

**VOCATIONAL HIGHER SECONDARY
FIRST YEAR**

**MAINTENANCE AND REPAIRS OF
AUTOMOBILES**

TEACHERS' SOURCEBOOK



**GOVERNMENT OF KERALA
Department of Education**

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State Council of Educational Research & Training
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Preface

Dear Teacher,

In the new concept of education teacher is not a mere sharer of knowledge. He is a facilitator. Studying textbooks and testing memory are not adequate in the learning process. So more innovative methods are introduced in this field. Theoretical knowledge is inadequate to become efficient in the field of practical work. Science and technology revolutionised the world. So learning strategies and methods are to be altered correspondingly. The field of education is subjected to violent changes, especially in technical education.

As a part of the reformation in the Vocational Higher Secondary Education, a student or learner centered method of learning is designed. This new system is also activity oriented. When a product of this system comes to society, he should be competent to perform the assignment which is entrusted on him. He should be qualified in every respect, especially in skill. Practical skill is given more preference in Vocational Education. Learning process is a continuous one. So the evaluation is to be continuous. The new system highlights this principle.

In VHSE, the MRA course is intended to provide the students knowledge in working and hands on experience in maintenance, servicing and repairing of various types of automobile. In the growing world scenario the role of an automobile technician is a respected and demanded one. To create this quality in the learners is the role of the teacher. I think this sourcebook on Maintenance and Repairs of Automobiles is prepared in view of developments in the field. This will help the teachers invent and introduce new teaching- learning strategies in the class room. In addition to this, active and sincere participation of the teachers is expected to reach the intended goals.

Imperative comments are expected on this book which may be useful for betterment. I expect the intention of this book is positively considered.

With regards,

Thiruvananthapuram

25. 11. 05

Dr. E. Valsala kumar

Director

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GENERAL APPROACH

Introduction

The ultimate aim of education is human refinement. Education should enable the learner to formulate a positive outlook towards life and to accept a stand which suits the well being of the society and the individual as well.

The attitude and potential to 'to work' has determined the destiny, progress and cultural development of the human race. As we all are aware, the objective of education to form a society and individuals having a positive work culture. The educational process expected in and outside our formal schools should concentrate upon inculcating concepts, abilities, attitudes and values in tune with these 'work culture.' Hence vocationalised education cannot be isolated from the main stream of education. In another sense, every educational process should be vocationalised. However, due to our inability to utilise the resources wisely, scarcity of job opportunities is a severe issue of the present society. For overcoming this deep crisis, emergent techniques have to be sorted out and appropriate researches have to be seriously carried out. It is in the sense that the content and methodology of vocational Higher Secondary Education have to be approached.

The Vocational Higher Secondary course was envisaged as a part of the National Policy on Education with the noble idea of securing a job along with education. The relevance of Vocational education is very great in this age of unemployment. This education system, which ensures a job along with higher education, stands aloof from other systems of education.

A learning environment which ensures vocational aptitude, vocational training, basic life skills, competencies related to different subjects, appropriate values and attitudes and existential readiness has to be provided here.

The curriculum should be one which recognises the specific personality of the learner and should develop it in a desirable way. It should provide opportunity to imbibe novel ideas to follow a critical approach and for learning through experiences.

The competency to transform one's own resources for the betterment of the society and the individual is to be ensured in each individual. Training in the sense of equality, democratic sense, environmental consciousness and devotion to the

constitution is an inseparable factor of the curriculum.

The need of a systematic curriculum is prevailing in vocational subjects. A scientifically structured curriculum incorporating the unique features peculiarity of Kerala ensuring the possibility of higher education and utilising the national and international possibilities of employment is required.

The new curriculum should be capable of assimilating the life skills, scientific temper, attitude of co-existence, leadership qualities and mental health to face the challenges of life. It should be capable of strengthening the competencies imbibed by the learners up to the tenth class.

A curriculum for selecting vocational areas according to the aptitude of the students, learning it in depth, acquire general awareness in the basic areas and to secure jobs has become the social need of the day. A learner centred, process oriented, need based vocational curriculum is envisaged.

What is learning?

- Learning is construction of knowledge and so it is a live and continuous mental process.
- Learning is a process of advancement through adding and correcting in the light of comparing the new issue with the previously learned concepts.
- Learning takes place as a part of the effort to solve problems.
- Learning takes place by assimilating bits of knowledge into ones own cognitive structure.
- Learning is not a linear process. It is a spiral process growing deeper and wider.
- Learning is an intellectual process rather than the mere memorisation of facts. Learning is a conglomeration of a variety activities like problem analysis, elucidation, critical thinking, rational thinking, finding out co-relations, prediction, arriving at conclusions, applications, grouping for other possibilities and extracting the crux. When opportunities are provided for intellectual processes learning will become effective and intellectual ability will get strengthened.

Theoretical foundations of learning

Education is the best device that can be adopted for creation of a new society. It should be democratic in content and process and should acknowledge the rights of the learner. It should also provide opportunity for better citizenship training. The concept of equality at all areas should get recognition in theory and practice.

There should be consious programme of action to develop nationality, humaness and love and against the enchroachment of the sectarianism of caste and religion.

The learner should be able to take firm steps and deferred against the social crisis like privatisation, liberalisation, globalisation etc and against all kinds of dominations.

They should develop a discrimination to use the acquired learning as a liberative

weapon.

They should be able to view education and life with the perspective of social well being.

They should get opportunity to recognise that co-operation is better than competition and that co-operation is the key to social life and culture.

A basic awareness of all the subjects needed for life essential for all students.

The remnants of perspectives formed in us during the colonial period still influence our educational philosophy. The solution to the present day perplexities of the society which approaches education on the basis of competitions and marketisation is only a comprehensive view of life.

It is high time that education was recognised on the basis of the philosophy of human education. The human approach to education has to reflect in its content, learning process and outlook. The perspective of 'learning to be ' and learning to live together as expressed by the UNESCO and the concepts of existentialist intelligence intrapersonal and interpersonal intelligence.

The basis of new approaches on curriculum, teaching- learning process are derived from the developments place in the east and west of the world.

When we begin to see the learner at the centre of the learning process, the teaching process has to be changed timely. It is the result of the rapid growth and development of Science and Technology and Pedagogy. If we want to undergo the changing process, we have to imbibe the modern hypothesis regarding learner, they have;

- Great curiosity
- Good imagination
- Numerous other qualities and interests
- Independent individuality
- Interest in free thinking and working in a fearless atmosphere.
- Have interest in enquiring and questioning.
- Ability to reach conclusions after logical thinking.
- ability for manifest and establish freely the conclusions arrived at.
- Interest for recognition in the society.
- Determination to face the interference of society and make components which is a part of social life.
-

When we consider the learning system, the domains to be stressed in education according to the modern development becomes relevant.

The **knowledge** domain consists of

- Facts
- Ideas
- Laws
- The temporary conclusions and principles used presently by scientists.

The learning is a process. The continuous procedures we undergo to reach a particular goal is process. The skills which are parts of the process to analyse the collected ideas and proofs and come to a conclusion is called *process skills*. Some important **process skills** are,

the skills;

- To observe
- To collect data and record
- To classify
- To measure and prepare charts
- To experiment
- To predict
- To recognise and control the variables
- To raise questions
- To generalise
- To form a hypothesis and check.
- To conclude
- To communicate
- To predict and infer
- To use tools.
-

Observation is the process of acquiring knowledge through the senses. It is purely objective oriented. Learning experiences which provide the opportunity to use all the senses may be used.

The process of grouping is known as **classifying**. Starting from simple groupings of data, it can extend to the level of classification into minute sub-groups.

In addition to this, consider the skills related to **creative domain** also, they are skills:

- To visualize
- To connect facts and ideas in new ways
- To findout new and uncommon uses of objects
- To fantasize

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- To dream
 - To develop creative isolated thoughts
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Creativity is an essential component of process and activities. The element of creativity is involved in finding out problems, formation of hypothesis, finding 'solutions' to problems etc. Through activity oriented learning experiences, opportunities to express creativity can be created.

Again, the following factors consisting in the **Attitudinal domain** are also important as;

- Self confidence
- Love for scientific knowledge
- Attitude to know and value history
- Respect human emotions
- Decide with reasonable present problems
- Take logical decisions regarding personal values

'Hypothesis' is a temporary conclusion drawn using insight. Based on knowledge and experiences relating to the problems the causes and solutions can be guessed.

As regards the **application domain** the important factors are the ability to:

- observe in daily life examples of ideas acquired.
- take the help of scientific process to solve the problems of daily life.
- choose a scientific life style
- connect the ideas acquired with other subjects.
- integrate the subjects with other subjects.

Some basic stands have to be taken on the new scientific knowledge about intelligence learning and teaching. When such basic concepts are accepted changes are required in the following factors.

- The vision, approach, structure and content of the curriculum.
- The vision, approach, structure and content of the textbooks.
- Role of the teacher and the learner.
- Learner atmosphere, learning materials and learning techniques.

Some scientific perspectives accepted by modern world in educational psychology are given below.

Constructivism

This approach puts forward the concept that the learner constructs knowledge. New

knowledge is constructed when ideas are examined and practiced in new situations relating them with the previously acquired knowledge and experience. That is assimilated into the cognitive structure of one's knowledge. This method which gives priority to critical thinking and problem solving provides opportunity for self motivated learning.

Social Constructivism

Social constructivism is a sub section of constructivism. Knowledge is formed, spread and imbibed and it becomes relevant in a social environment. Interactive learning, group learning, co-operative participatory learning, all these are concepts put forward by social constructivism.

The main propounders of constructivism are Piaget, Vygotsky and Bruner.

Discovery learning and interactive learning have prime importance. Learning takes place as a part of the attempt for problem solving. The activities of a learner who confronts cognitive disequilibrium in a learning situation when he tries to overcome it leads to the renewal of cognitive structure. It is through this process construction of new knowledge and the assimilation of them that learning takes place. Observation and enquiry are unavoidable factors. The learner advances towards new areas of acquisition of knowledge where he tries to compare his new findings with the existing conceptions.

