ignition system • Magneto coil ignition system • Electronic ignition system 	Discussion Demonstration using multimedia Classification chart Project	Activity log Chart Project report

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<ul style="list-style-type: none"> ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 			
<p>circuit diagrams of battery coil</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Draw and Explain the working of battery coil ignition system and magneto coil ignition system</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>circuit diagrams of magneto ignition systems</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Draw and Explain the working of magneto coil ignition system</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>components of ignition system</p> <ul style="list-style-type: none"> • Battery • Ignition coil • Contact breaker • Condenser • Distributor • Spark plug • Magneto <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>List the components of ignition system and mention its functions</p> <ul style="list-style-type: none"> • Battery • Ignition coil • Contact breaker • Condenser • Distributor • Spark plug • Magneto 	<p>Group discussion</p> <p>Demonstration</p>	<p>Activity log</p>

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<p>Types, construction and working of spark plugs</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the construction and working of different types of spark plugs</p> <ul style="list-style-type: none"> • Hot and cold plugs • Long reach and short reach 	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>comparison between battery coil and magneto ignition systems</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Compare battery coil ignition system and magneto coil ignition system</p>	<p>Chart</p> <p>Group discussion</p> <p>Debate</p> <p>Demonstration using Multimedia</p>	
<p>Basic electronics-semiconductors, diodes, transistors, thyristor</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the concept and function of semiconductors, diodes, transistor, thyristor</p>	<p>Group discussion</p> <p>Demonstration</p>	<p>Activity log</p>
<p>Electronic ignition system</p> <ul style="list-style-type: none"> • Basic distributor type • Distributor less type • Capacitor discharge ignition (CDI) system • Coil on plug <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill 	<p>Classify electronic ignition system</p> <ul style="list-style-type: none"> • Basic distributor type • Distributor less type • Capacitor discharge ignition (CDI) system • Coil on plug 	<p>Discussion</p> <p>Demonstration using multimedia</p> <p>Classification chart</p> <p>Project</p>	<p>Activity log</p> <p>Chart</p> <p>Project report</p>

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<ul style="list-style-type: none"> ➤ Classification Skill 			
<p>Distributor less ignition system</p> <ul style="list-style-type: none"> • SDLI • DDLI <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Draw the circuit diagram and explain the working of distributor less ignition system</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>circuit diagram of electronic ignition system</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Draw and explain the working of CDI and coil on plug ignition system</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>Timers</p> <ul style="list-style-type: none"> • Pulse generator • Hall effect switch • Optical switch <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the working of different timers used in basic distributor type ignition</p> <ul style="list-style-type: none"> • Pulse generator • Hall effect switch • Optical switch 	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>

Assessment activity

1. Seminar on battery coil ignition and magneto ignition systems
2. Assignment on construction and working of ignition coil and spark plug
3. Debate on 'battery coil ignition is better than magneto ignition system'
4. Seminar on distributor less ignition system and CDI system
5. Class test

List of items in portfolio

1. Activity log
2. Classification chart
3. Assignment
4. Seminar report
5. Debate report
6. Project report
7. Answer sheet

4.6 EMISSION CONTROL SYSTEM

INTRODUCTION

Vehicle emission control system is the study of reducing the motor vehicle emission. Emissions of many air pollutants have been shown to have variety of negative effect on public health and the natural environment. The unit describes the sources of automotive pollutions, Euro norms and their implementation in India. The working of various emission control systems are also explained in this unit.