Learning is a live mental process. Rather than the ability for memorisation of facts cognitive process has to be given emphasis. The process of problem analysis, elucidation, critical thinking, rational thinking, finding out co-relation, prediction, hypothesis formation, application, probing for other possibilities, extracting the crux and other processes are of critical importance in learning.

Constructivism gives greater predominance to co-operative learning. Social and cultural factors influence learning. Sharing of knowledge and experience among learners, collective enquiry, assessment and improvement, group activity and collaborative learning, by sharing responsibilities with the objective of public activity, provide opportunity for effective learning.

In learning internal motivation is more important than external motivation. The learner should have interest and initiative in learning. Learning situation should be capable of forming a sense of ownership in of the learner regarding the learning process.

Learning is not a linear process. It progresses in a spiralled way advancing deeper and wider.

Learner-his nature and features

The learners in standard XI has undergone a learner centered and process oriented learning experience up to X standard. He is adequately competent to select vocational subjects according to his aptitude and interest and to acquire higher education and profession as he wishes. The aspirations about future life is framed in this particular age

foreseeing national and international job opportunities. Some of the peculiarities of the learner at this stage are:

- Physical, intellectual and emotional planes are intensive changes during this age and their reflections can be observed.
- Ability to enquire, discover and establish cause-effect relationship between phenomena.
- Readiness to undertake challenges.
- Capacity to shoulder leadership roles.
- Attempt to interpret oneself.
- Susceptibility to different pressures.
- Doubts, anxieties and eagerness about sex.
- Longing for social recognition.

Needs of the learner

- To make acquaintance with a job through vocational education.
- To acquire more knowledge in the concerned area through higher education.
- To recognise and encourage the peculiar personality of the later adolescent period.
- To enable him to defend against the unfavourable circumstances without any help

Role of the Learner

- Active participant in the learning process.
- Acts as a researcher
- Sharer of information
- Sharer of responsibilities
- Collects information
- Takes leadership
- Involves in group work
- Acts as a co- participant
- Observes his environment
- Experiments and realises
- Makes interpretations and draws inferences.
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Role of the Teacher

The teacher should;

- consider the 'Stress and strain' of the teenagers
- understand the socio- economic and cultural background of the students.

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- promote and motivate the students to construct knowledge.
 - arrange proper situations to interact in and outside of the classroom.
 - guide the students by explanations, demonstrations etc.
 - promote opportunity for co-operative learning and collaborative learning.
 - facilitate interpersonal and intra-personal interactions.
 - act as a democratic leader.
 - act as a problem solver
 - effectively guide the students for the selection and conduct of various continuous evaluation elements.
 - continuously evaluate the progress of the learners.
 - gives scaffolding/support wherever necessary.
 - motivate for learning
 - promote divergent thinking.
 - act as a democratic group leader.
 - act as a co-learner
 - gives variety of learning experiences.
 - be a constant student
 - facilitate for reference/data collection
 - have a clear understanding about the age, needs, peculiarities, abilities, nature, aptitude etc. of the learner.
 - have the ability to motivate the learner in order to acquire and enrich their knowledge.
 - be a guide to the learner in developing insights and creating responses on current affairs.
 - be capable to lead the learner into a variety of learning methods and process based on curricular objectives.
 - be a link between school and community.
 - be a good organiser, guide, friend, philosopher and co-learner.
 - have an inter disciplinary approach in learning activities.
 - be able to guide the learner in his/her career prospects based on his interest aptitude and ability.
 - be impartial and democratic.
 - provide ample experiences to attain the basic values and objectives of the curriculum.
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New Concepts of Learning

1. Discovery Learning-

The teacher has to create a motivating atmosphere for the learner to discover concepts

and facts, instead of listening always. Creating occasion to progress towards discovery is preferred. Instead of telling everything before and compelling to initiate the models, situations are to be created to help the children act models as themselves.

2. Learning by discussion

That discussion leads to learning is Burner's theory. Here discussion is not opposing each other. It is a sharing on the plane of ideas. New ideas are arrived at by seeking explanations, by mutual giving and taking of ideas and by problem solving.

3. Problem solving and learning

Only when the learner feels that some thing is a problem to be solved that he takes the responsibility of learning it. It is an inborn tendency to act to solve a problem that causes cognitive disequilibrium in a particular area. It is also needed to have confidence that one is capable of doing it. The problems are to be presented in consideration of the ability and level of attainment of the learner.

4. Collaborative learning

This is the learning in which the responsibilities are distributed among the members of the group keeping common learning objectives. The common responsibility of the group will be successful only if each member discharges his duties. All the members will reach a stage of sharing the result of learning, equally through the activity with mutual understanding. The teachers who arrange collaborative learning will have to make clear the responsibilities to be discharged. This is possible through the discussion with the learners. Collaborative learning will help to avoid the situations of one person working for the whole group.

5. Co-operative learning

This is the learning in which the learners help one another. Those who have more knowledge, experience and competency, will help others. By this exchange of resources the learners develop a plane of social system in learning also. As there are no high ups and low ones according to status among the learners they can ask the fellow students doubts and for helps without any hesitation or in hesitation Care should be taken not to lead this seeking of help to mechanical copying. It should be on the basis of actual needs. So even while encouraging this exchange of ideas among the members of the group cautions acceptance is to be observed as a convention. There should be an understanding that satisfactory responses should come from each member and that the achievement of the group will be assessed on the basis of the achievement of all the members

6 Zone of Proximal Development

Vygotsky observes that these is a stage of achievement where a learner can reach by himself and another higher zone where he can reach with the help of his teachers and peers and elders. Even though some can fulfil the learning activity by themselves there is

the possibility of a higher excellence. If appropriate help is forth covering every learner can better himself.

7 Scaffolding

It is natural that the learner may not be able to complete his work if he does not get support at the proper time. The learner may require the help of the teacher in several learning activities. Here helping means to make the learner complete the activity taking responsibility by himself. The teacher has to keep in mind the objective of enabling the learner to take the responsibility and to make it successful.

8 Learning: a live mental process

Learning is a cognitive process, only a teacher who has an awareness as to what the cognitive process is alone can arrange learning situations to the learner to involve in it. Learning can be made effectively and intellectual sharpness can be improved by giving opportunity for the cognitive processes like reminding, recognising compromising, co-relating, comparing, guessing, summarising and so on. How is cognitive process considered in language learning? Take guessing and prediction for example.

- Guessing the meaning from the context.
- Guessing the content from the heading.
- Predicting the end of the story.
- Guessing the incident, story from the picture.
- Guessing the facts from indications.
- and other such activities can be given the following activities can be given for the cognitive process of summarisation.
- Preparation of blue print.
- Preparation of list.
- Preparation of flow chart.
- Epitomising in one word.
- Giving titles and so on.
- Symbols, performance of characters indications, lines of a poem, tables, pictures, concepts, actions, body language and such things can be given for interpretation. Process based language given for interpretation. Process based language learning has to give prime importance to the cognitive process.

9 Internal motivation

Internal motivation is given more importance than external motivation. The teacher has to arouse the internal motivation of the learner, A person internally motivated like this alone can immerse in learning and own its responsibility. How motivating is each of the activities is to be assessed.

10 Multiple intelligence

The Theory of Multiple Intelligence put forward by Howard Gardener has created a turning point in the field of education. The National curriculum document has recommended that the curriculum is to be designed taking into consideration of this theory.

Main factors of the intellect :

1. Verbal/linguistic Intelligence

Ability to read and write, making linguistic creations , ability to lecture competence effective a communication , all these come under this . This can be developed by engaging in language games and by teaching others.

2. Logical /mathematical Intelligence

Thinking rationally with causes and effect relation and finding out patterns and relations come under this area, finding out relations and explaining things sequential and arithmetical calculations are capable of developing this area of intelligence.

3. Visual /spatial Intelligence

In those who are able to visualise models and bringing what is in the imagination into visual form and in philosophers, designers and sculptors this area of intelligence is developed. The activities like modelling using clay and pulp, making of art equipments, sculpture, and giving illustrations to stories can help the development of this ability.

4 Bodily Kinaesthetic Intelligence

The activities using body language come under this. This area of intelligence is more developed in dancers and actors who are able to express ideas through body movements and in experts in sports, gymnastics etc.

5 Musical Intelligence

This is an area of intelligence which is highly developed in those who are able to recognise the different elements of music in musicians and in those who can here and enjoy songs. Playing musical instruments, initiating the songs of musicians, listening silently to the rhythms and activities like this are capable of developing this area of intelligence.

6 Interpersonal Intelligence

Those in whom this area of intelligence is developed show qualities of leadership and behave with others in a noble manner. They are capable of understanding the thought of others and carrying on activities like discussion successfully.

7 Intrapersonal Intelligence

This is the ability to understand oneself. These people can recognise their own abilities and disabilities. Writing diaries truthfully and in an analysing way and assessing the ideas

and activities of others will help developing this areas of intelligence

8 Naturalistic Intelligence

A great interest in the flora and fauna of the nature, love towards fellow beings interest in spiritual and natural factors will be capable of developing this area.

9. Existential Intelligence

The ability to see and distinguish ours own existence as a part of the universe, ability to distinguish the meaning and meaninglessness of life, the ability to realise the ultimate nature of mental and physical existences, all these are the peculiarities of this faculty of intelligence.

Emotional Intelligence

The concept of emotional intelligence put forward by **Daniel Golman** was used in framing the new curriculum. The fact that one's **Emotional Quotient (E.Q)** is the greatest factor affecting success in life is now widely accepted. The teacher who aims to focus on improving the emotional intelligence of students need to concentrate on the following.

i) Ability to take decisions

Rather than imposing decision on students while planning and executing activities, the students may be allowed to take part in the decision making process. Taking decisions through open discussion in the class, inviting students suggestions on common problems etc. are habits to be cultivated.

ii) Ability to reach consensus

- When different opinions, ideas and positions arise the students may be given the responsibility to reach a consensus.
- Imaging what would be the course of action in some situations, allowing to intervene in a healthy way in problems between individuals.

iii) Problem solving

- Developing the idea that there is reason and solution to any problem.
- Training in finding reasons for problems.
- Suggesting solutions through individual or group efforts.
- Discussing social problems.
- Analysing the shortcomings in methods to solve problems.

Whether plastic can be banned within school premises can be given as a problem. Group discussion will provide reasons and solutions. Problems which can influence classroom learning and for which the learner can actively contribute solutions need to be posed.

- Self criticism, evaluation

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- Ability to face problem-situation in life
 - Thinking what one would do if placed in the situation of others, how one would respond to certain experiences of others - All these foster the growth of emotional intelligence.

iv) Life skills

Life skills need to be given a prominent place in education. W.H.O. has listed ten skills required for success in life.

- Self awareness
- Empathy
- Inter personal relations
- Communication
- Critical thinking
- Creative thinking
- Decision making
- Problem solving
- Coping with emotion
- Coping with stress

The new curriculum addresses these areas.

Knowing the characteristics of the learner, role of the teacher and how to use the teachers handbook help the teacher to plan and effectively implement learning activities.

Objectives of the Vocational Higher Secondary Curriculum.

- To facilitate higher education while giving opportunity to enter in the field of employment.
- To develop environmental awareness, sense of national integration, tolerance and human values so as to ensure social and cultural improvement.
- To enable the learner to find on his own employment.
- To inculcate mental courage in the learner to face unfavourable situations.
- To make human resource development possible.
- To enable the learner to understand social problems and to react appropriately.
- To develop the learner to identify and develop his own competencies.
- To develop vocational aptitude, work culture and attitude in the learner so as to provide useful products and services to the society.
- To create an awareness about mental and physical health.
- To acquire awareness about different job areas and to provide backgrounds for acquiring higher level training in subjects of interest.
- To develop possibilities of higher education by creating awareness about common entrance examinations.

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- To provide situation for the encouragement of creative thinking and organising training programmes in each area, creative abilities and to develop artistic talents.

Nature of Approach

The learning device is to be organised in the selected vocational subjects in such a way that adequate practical experience should be given, making use of the modern technology. The development in each area on the basis of information technology is to be brought to the learner. The work experience in the respective fields(OJT, Field trip, Production/ Service training, Survey, Workshop, Exhibition, Youth festival, Physical fitness etc.) are to be adjusted suitable to the learning and evaluation process. The participation and leadership of the students in planning and execution is to be ensured through this kind of activities. Social service is to be made a part of the course.

Approach towards Vocational Higher Secondary Education

The learning methodology has to be organised so as the learning provide adequate practical thinking on the opted vocational subject utilising the new technology. The development of information technology should be made available in each sector. Work experience, OJT, Field trip production, Service cum training centre, Survey, Workshops, Exhibitions, Youth festivals, Physical fitness etc should be systematised well appropriate to learning and evaluation. Learner participation should be ensured in the planning and implementation of these activities. Social service should be a part of the course. If a learner has to change his school, he should be provided an oppurtunity to continue his studies in the new school. While considering criteria for admission to higher courses, grades of vocational subjects should also be given due weightage. In tune with the changes in the Vocational Higher Secondary Education changes should be ensured in the field of higher education.

The teachers have to take special care in arranging learning activities for the development of all the faculties of intelligence.

Learning activities and learning atmosphere.

A proper learning atmosphere is essential for the betterment of learning activities.

They are:

- Proper physical environment
- Healthy mental atmosphere
- Suitable social atmosphere
- Active participation of PTA, Local bodies and SRG
- Reference materials and visual media equipments.
- Academic monitoring
- School Resource Group (SRG)

SUBJECT APPROACH

Introduction

Gandhiji envisaged development of roads as a parameter to our nation's growth. Our roads and vehicles on them have evolved ever since and now we possess express ways on which most sophisticated technologies transport men and 'cargo'. At the same time, we have criss- cross village roads on which Sturdy Ambassadors still cruise.

Many of World's automobile giants have accepted India as a potential automobile market with enormous man power and low cost potential land. They have set up vast manufacturing units providing job opportunities to lakhs of people. Their products on road need expert technicians across the country to ensure their trouble free life. We have numerous authorised service centres of most of these companies offering quality of service at affordable prices. These centres employ technicians trained to perform specific tasks and have special service tools designed to perform specific repair works.

Definitely automobile industry has established itself as a rapidly growing sector in our industrial arena. It offers great job opportunities to those who can perform repair and maintenance activities of vehicle. Vocational Higher Secondary Education department offers the course MRA (Maintenance and Repairs of Automobiles) which is designed to explore these potential.

Course Objective

The prime objective of the course is to equip students with technologies necessary to perform repairs and maintenance of various automobiles. It offers them possibilities to venture as entrepreneurs or to find a job in any of the numerous service centres across the country.

After successful completion of the course, students have the option to go for higher students as well.

Curriculum Objectives

- 1 To learn the structure and working of various units in an automobile
- 2 To understand the possible defects and their symptoms which can happen to various components of automobiles.

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- 3 To develop skills in students to provide periodic and systematic maintenance to automobile.
 - 4 To mould out technicians who can perform service of all types of vehicles independently.
 - 5 To develop man power having technical knowledge in this field.
 - 6 To enable students with the capacity to work together in the society.
 - 7 To make students qualified for higher studies in this field.

Learning Approach

Learning is a continuous and smooth process leading to a behavioural change in the learner. In a broad sense the learner himself has to create knowledge. The real knowledge can be acquired only through activities in which the learner is a participant. Proper understanding of technical subjects inevitably demands 'hands on' experiences. The learning process should result in the development of various facts of multiple intelligence. More over the knowledge and skill acquired by the learner must be contributive for the overall development of the society and should serve as an indicator of social development.

To brief up, it can be said that the learning of the subject should help the learner to earn his livelihood by the successful implementation of the skills and knowledge he has developed.

Learning Strategies

The learning process should advance through two phases; in the first phase, the learner thoroughly understands the problem met out to him. In the second phase he develops solutions to the said problem.

The circumstances to help the learner to complete these phases successfully are to be created by the teacher. In other words the teacher becomes a guide who directs his student towards feasible solutions to a particular problem. Also, during learning process, the student is encouraged to achieve his own findings and to proceed in quest of more knowledge.

Observations, researches etc. are very much integral for this type of learning. Group activities are powerful tools which ensure active participation of each student. They also help to maintain learner's interest on the subject of study.

Students must be encouraged to contribute and share the ideas which they have derived and to develop such ideas through group discussions.

Collective researches, evaluation of such researches and other similar group activities must be organised by the teacher. It is desirable to assign responsibilities of these activities to students themselves to make them capable to individually conduct such work.

Workshop practicals, assignments, seminars, observations, projects, field visits etc must be effectively utilised in the process of teaching.

Developing ability in students to identify possible defects that may occur in automobiles is a key factor in the advanced method of teaching the subject. More over student evaluate all possible repairs techniques and should suggest most apt solution for the specific problem. Such a method provides them with a in-depth knowledge of a problem as well as its solution. Whenever possible provide students with opportunity to experience the on hand problems. For example, suppose a particular vehicle is not yielding the fuel efficiency suggested by its manufacturer. The students must be required to analyses the reasons for this shortcoming physically and suggest all possible remedial measures. Doing so, he develops a detailed knowledge about fuel system of an automobile.

Field visit is another effective tool, which helps students to directly communicate with problematic areas. Workshops deal with vehicles of different troubles every day. In a class room the teacher and students can discuss only specific problems. But a field visit develops the perspective of a student in to a wider one. Conduct such visits as frequently as possible and make it a practice of student to prepare detailed report after each visit.

SYLLABUS REVISION

So as to improve the teaching process of the subject Maintenance and Repairs of Automobiles (M.R.A), it was necessary to introduce some changes in the existing syllabus.

We have rearranged the pattern of syllabus by merging practical classes with theory topics. In this revised syllabus, which is attached herewith, we have included comparatively new technologies which were not found in the existing syllabus.

The Source Book for the subject M.R.A is prepared based on the revised syllabus.

SYLLABUS

1st year theory

unit. 1

Introduction

Types of automobiles- purpose, capacity, fuel used, number of wheels, drive of the vehicle, specification, history of automobiles.

Construction of automobiles- body, chassis, monocoque structure, chassis components, frame- construction, defects.

IC engines and EC engines- classification of IC engines, Introduction to volume, temperature, force, pressure, work, power, energy, vacuum, internal energy, friction, torque

Engine terminology- T.D.C, B.D.C, Stroke, bore, clearance volume, piston displacement, compression ratio, engine capacity, IHP, BHP, FHP, MEP, Mechanical, thermal and volumetric efficiencies.

Engine operation- working of two strokes and four stroke engines- diesel and petrol.

Engine cycles- otto and diesel, comparison of two stroke and four stroke engines, comparison of petrol and diesel engines.

Introduction to rotary engines.

Unit. 2

Engine Construction

Study of engine components:- stationary components- cylinder head, cylinder block, oil pan, cylinder liner, gaskets, manifolds, muffler etc.

Moving parts- piston, piston rings, piston pins, piston clearance, cylinder face, connecting rod, crank shaft, vibration damper, flywheel, camshaft, timing gears, valves, valve mechanism, valve timing, valve clearance, bearings, multivalve systems.

Engine balancing, static balancing, power overlap.

Unit. 3

Petrol fuel systems

Properties of petrol fuel, combustion chamber designs, fuel feed systems, layout of fuel system, Air cleaners, fuel tank, Types of fuel pumps, fuel filters, Carburettors- Principle and functions, Types of carburettors, Simple carburettor, Construction and working of various circuits in fixed venturi carburettor, variable venturi (S.U) carburettor, Mixture strength.

Troubles and remedies of fuel pumps and carburettors- carburettor adjustments- method of carburettor balancing- testing of fuel pump. Introduction to MPFI- working, types.

Unit.4

Diesel fuel system

Properties of diesel fuel, combustion chamber designs, glow plugs, decompressor, layout of diesel fuel feed system, feed pump, fuel injection pump, injectors, nozzles, fuel pumps drives and injection timing mechanisms, Governors, fuel filters.