UNIT GRID

IDEAS/CONCEPTS/SKILLS	LEARNING OUTCOMES	SUGGESTED ACTIVITIES	ASSESSMENT
Necessity of emission control <u>Skills</u> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill	Describe the necessity of emission control		
Source of automotive emission	Identify the sources of automotive emission		

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<p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 			
<p>Charts showing norms of euro 3 and 4 of petrol and diesel vehicles</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>State the norms of Euro III and IV of petrol and diesel vehicles and the implementation year in India</p>		
<p>Positive crankcase ventilation</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the working of positive crank case ventilation</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>Vapour recovery system</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the working of vapour recovery system</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>Exhaust Gas Recirculation [EGR]system</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the working of Exhaust Gas Recirculation [EGR] system</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>

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<p>Air injection system</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the working of air injection system</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>
<p>Catalytic convertor</p> <p><u>Skills</u></p> <ul style="list-style-type: none"> ➤ Drawing skill ➤ Observation skill ➤ Presentation skill ➤ Classification Skill 	<p>Explain the working of two way and three way catalytic convertor</p>	<p>Discussion</p> <p>Demonstration through multimedia</p> <p>Practical activity</p> <p>Seminar</p>	<p>Discussion points</p> <p>Activity log</p> <p>Seminar report</p>

Assessment activity

1. Seminar on emission control systems

Divide the students into 5 groups. Assign the groups to present any one of the emission control system as listed below

Group No	Name of emission control system
I	Positive crank case ventilation
II	Vapour recovery system
III	Exhaust gas recirculation system
IV	Air injection system
V	Catalytic convertor

2. Class test

List of items in portfolio

1. Activity log
2. Classification chart
3. Assignment
4. Seminar report

5. Debate report
6. Project report
7. Answer sheet

EXTENDED ACTIVITIES

- Field visit
- On The Job training
- Seminar by Industrial Experts
- Vocational Expo
- Production –Cum- training
- Exhibition

ON THE JOB TRAINING

On the job training is also called direct instruction. It is one-on-one training located at the job site, where someone who knows how to do a task shows another how to perform it. It is often inexpensive because no special equipment is needed other than what is normally used on the job. The important features of On the Job training is as follows

- OJT helps the students to achieve practical experience along with theoretical study
- OJT give opportunity to the student to directly view and get experience the various practical works included in the syllabus
- OJT creates awareness about the discipline, punctuality and security precautions while working in an Industrial environment

The advice, Practical instruction and explanations given by the experienced mechanic increases the knowledge level of the students

- The theory classes conducted along with OJT helps the students to understand the subject in depth and detail
- OJT also helps the students to get knowledge in marketing strategies, customer relation, front office management, inventory control, advanced technologies, Spare parts management and familiarize special tools and equipment.

As far as automobile technology course is concerned, it is not much difficult to find institutions for On the Job training. In most of the localities, it is easy to find well equipped automobile workshops. Anyway in some rural areas it is difficult to facilitate institutions as they

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are far from the school. The department of Vocational Higher Secondary should take initiation to make an MOU between Govt. and industries in this regards. KSRTC, Defense sector and various reputed vehicle dealers etc. should come under this agreement. The depart is planning to conduct in the first year two weeks and in the second year two week, (altogether four weeks) during the two year course. It can be conduct one week after the completion of each module or two weeks in first and second year. The time of the OJT can be fixed as per the decision of the SRG

List of Reference Books and Instructional Materials

1. THE AUTOMOTIVE ENGINES – S Srinivasn – Tata McGraw-Hill – 2001
2. A TEXT BOOK OF AUTOMOBILE ENGINEERING – R K Rajput – Lakshmi Publications (P) Ltd - 2007
3. THE AUTOMOBILE – Herban Singh Reyat - S.Chand and Co.- 2004
4. AUTOMOBILE ENGINEERING Vol. I–Dr. Kirpalsingh –Standard Publishers Distributers -2003
5. AUTOMOBILE ENGINEERING Vol. II –Dr. Kirpalsingh –Standard Publishers Distributers - 2003
6. AUTOMOTIVE MECHANICS – William H Cruise & Donald L Anglin - Tata McGraw-Hill - 2007
7. AUTOMOBILE ENGINEERING – Narag – Khanna Pub.- 1986
8. AUTOMOBILE ENGINEERING – R B Guptha- Sathyaprakasan Pub. -2006