Defects and remedies of- fuel feed pumps, injection pump, injector and nozzles, testing method of nozzles- calibration and phasing of injector pump, CRDI system.

Introduction to gas fueled cars- introduction to Electric and Hybrid cars.

Unit.5

Cooling Systems

Introduction, Necessity and methods of cooling, air cooling, water cooling, liquid cooling, thermosyphon, pump circulation, layout of water cooling system, Types of Radiators, Pressure caps, Thermostats, Coolants.

Troubles and remedies of cooling system.

Lubrication system

Introduction, Necessity, types of lubricants, properties of lubricant oil, types of lubricating oil pumps, Full flow and bypass filtering methods, various lubricating oil filters, strainers.

Troubles and remedies of lubricating system crank case ventilation- various greasing points.

Unit. 6

Introduction

Battery and Magneto ignition systems- construction, working and comparison, study of distributor, Dwell angle, condenser, types of ignition coil, spark plugs, Ignition advance mechanisms, advanced ignition systems.

Troubles and remedies of ignition system, Factors governing ignition advance, complaints in spark plugs and its cleaning.

Unit. 7

Electrical system

Introduction- Battery- various types, constructional details, working principles- specification of battery, Battery rating, Procedure of battery charging, Battery testing, Defects and repairs of batteries

Charging system

Introduction- working principles of Dynamo- construction and operation, charging circuit, regulators, working principle of alternators- construction and operation of alternator- rectifiers, comparison between Dynamo and Alternators.

Defects and repairs of Dynamo and Alternators.

Starting system

Introduction- Starting motors, starting circuit, different types of starting mechanisms, solenoid switches.

Defects and remedies of starting system.

Other electrical equipments

Various circuits of lighting system- various types of bulbs and reflectors- focussing and adjustments of head lamps- various switches- Horn and wind screen wiper- Accessories

Troubles in light circuits and various electrical equipments.

Unit. 8

Maintenance

Maintenance of frame, maintenance of Engine, Maintenance of fuel feed systems, Inspection of various filters, fuel lines and carburettor, Maintenance of diesel fuel system- inspection of various filters, fuel lines and injectors.

Maintenance of cooling system, testing of fan belt, testing radiator cap, cleaning of cooling system, checking radiator leak.

Maintenance of lubricating system: Checking oil level, changing oil, changing filter, servicing oil pump.

Maintenance of Ignition system:- Inspect distributor, spark plugs, high tension leads.

Maintenance of Battery:- Visual checkup, check electrolyte, cleaning battery cell- checking the charge of battery.

Maintenance of charging system:- Care and maintenance of dynamo and alternator

Maintenance of starting and other electrical equipments:- care and maintenance of starting and electrical equipment.

SYLLABUS PRACTICAL

Unit. 1

- Fundamentals of Engineering drawing
- Demonstration of available vehicles.
- Different chassis, body, components of chassis, defects of chassis frames.
- Preparation of charts showing cross section of 2- stroke and 4- stroke engines.
- Schematics of working cycles.
- Demonstration of measuring instruments, tools, servicing equipments and identification of the same.

Unit. 2

- Safety precautions in workshop
- Marking and filing practice
- Thread cutting with taps and dies
- Cutting with hacksaw
- Soldering practice.
- Hand and spray painting.
- Riveting practice.
- Drilling with hand and power drill.
- Identification of IC engine components.

Unit. 3

- Fuel system
- Study of different types of petrol fuel pumps.
- Study of different types of carburettors.
- Practice on detecting and rectifying common troubles by overhauling various carburettors.

Unit. 4

- Fuel pumps in Diesel engines
- Study of different types of fuel injection pumps.
- Practice on detecting and rectifying common troubles.

Unit. 5

- Study of cooling system
- Water pumps
- Thermostats
- Pressure cap
- Practice on detecting and rectifying troubles in cooling system.
- Study of different types of oil pumps.
- Practice on detecting and rectifying common troubles in lubricating system.

Unit. 6***Ignition system***

- Train students dismantling, disassembling, testing, repairing and remounting of the following.
 - a. Ignition coil
 - b. Distribution
 - c. Spark plug
 - d. Leads

Unit. 7

- Practice in detecting and rectifying common troubles in:-
 - a. Starter circuits
 - b. Dynamo and charging circuits
 - c. Battery recharging methods
 - d. Ignition timing in 4 cylinder engines.
 - e. Detecting and rectifying common troubles in head lamps, side lamps, indicator lamps, tail lamps, warning lamps, different panel instruments.

Unit. 8

- Maintenance of frame, engine, petrol fuel system, diesel fuel system, cooling system, lubricating system, ignition system, battery, charging system and starting system.

PLANNING

Teachers are expected to plan the learning activities. The planning should be done yearly, termly and monthly, and then report should be submitted in the school resource group, so that the available time in an academic year can effectively be utilised. This will be helpful for planning the common programmes to be conducted in and outside the school as part of the curriculum. Activities that are common for various subjects can be clubbed together so that the resources can be utilised to the maximum.

Year Plan

Term	Month	Units	Topics	Hours
I	July	I	Introduction of Automobiles and working of IC Engines	T- 25 P- 60
	Aug	II	Construction of Engines	T- 18 P- 70
	Spet	III	Construction of Engine Fuel system of petrol Engine	T- 8 P- 14 T- 17 P- 45
II	Oct	IV	Fule system of diesel Engine	T- 19 P- 65
	Nov	V	Cooling and Lubrication System	T- 19 P- 50
		VI	Ignition system	T- 5 P- 18
	Dece.	VI	Ignition system	T- 20 P- 63
III	Jan	VII	Electrical system and Charging system	T- 18 P- 75
	Feb	VII	Starting system and other Electrical system	T- 8 P- 30
	Mar.	VIII	Maintenance of Automobiles	T- 8 P- 30
			Total	T- 160 P- 520

MODEL LESSON PLAN

UNIT.2

ENGINE CONSTRUCTION

Name of Teacher :	Class : I st VHSE
Name of the School :	Division :
Subject : Maintenance and Repairs of Automobiles	Strength : 30
Topic : Cylinder Head	Average age :
	Duration : 1 hour

Curriculum Objectives

Develop knowledge on the structure and functioning of cylinder head.

Concepts and Ideas

The design of cylinder head varies with respect to changes in valve mechanisms and other factors

Process Skill

Observation
Communication
Comparison
Drawing.

Previous Knowledge

Students have knowledge about the working of IC engines.

Materials required

Charts showing the shape of different cylinder heads, actual components.

Response/ Feed back

Participation, understanding, drawing ability.

<p>Activities</p> <p>Demonstrate charts and actual components in class room or in workshop. Generate a discussion in class room on the differences in structure of cylinder head for pushrod engines and for engines with OHC mechanism</p> <p>Consolidation</p> <p>Students are made to understand the following.</p> <p>Machining activities performed on castings of cylinder heads.</p> <p>Differences effected on the construction of cylinderheads with respect to valve mechanism.</p> <p>Provisions made on cylinder heads for effective cooling.</p> <p>Materials used in manufacture of cylinderheads.</p>	<p>Assignment</p> <p>Prepare a report based on the class room discussion with appropriate sketches.</p>
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MODEL UNIT PLAN

UNIT.1

Sl. No	Curriculum Objectives	Activities	Learning Materials	Evaluation						Hour	
				CT	Project	Assignment	Seminar	GD	Practical		
1.	To develop basic interest about automobile and its functioning.	Survey Analysis	Broachers, Charts.	✓		✓					7
2.	Understanding about classifications of engines.	Data collection. Summarising Preparation of charts.	Charts, Text book.	✓		✓		✓			4
3.	Comparison of different IC engines.	Preparation of notes.	Textbooks, Workshop manuals etc.	✓			✓	✓			4
4.	Make a clearcut idea about the various engine terminology.	Data collection. Analysis.	Broachers, Textbooks, Other sources.	✓				✓			10

EVALUATION

Evaluation helps to assess the rate of the students and to recognise to what extent each student has achieved the specified capabilities. These evaluation results are the basis on which the students, teachers, parents and society can assess the educational progress.

Written examination based on the text book alone is not of much use. An evaluation that comprehensively assesses the abilities (practical skills) envisaged in the curriculum is what is required. Therefore continuous Evaluation (CE), Practical Evaluation (PE), Terminal Evaluation (TE) and Vocational Competency Evaluation (VCE) are required in Maintenance and Repairs of Automobiles. Written examinations for evaluating Knowledge and practical examination for evaluating practical abilities are required in terminal evaluation. Practical examination consists of doing certain specified activities for detecting a complaint and repairing the part, or maintenance of different components of automobiles. Vocational Competency Evaluation judiciously evaluates the required value addition and the consequent capacity building in the selected vocational skills.

Continuous and Comprehensive Evaluation

Most of our traditional evaluation methods are related only to the area of knowledge. There are criticisms about their comprehensiveness and usefulness precisely because of that. It is a weakness of our evaluation method that practical capabilities are not being assessed in any subject. It is to rectify this deficiency that the evaluation method is being changed to include assessment of practical capabilities, attitudes, products associated with study and so on. It is through continuous evaluation that the knowledge related fields and products are evaluated. This is possible only that way. Through this, every learning activity that takes place within an year can be subjected to continuous evaluation. Evaluation should be done not by the teachers alone. Students can evaluate themselves. Classmates can evaluate one another. These should be considered as means of improving education. Activities in class room like discussion quiz, seminar, worksheet, preparation, symposium, debate, preparation of observation notes and preparation of subject diary should be evaluated by children also, along with the teacher. For this, evaluation rebric can be developed by the students themselves. Observe some indicators given below for this.

Discussion

- Presentation of ideas that are new, different and original (that gives clarity to the topic of discussion)
- Presenting one's own opinions in clear language.
- Waiting for one's turn and making use of it
- Listening carefully to what others say
- Speaking with mutual respect in respectable and moderate language.

Quiz

- Preparation of questions in the work book ensuring quality and comprehensiveness of the questions.
- Giving correct answers
- Obeying rules

Notes

- Comprehensiveness (inclusion of all important materials)
- Clarity (clear language, clear writing)
- Doing correctly according to instructions

Debate

- Speaking relevantly with out deviating from topic
- Presenting opinions with clarity in ideas
- Presenting logical arguments in friendly languages
- Accepting agreeable parts of opposite view points.

The items with the concerned indicators, to be considered for recording in continuous evaluation (CE) are given in a table in the coming section.

Curriculum Committee Decision on Evaluation

The terminal Evaluation of Maintenance and Repairs of Auromobiles is conducted by a public examination which consists of theory aspects . For theory examination (TE) the maximum score is 80. In addition, there will be continuous evaluation (CE) for a maximum of 20 scores. The details of CE items are as follows.

Evaluation Activities for CE

The continuous evaluation may include the following activities;

1. Class Test
2. Assignment
3. Seminar/Symbosium
4. Project
5. Collection/Records

6. Group discussion/Debate

CE items that has to be recorded for MRA course are;

1. Class test
2. Assignment
3. Seminar/Project

You can conduct any number of assignments and seminars/projects but record any one of the assignments and seminars/projects for CE.

1. **Class Test**

The unit test or quarterly examinations are considered and the average marks obtained by the students are converted into 20 scores. Those who are absent in a list may be given a chance on his/her request, if it is found genuine.

2. **Assignment**

Assignment is an activity to achieve the curriculum objectives undertaken by the students, in continuation with activities carried out in the class. It is a self learning cum Evaluation activity and it should ensure that the work is completed within a stipulated time according to the teacher's direction by utilising the maximum capabilities of the students and Exploring maximum possibilities. If same topic is given to all the students, the involvement of the students in his/her work should assure using some tools like viva-voce. If different tasks are assigned, the level of task should be uniform and evaluation indicators should be specified in advance. The activity begins in the classroom with proper planning and preliminary discussion and carried out completely outside the class. The document containing the activities should be submitted in time for the completion of evaluation. The document may be shared if it is relevant and there is demand if a student delivers more than one seminar the best is taken for CE reporting. Every student should be given a chance as it reflects his/her CE score.

3. **Seminar**

Seminar is a very effective self learning activity which helps to go deeper into the different aspects of a particular topic in the syllabus. The information collected from various sources with the guidance of teacher are systematically organised and presented in the class so that the information is shared among the student. The students from the audience side can raise doubts and questions regarding the content and even contribute to.

The topic and subtopics are to be emerged during discussion in the class room as a need to know more about the topic. If there are sufficient content for the subtopics each of them can be assigned to each student, but they should work in a collaborative manner. A seminar paper or notes is prepared and submitted to the teacher for verification and authentication when the seminar is presented the other students record the points in their note books and each student prepare his/her own seminar paper of the same topic. At the same time the student who presents the paper also modifies his/her paper

reflect the points emerged during the discussion. All the paper are compared and evaluated to ensure the uniqueness of the efforts made by each student to acquire the information regarding the topic.

4. Project

In Maintenance and Repairs of Automobiles, designing and development is regarded as project. As in the case of any project, designing is a process oriented activity, in which there are different stages to be evaluated and a product is evolved. It is group activity through which a work is developed using a package or any other development tool.

The project begins with identifying the application area and the associated problems. The elements involved in designing are recognised and procedure or steps are derived. The students explore possibilities of cooperative and collaborative learning and apply their problem solving skill using and development tool/package.

Once the group is formed, it is intimated to the teacher and initial planning is done in consultation with the teacher. The students are constantly in touch with the teacher throughout the stages of project work . A project diary is to maintained by each group and the activities are to be recorded, which will be helpful in preparing project report.

After designing it should be verified by the teacher and preparation of project report with the specified format is begun. Each of the group member should have a copy of the report and one copy should be submitted to the teacher which will be kept in the library for reference. While setting the CE, the teacher may conduct a viva-voce to ensure the involvement of the student in this activity.

Structure of Project Report

1. Cover Page (Project title, Name of Students, Course and Duration)
2. Certificate
3. Preface/ Abstract
4. Content
 - Introduction
 - Aims (Objectives)
 - Problem study/ Analysis
 - Development Tools and Facilities used
 - Source Code/ Procedure/Steps
 - Outputs
 - Conclusion
5. Annexure (Sample data, data sheet etc.)
3. Bibliography

CE Item	Evaluation Indicators	Weightage	Score
1. Class Test	Average marks of all tests including Mid-Term and Quarterly (minimum three) converted into 20.		20
2. Assignment	1. Awareness of the content 2. Comprehensiveness of the content 3. Systematic and sequential arrangement 4. Observation/suggestions/Views Judgements/ Evaluation 5. Timely Submission	4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1	20
3. Seminar	1. Ability to plan and organise 2. Skill in the collection of data 3. Awareness of the content (presentation of the paper, participation in discussion, ability to substantiate the ideas and views) 4. Ability to prepare the report (sequence in the presentaionof the concepts, authenticity and clarity of ideas/views/concepts) 5. Quality of Seminar Document	4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1	20
4. Project	1. Ability to plan (Selection of the method for solution of the problem identifying suitable tools, planning the various activities to be carried out in each stage) 2. Ability to collect data (sufficiency and Relevance of data. Classification and arrangement of data for analysis, reliability and authenticity of the Collected data.) 3. Ability to analyse the elements and procedure (Structuring of elements and developing logic. Efficieny in using the package/tool. Recognising design errors and correcting them) 4. Ability to prepare the project report (Reflection of the process skills. Communicability and authenticity of the report in relation with the Project diary 5. Viva Voce(Knowledge of the content and Process)	4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1 4/3/2/1	20

CE item calculation

Subject		item: Assignment					
Sl. No	Name	Evaluation Indicators					Total Score (20)
		I (4)	II (4)	III (4)	IV (4)	V (4)	
1	Anand	2	3	4	4	4	17
2	Shibu	4	3	4	4	4	19

Total CE calculation

Sl. No	Name	CE Items			Total (60)	Total CE Out of 20
		1 Class Test (20)	2 Assignment (20)	3 Seminar/ Project (20)		
1	Anand	18	17	19	54	18
2	Shibu	20	19	18	57	19

Terminal Evaluation (TE)

Terminal Evaluation is in written form. The test should not be aimed to test the memory alone. The terminal evaluation question gives more emphasis on application level, analysis and synthesis. The question are framed so that the students are able to apply their different mental process. The maximum score is 80 and the minimum score of TE is 24 (30%).

Subject Consolidation

Sl. No	Name	CE (20)	TE (80)	Total CE+ TE (100)	Grade

The maximum score of CE + TE is 100 and the minimum score is 30(30%)

Practical Evaluation (PE)

The scholastic area includes those area in which the learner attain knowledge and skills based on the curriculum. This leads to create more interest on certain area of a subject. "Emphasis should be given to each topic for learning activity and develop skills. In the practical Examination, the external Examiner is able to evaluate the skills that are attained by learning experiences. The practical Examination question paper is always activity based.

Practical Evaluation (PE) Items

Split up of Score

Indicators	Total score	Percentage
1. Requirement of tools Identified.	7.5	5%
2. Procedure	30	20%
3. Programming skill/ Designing Skill	7.5	5%
4. Result/ Output	45	30%
5. Viva	15	10%
6. Record	15	10%
Total	150	100%

Practical examination should be result oriented. After dismantling, students must be required to observe dimensions of components and note any damages in this components.

The maximum score of PE is 150 and the minimum score is 60 (40%)

Vocational Competency Evaluation (VCE)

Being a vocational course, a system to judiciously evaluate the required value addition and consequent capacity building in the selected vocational subject is highly essential. As the other evaluation components like CE, PE and TE cannot assess the vocational competencies and professional skills acquired by the students, an internship evaluation (IE) component has been introduced to meet this requirement.

Internship evaluation should be done based on the following components.

I. Regularity and punctuality.

A regular presence and habit of time bound completion of task is a must for attaining maximum efficiency.

II. Value addition

Value addition can be evaluated through conducting field visits/survey. The experiences gained through field visit and survey increases the level of intrinsic motivation and positive attitude towards the vocational field and there by increase his value as a skilled semi-professional.

III. Capacity building

Capacity building can be evaluated through conducting the following activities.

1. OJT/Simulated experiment
2. Performance- Camp/ Exhibition/ Clinic.
3. Performance- Production/Service cum Training centre.

These components helps the students to practice the acquired skills in the real situation and there by increasing self confidence and promoting self reliance.

I. Regularity and Punctuality can be evaluated by 5 point grading system.

Rating scale

		1	2	3	4	5
1	Regularity	Never regular	Often regular	Usually regular	Most of the time regular	Always regular
2	Punctuality	Never Punctual	Often Punctual	Usually Punctual	Most of the PunctualPunctual	Always

Regularity and punctuality can be assessed by using attendance of the student and time bound completion of tasks.

The aim of value addition is to measure the interest, devotion Group managment, perseverance of the learner in specific areas Value addition can be evaluated from field visit, survey and simulated experiments.

Capacity building is aimed at measuring the skills of the learner from OJT/ production cum training centre/ research and development/graded area exposure.

The minimum score of VE should be 30. The VE score in the first year should be carried over to second year as vocational education is a continuous process.

VE Item	Evaluation Indicators	Weightage	Score
1. Regularity and Punctuality			10
2. Value addition	<p>Field Visit</p> <p>1. Attitude and readiness towards the task. 4/3/2/1</p> <p>2. Capacity for observation. 4/3/2/1</p> <p>3. Data collection. 4/3/2/1</p> <p>4. Application of ideas. 4/3/2/1</p> <p>5. Documentation/ recording. 4/3/2/1</p> <p>Or</p> <p>Survey</p> <p>1. Planning. 4/3/2/1</p> <p>2. Data collection. 4/3/2/1</p> <p>3. Consolidation of data and analysis. 4/3/2/1</p> <p>4. Drawing inference. 4/3/2/1</p> <p>5. Reporting. 4/3/2/1</p>		20
3. Capacity building	<p>OJT/ Simulated Experiment</p> <p>1. Involvement/ Participation. 4/3/2/1</p> <p>2. Skills in doing work/ Communication skill. 4/3/2/1</p> <p>3. Time bound action. 4/3/2/1</p> <p>4. Capacity for observation, analysis and innovation. 4/3/2/1</p> <p>5. Documentation, Recording and display. 4/3/2/1</p> <p>Or</p> <p>Performance in camp/ Exhibition/ clinic</p> <p>1. Ability for planning and organisation. 4/3/2/1</p> <p>2. Mastery of subject. 4/3/2/1</p> <p>3. Ability for communication. 4/3/2/1</p> <p>4. Innovation. 4/3/2/1</p>		20

VE Item	Evaluation Indicators	Weightage	Score
	5. Involvement/Social commitment. Or Performace in production/ service cum training centre (PSCTC)	4/3/2/1	
	1. Mastery of vocational skills.	4/3/2/1	
	2. Managerial capacity.	4/3/2/1	
	3. Promoting self confidence.	4/3/2/1	
	4. Innovative approach.	4/3/2/1	
	5. Promoting self -reliance.	4/3/2/1	

Vocational Competency Evaluation(VCE) Items

Items	Score
Regularity & Punctuality	10
Field visit/survey(any one)	20
OJT/simulated experiment Performance- Camp/exhibition/ Clinic Performance- PSCTC (any one)	20
Total	50

A minimum of 80% attendance is required for promotion to the second year. Those who have shortage of attendance should repeat first year. Those who have more than 80% attendance but failed to achieve 30% of internship evaluation (IE) will be promoted to the second year. He has to improve the component in which a performed. He has to attain the minimum by improving the particular component to get eligible for appearing second year public examination.

1

INTRODUCTION

Introduction

The chapter is intended to provide students with a general idea about various types of automobiles. Since this subject is relatively new for higher secondary students a brief history of automobiles also is included. It explains construction of automobiles and purpose for which a vehicle is made. It gives students the ideas about recondition of chassis frames.

A detailed study of engines comprising the following is made in this chapter.

1. Classification of IC Engines and their working.
2. Engine terminology
3. Various efficiencies associated with engine performance.

Syllabus

Introduction

Types of automobiles- purpose, capacity, fuel used, number of wheels, drive of the vehicle, specification, history of automobiles.

Construction of automobiles- body, chassis, monocoque structure, chassis components, frame- construction, defects.

IC engines and EC engines- classification of IC engines, Introduction to volume, temperature, force, pressure, work, power, energy, vacuum, internal energy, friction, torque

Engine terminology- T.D.C, B.D.C, Stroke, bore, clearance volume, piston displacement, compression ratio, engine capacity, IHP, BHP, FHP, MEP, Mechanical, thermal and volumetric efficiencies.

Engine operation- working of two strokes and four stroke engines- diesel and petrol.

Engine cycles- otto and diesel, comparison of two stroke and four stroke engines, comparison of petrol and diesel engines.

Introduction to rotary engines.

Curriculum Objectives

This unit has following objectives

1. The student should develop basic interest about automobile and its functioning.
2. He should understand the basic structure of various automobiles
3. Make students able to identify different types of automobiles
4. To help student gather knowledge about various heat engines.
5. To make student understand various ways in which engines are classified and purpose of each classification.
6. The student should understand the working of various IC engines and general terminology of IC engines.
7. The student should identify the differences between various engines.

Activities

Provide students with the list of various automobiles manufactures. Ask them to collect informations regarding various models of each manufacturer. Group students with respect to manufacturer's range of products. They have to identify the purpose of each vehicle, their basic structure and specification through field survey. Make them share the collected data (including pictures) and compile the same into album.

Provide students with a list of vehicle employing engines of different specification. It should indicate the various classification of engines. Make students prepare a chart in the given format, comprising various classification.

eg,

Make	Model	Capacity	Fuel used	Purpose	Type of Vehicle	Drive	Type of Engine

Ask students to collect details about the performance of two stroke and four stroke engines of same capacity. Provide them with additional information about power and efficiencies.

Ask the students to collect data regarding possible defects in chassis frames.

Make students prepare charts showing cross section of two stroke and four stroke engines, schematic of working cycles.

Subject : Maintenance and Repairs of Automobiles

Unit. 1 : Introduction

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
1. Creating interest about automobile and its functions.	Different vehicles are required for different purposes.	Observations Communication Classification	Survey Analysis	Brouchers Chart	Under- standing. Chart preparation. Album.	
2. Understanding about classification of engine.	Engine can be designed in different ways according to specific requirements.	Observations Classification	Data collec- tions Summerising Preparation of chart.	Chart Textbook	Under- standing. Chart Participa- tion	
3. Comparison of different engines.	IC engine can be deliver different power outputs according to their working pattern, compromising on other factors	Observations. Communica- tion.	Preparation of notes.	Text books Other sources.	Under- standing.	

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
4. Make a clear cut idea in students about the various engine terminology.	Engine capacity and power are varying according to its cubic capacity or cubic centimeter (CC)	Understanding.	Data collection Analysis	Brochures Text books. Other sources.	Under- standing.	

2

ENGINE CONSTRUCTION

Introduction

Students have already learnt what an automobile is, its classification. Functioning of different types of power sources used in various automobiles is described in previous topic. In this chapter the various engine components and their functioning is referred. After completion of this chapter the students should understand the functioning of stationary parts like cylinder head, cylinder block, oil pan, cylinder liners, various gaskets,, manifolds, mufflers etc and moving parts like piston, piston rings, piston pin, connecting rod, crankshaft, valves, valve operating mechanism, bearings etc. They should be able to explain the necessity of engine balancing- both static and dynamic. Also they should know what is power overlap.

Syllabus

Engine Construction

Study of engine components:- stationary components- cylinder head, cylinder block, oil pan, cylinder liner, gaskets, manifolds, muffler etc.

Moving parts- piston, piston rings, piston pins, piston clearance, cylinder face, connecting rod, crank shaft, vibration damper, flywheel, camshaft, timing gears, valves, valve mechanism, valve timing, valve clearance, bearings, multivalve systems.

Engine balancing, static balancing, power overlap.

Curriculum Objectives

1. To make students understand the structure and functions of various engine components- both stationary and moving.
2. To create awareness in students about the necessity of engine balancing.

Activities

- After brief description about every engine component, arrange students in group. Make students to collect defective or damaged engine components from nearby workshops. Demonstrate the entire components in the class room. Ask students to identify and compare each component individually.
- Distribute a set of engine components to each group and make them prepare drawing of an assembled engine.

or

- Ask students to collect components of I.C engine from the school workshop or else where and make free hand three dimensional view of each component and label the parts.
- Demonstrate a running engine to the student and disconnect any one spark plug, Let them observe the variation in the running of engine.
- Arrange students in groups and assign them to work on project to create a working model of valve mechanism. They may make it using actual components. Demonstrate every model in class room and compare.

Subject : Maintenance and Repairs of Automobiles

Unit. 5 : Engine Construction

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
1. To understand the structure and function of various engine components- both static and dynamic.	Arrangement of mechanism to convert heat energy to mechanical energy	Observations. Drawing	Drawing Collection of parts. Sorting.	Engine components. Drawing.	Participation. Drawing ability.	
2. Necessity of engine balancing.	Dynamic as well as static balance is necessary for smooth engine operation.	Observations	Discussions.	Running engine.	Observations.	

3

PETROL FUEL SYSTEM

Introduction

This chapter explains the properties of automobile fuels. It gives students the knowledge of different types of fuel pumps and their functioning. The principles of carburetion, construction and working of various types of carburetors are also described in detail, in this chapter. When the student complete studying this chapter, he should acquire thorough knowledge in the maintenance and service of traditional as well as advanced technologies in the petrol fuel feed system.

Syllabus

Petrol fuel systems

Properties of petrol fuel, combustion chamber designs, fuel feed systems, layout of fuel system, Air cleaners, fuel tank, Types of fuel pumps, fuel filters, Carburetors- Principle and functions, Types of carburetors, Simple carburetor, Construction and working of various circuits in fixed venturi carburetor, variable venturi (S.U) carburetor, Mixture strength.

Troubles and remedies of fuel pumps and carburetors- carburetor adjustments- method of carburetor balancing- testing of fuel pump. Introduction to MPFI- working, types.

Curriculum Objectives

1. To make student gather knowledge about qualities and properties of different automobiles fuels.
2. To make students understand the methods and the components through which fuel is fed to a petrol engine.
3. To make student aware about necessity and the methods for changing the ratio of air fuel mixture to ensure optimum performance of engine.
4. To develop knowledge in the student about traditional as well as advanced fuel systems.

Activities

- Generate discussions about commercial automobile fuels. Explain their properties.
- Demonstrate the functioning of fuel feed system through multimedia.

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- Ask them to create layout of fuel feed system.
 - Explain in class room about different types of air cleaners and fuel filters. Ask students to make drawings of the same.
 - Teacher demonstrate different types of fuel pumps and explain. Generate a discussion in students comparing functioning of fuel pump and prepare required drawings notes on the same.
 - Ask the students to discuss about how fuel supply from the pump is controlled when engine does not demand fuel.
 - Generate a discussion about the variations in engine demands under different conditions of speed and load and make student to understand necessity of changing ratio of air fuel mixture.
 - Demonstrate working of a spray gun to explain venturi principle.
 - Teacher demonstrate a simple carburettor and explain its working. Generate a discussion in students about difficulties that may be incurred, if simple carburettors are employed in engines. Ask them to suggest improvements. Explain various carburettor circuits.

Subject : Maintenance and Repairs of Automobiles

Unit. 3 : Petrol Fuel System

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
1. Providing knowledge about qualities of different fuels.	Even though all fuels are hydrocarbons they have different qualities and properties.	Identification Observations. Classification	Discussion	Text book.	Understanding Participation.	
2. Understanding the methods through which petrol is fed into engine.	Fuel should be atomised for best combustion.	Observation Experimentation	Data collection. Summerising.	Fuel pumps. Carburettors.	Observations. Understanding.	
3. Learning about various components in petrol fuel system.	Necessity of petrol fuel system.	Drawing.	Discussion.	Text book.	Understanding.	
4. Making students aware about necessity of methods for charging the air fuel mixture.	Mixture strength must be varied as per the changes in engine demands.	Observation. Communication.	Discussion. Analysis.	Fuel pump and Carburettor.	Participation.	

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
5. Creating knowledge in students about advanced fuel system.	Petrol fuel supply system is of fastly advancing nature.	Investigation.	Demonstration.	Service hand book.	Understanding.	

4

DIESEL FUEL SYSTEM

Introduction

This chapter gives an idea about the properties of diesel fuel and its combustion. After studying this chapter the student should be able to explain how each component of fuel system works; Possible troubles that may occur and the repair techniques of the fuel feed pump, fuel injection pump, fuel injectors, nozzles, governors, filters etc. It also refers the advanced technologies in the Diesel injection system.

Syllabus

Diesel fuel system

Properties of diesel fuel, combustion chamber designs, glow plugs, decompressor, layout of diesel fuel feed system, feed pump, fuel injection pump, injectors, nozzles, fuel pumps drives and injection timing mechanisms, Governors, fuel filters.

Defects and remedies of- fuel feed pumps, injection pump, injector and nozzles, testing method of nozzles- calibration and phasing of injector pump, CRDI system.

Introduction to gas fueled cars- introduction to Electric and Hybrid cars.

Curriculum Objectives

1. To make students understand the methods and components through which fuel is fed to a diesel engine.
2. To make students understand the necessity of using clean fuel and various types of filters.
3. To make students know about various diesel injection pumps.
4. To enable the students to understand the necessity and methods to control quantity of fuel injection with respect to engine requirements.
5. To provide students with the knowledge of methods of varying the diesel injection timing.
6. To provide students with detailed knowledge about various fuel injectors and nozzles.
7. To make students able to test various nozzles, to calibrate and phase injection pumps.
8. To provide students with the knowledge of advanced technologies in this field.

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9. To make students aware about different fuel governing systems.
 10. To expose students towards new generation vehicles like gas and hybrid cars.

Activities

- Teacher demonstrate components of Diesel fuel system in class room. Explain its working in detail. Ask them to create layout of diesel fuel feed system.
- Explain possible contamination in automobile fuels. Ask students to conduct a seminar about damages that can happen is contaminated fuel is used and how such damages can be avoided by proper filtration.
- Generate a discussion in class room about necessity of varying the quantity of fuel injection according to differences in engine requirements. Explain the methods adopted in jerk/on-line pumps to control fuel supply.
- Explain the necessity of varying the diesel injection timing. Demonstrate a timer in class room and explain its functioning. Ask students to prepare notes on the same with required diagram.
- Demonstrate a rotary distributor diesel injection pump and explain the methods adopted in rotary distributor pump to control fuel supply.
- Ask students to collect different types of damaged or used injectors from nearby workshop or from school workshop. Ask them to identify and compare these items. Give detailed explanation about each.
- Generate a discussion about necessity of fuel governors. Explain fuel governors in detail.
- Visit nearby diesel pump service centre to learn various testing methods of nozzle. Show them how calibration and phasing of injection pump is done. Make students prepare a detailed report.
- Conduct a field visit to a workshop equipped to service CRDI engines. Make students to prepare a detailed report.
- Ask students to collect articles relating latest developments in automobile fuels and make an album or chart.

Subject : Maintenance and Repairs of Automobiles

Unit.5 : Diesel Fuel System

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
1. Understand the methods through which diesel fuel is fed and components employed for the same.	Homogeneous supply of diesel fuel of very high pressure must be ensured.	Observations. Communication.	Demonstration. Drawings.	Components.	Understanding.	
2. To create awareness in students about the necessity of using very clean fuel in diesel system and about various filtration methods.	Necessity of using clean pump.	Inferring. Communication.	Seminar. Discussion.	Drawing. Filters.	Acquired understanding. Presentation.	
3. To make knowledge in students about conventional fuel injection pump.	Different methods are used to attain the proper diesel injection.	Observation. Communication.	Discussion. Analysis.	Text book.	Participation.	
4. To enable students understand the necessity and methods to control quantity of fuel injected with respect to engine requirements.	Engine demands varying quantities of fuel.	Observation. Communication. Plotting graph.	Discussion. Drawing graph. (Speed Vs fuel consumed)	Schematic diagram. Graph paper.	Understanding. Analysis of graph.	

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
5. To provide students with the knowledge about methods to vary the diesel injection timing.	Injection timing has to be varied with respect to engine speed and load.	Observations. Information.	Demonstration. Preparation of notes and drawings.	Timer mechanism. Diagram.	Understanding. Notes. Drawing diagrams.	
6. To provide students with detailed knowledge in various fuel injectors and nozzles.	Perfect atomization of diesel fuel.	Observation. Communication.	Drawing Discussion	Textbook. Diagram.	Participation.	
7. To make student aware about different governing systems	Control of fuel delivering to meet operating condition.	Investigation. Observation. Communication.	Discussion. Analysis.	Text book.	Participation. Understanding.	
8. To make students able to test various diesel nozzles and to calibrate and phase injection pump.	Injection pump is a very precise and accurate equipment.	Observation. Communication. Recording.	Fuel feed unit. Preparation of report.	Text book. Drawings.	Participation. Acquired understanding.	

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
9. To give students the knowledge of advanced technologies in diesel injection.	Diesel fuel is gaining more importance as an automobile fuel with developments in injection Technologies.	Observations. Communication Recording.	Field visit. Preparation of report.	Textbook. Drawings.	Participation. Acquired understanding. Report.	00 Hours
10. To expose students towards new generation vehicles like gas and hybrid cars.	Development of new breed of cars.	Observation. Learning.	Collection.	Articles.	Understanding. Album/ Chart.	00 Hours

5

COOLING SYSTEM AND LUBRICATION SYSTEM

Introduction

The purpose of this chapter is to make the students understand the functioning of two important systems necessary for the smooth functioning of IC engines- lubrication system and cooling system.

Under cooling system, various methods of cooling, operation of different components in cooling system etc, are prescribed. It makes students to know about possible defects and repair tactics associated with cooling system.

In lubricating system, operation of engine lubrication is explained with a detailed study on each component. It discusses the functions of lubricating oil and the properties required for the same.

After studying the chapter students must be able to service the above two systems.

Syllabus

Cooling Systems

Introduction, Necessity and methods of cooling, air cooling, water cooling, liquid cooling, thermosyphon, pump circulation, layout of water cooling system, Types of Radiators, Pressure caps, Thermostats, Coolants.

Troubles and remedies of cooling system.

Lubrication system

Introduction, Necessity, types of lubricants, properties of lubricant oil, types of lubricating oil pumps, Full flow and bypass filtering methods, various lubricating oil filters, strainers.

Troubles and remedies of lubricating system crank case ventilation- various greasing points.

Curriculum Objectives

1. To make students aware about the necessity of engine cooling and its effect in engine performance and its control.

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2. To make students aware about the necessity of engine lubrication and various lubrication systems.
 3. To encourage students to explore possibilities in utilising thermal energy more efficiently.
 4. To make them experts in the maintenance of cooling and lubrication system.

Activities

- Briefly explain the factors affecting thermal efficiency and initiate a discussion among students about the necessity of proper cooling.
- Explain necessity of maintaining proper operating temperature.
- Explain the increase in cooling rate when increased area is provided for radiation (Take hot water in a tray and similar water in a glass and check the cooling rate) Explain air cooling system.
- Heat water in a glass jar with glitter powder (light aluminium pieces). Let them observe upward flow of glitter powder. Explain thermosiphon system.
- Explain components in pump circulating cooling system. Ask them to prepare drawing showing various positions of pressure cap and thermostat. Ask them to prepare a chart showing structure of radiator. Discuss the functioning of water pump and radiator fan. Ask them to compare electric fan and engine driven fan.
- Generate a discussion between students about possible defects that may occur in cooling system and bring out rectification methods.
- Ask students to collect data on various lubricants and prepare a table showing properties of each.
- Explain types of lubricating system in detail. Make them sketch a lay out of pressure lubrication system. Demonstrate various oil pumps and ask them to make drawings of the same.
- Intiate a discussion comparing full flow and bypass filtering methods. Ask students to collect various types of filters and data regarding them. Make students to share the collected data. Ask them to prepare notes regarding the collected data.
- To engage students in a group discussion to explore possibilities in reducing the wastage of heat energy.
- Divide students to small groups and ask to overhaul various components in cooling and lubricating system.

Subject : Maintenance and Repairs of Automobiles

Unit. 5 : Cooling System and Lubrication System

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
1. Creating idea about the necessity of engine cooling and its effect on engine performance.	Engine can't work long time with out cooling and cooling should be controlled to a certain limit.	Observations. Communication.	Demonstration. Explanation.	Textbook.	Participation.	
2. Creating idea about necessity of engine lubrication.	Reduced friction saves power.	Observation. Experimentation.	Demonstration. Experimentation.	Water, tray, heater, glass etc.	Participation. Ability to observe and infer.	
3. Encourage students to explore possibilities in utilising thermal energy.	A huge part of heat energy has to be recovered to increase the thermal efficiency of engine.	Communication.	Group discussion.	Reference book.	Participation.	

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
4. Developing expertise in maintenance of cooling and lubrication system.	Cooling and lubrication systems are vital in engine performance.	Working skill.	Overhauling various lubrication and cooling system.	Tools and components.	Participation. Skill.	

6

IGNITION SYSTEM

Introduction

This chapter is intended to create interest and develop skills in working and repair of various types of ignition systems. It provides students the knowledge about working of Magneto, Battery ignition and about mechanism to change ignition timing.

After learning this unit, the student should develop expertise in the service of ignition system. It is also the objective of this unit to encourage students to maintain knowledge about latest developments in this field.

Syllabus

Introduction

Battery and Magneto ignition systems- construction, working and comparison, study of distributor, Dwell angle, condenser, types of ignition coil, spark plugs, Ignition advance mechanisms, advanced ignition systems.

Troubles and remedies of ignition system, Factors governing ignition advance, complaints in spark plugs and its cleaning.

Curriculum Objectives

1. To create interest and develop skills in students to understand working of various ignition systems.
2. To create awareness about the importance of ignition timing in smooth functioning of engines.
3. To provide them with the knowledge of mechanism incorporated in ignition system to alter the ignition timing with respect to the change in engine's speed and load.
4. To encourage the students to engage in research of new inventions in ignition system.
5. To develop expertise in students in the maintenance of ignition system.

Activities

- Explain various components in a battery ignition system and generate a discussion in class room about the circuit diagram. Ask students to generate drawing of various components, after demonstrating them.

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- Attach a D.C source to central terminal of distributor cap. Connect small bulbs in place of spark plugs. Make students arrange them to glow following the firing order of the engine.
 - Demonstrate and explain magneto ignition system in class room. Practice students to generate spark using magneto and spark plugs.
 - Conduct a seminar on various ignition system.
 - Start a discussion in class room about importance of ignition timing. Contribute teacher's suggestions during discussion and ask students to note down various points.
 - Demonstrate ignition advancing mechanism in class rooms. Assign students to prepare notes and drawings.
 - Ask students to collect articles regarding advanced technologies in the field of ignition. (A field visit may be conducted)
 - Compile the data collected from the articles to a chart.
 - Give practical training to the students on the testing and repairing of the following.
 - 1 Ignition coil
 - 2 Distributor
 - 3 Spark plugs
 - 4 Leads
 - Following tests may conducted in school workshop.
 - 1 Low tension test
 - 2 High tension test
 - 3 Ground test.

Subject : Maintenance and Repairs of Automobiles

Unit. 6 : Ignition System

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
1. Creating interest and developing skill in working and repair of ignition systems.	Creation of high voltage current and its distribution for effective sparking.	Observations. Working skill.	Explanation Demonstration. Creating drawings. Experimentation.	Components. Bulbs. DC source.	Understanding. Drawings. Participation.	
2. To create knowledge about magneto ignition system.	Rotating a magnet in a coil of conductor generates electric current.	Observation. Experimentation.	Experimentation. Seminar.	Working magnet Spark bulbs.	Understanding. Seminar. Participation.	
3. To provide knowledge about mechanisms to change ignition timing.	Importance of ignition timing.	Communication. Inferring.	Discussion with teacher participation. Preparation of notes. Demonstration.	Textbook. Articles. Components.	Understanding. Participation. Notes. Drawings.	

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
4. Encouraging students to maintain knowledge about developments in field of ignition upto date.	Developments in ignition.	Communication. Investigation.	Collection of articles. Field visit.	Articles. Chart.	Participation. Understanding. Knowledge acquired.	
5. To develop expertise in service of ignition system.	Proper knowledge on ignition system components is necessary to service the system.	Infering.	Workshop practice.	Testing equipments. Working components. DC source.	Participation. Acquired knowledge. Working skill.	

7

ELECTRICAL SYSTEM

Introduction

The role of autoelectricians are gaining more importance rapidly with the development of new generation cars, which employ numerous electrical accessories. Through this chapter the student has to acquire detailed understanding about various electrical needs in automobiles. Also, they learn about construction and functioning of equipment involved in the generation and storage of electricity.

This chapter gives students indepth knowledge about various troubles that can affect the electrical equipment and about remedial functions of the same.

Syllabus

Electrical system

Introduction- Battery- various types, constructional details, working principles- specification of battery, Battery rating, Procedure of battery charging, Battery testing, Defects and repairs of batteries

Charging system

Introduction- working principles of Dynamo- construction and operation, charging circuit, regulators, working principle of alternators- construction and operation of alternator- rectifiers, comparison between Dynamo and Alternators.

Defects and repairs of Dynamo and Alternators.

Starting system

Introduction- Starting motors, starting circuit, different types of starting mechanisms, solenoid switches.

Defects and remedies of starting system.

Other electrical equipments

Various circuits of lighting system- various types of bulbs and reflectors- focussing and adjustments of head lamps- various switches- Horn and wind screen wiper- Accessories

Troubles in light circuits and various electrical equipments.

Curriculum Objectives

1. To make the student understand various electrical needs in an automobile.
2. To make them understand the necessity and method of power generation and of power storage.
3. To make them learn the process of construction, working and trouble shooting of various batteries.
4. To make students learn about charging system.
5. To provide students in the knowledge of construction and working of dynamo, alternator and regulator.
6. To make them identify faults associated with dynamo, alternator and to repair them.
7. To make them learn the process involved in engine starting.
8. To make students rectify any trouble in the starting system.
9. To generate interest in the functioning of various electrical equipment and to make students learn about their working.
10. To make students trouble shoot and repair various electrical equipment.
11. To generate interest in students to acquire upto date knowledge in this field.

Activities

- Generate a discussion in class room about various electrical needs in an automobile.
- Ask students to conduct a survey about different types batteries employed in various automobiles. Ask them to prepare a chart.
- Explain the working of battery in detail. Demonstrate cut section of a battery showing different components. Ask students to make drawing and prepare notes.
- Explain specification, working principles, battery rating etc, in classroom. Conduct a viva voce on the same.
- Conduct a field visit to learn battery charging and testing. Ask them to prepare a detailed report on it, including defects and repair.
- Give an assignment to students to prepare detailed notes on magnetism and dynamic based on their studies in lower classes.
- Explain charging circuit
- Explain working principle of dynamo
- Ask students to dismantle a dynamo and identify various components. Make them to create a drawing and prepare notes on the same.
- Generate a discussion about necessity of regulator.
- Demonstrate a regulator and explain how current and voltage can be varied and how the reverse flow of current is prevented using cut- out.
- Explain generation of alternating current by employing slip rings.
- Dismantle an alternator- demonstrate its components explain its working. Ask students to create circuits diagrams and notes on the same.

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- Briefly explain functions of rectifier.
 - Make students prepare a chart comparing dynamo and alternator.
 - Conduct necessary practicals to examine the condition of various components of dynamo and alternator. Ask students to suggest remedies.
 - Generate a discussion among students about how an automobile can be started. Give them an assignment to prepare notes of the same.
 - Explain starting circuit. Explain construction and working of starter motor.
 - Demonstrate a disassembled starter motor. Make the student to generate drawing and prepare notes on the same.
 - Demonstrate and discuss bendix and overrunning clutch
 - Demonstrate a nut and bolt to explain the inertia drive.
 - Explain construction and working of solenoid switch. Ask students to create drawing and prepare notes on the same.
 - Provide circuit diagram of the following.
 1. Headlight circuit
 2. Indicator circuit
 3. Horn circuit
 - Conduct a seminar on these circuits and ask students to prepare notes.
 - Engage students in a project work to create the above circuits using material available in school workshop.
 - Demonstrate different types of bulbs and reflectors. Ask students to prepare drawings and notes on them.
 - Practice students on focussing and adjusting of head lamps.
 - Demonstrate various types of horns. Disassemble a horn and ask students to assemble the same and make it work. Explain horn tuning.
 - Demonstrate a wind screen wiper and explain. Ask students to prepare drawings and notes on it.
 - Discuss various electrical accessories employed in various automobiles.
 - Assign students to prepare a detailed note on possible troubles that can occur in lighting circuit, horn, wiper, motor etc.
 - Arrange students in small groups and conduct a quiz on this chapter.
 - Conduct a survey on electrical equipment in modern cars.

Subject : Maintenance and Repairs of Automobiles

Unit. 6 : Electrical Systems

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
1. Understanding of various electrical needs in automobile.	Electrical needs keep on increasing with development of new generation cars.	Communication. Analysis.	Discussion. Assignment.	Articles.	Participation Acquired knowledge.	
2. Understanding the necessity and methods of power generation and power storage.	Electricity can be generated and stored in automobiles.	Communication. Analysis.	Survey Chart preparation. Demonstration. Making drawing. Field visit.	Cut section of Battery. Text books.	Viva voce. Participation. Acquired knowledge. Report of field visit.	
3. Troubles shooting of various batteries.	Battery needs proper and regular maintenance.	Observation Inference.	Discussion. Field visit	Textbook. Articles.	Acquired knowledge. Participation.	

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
4. Make students to learn charging system of automobiles.	Principles of electromagnetic Induction.	Observation. Work skill.	Assignment. Practical work. Drawing. Demonstration.	Dynamo. Alternator. Regulator. Rectifier. Circuit diagram.	Acquired knowledge. Prepared chart.	
5. To make students understand the working and repairs of dynamo and alternator.	These equipment rapidly wear and so need proper care.	Observation. Inference.	Practical work.	Dynamo, alternator, regulator.	Acquired knowledge. Working skill.	
6. To make them understand processes involved in engine starting.	All engines need to be cranked for starting.	Observation Communication.	Discussion. Assignment. Demonstration. Drawing. Notes.	Starting motor. DC source. Solenoid switch. Drive mechanism. Nut and bolt. Circuit diagram.	Acquired knowledge. Participation. Assignment.	

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
7. Make students able to rectify complaints of a starting system.	Repulsion of like fields generate powerful motion.	Observation. Communication.	Discussion. Assignment. Demonstration. Preparation of drawings. Notes.	Starting motors. Solenoid switch.	Acquired knowledge.	
8. Functioning of various electrical equipments in automobile.	Many equipments in automobile work on electricity generated in it.	Participation. Observation.	Seminar. Demonstration. Drawings. Notes. Practical works. Discussion. Assignment. Projects.	Circuit diagram. Bulbs. Horn. Wiper motor. Head lamps, tail lamps.	Knowledge. Assignment. Project work.	

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
9. Trouble shoot and repair various electrical equipments.	Electrical equipments are very vulnerable.	Analysis. Workskill.	Practical work. Discussion. Assignment.	Various electrical equipments.	Knowledge. Participation. Work skill.	
10. To generate interests to acquire upto date knowledge in this field.	Electrical demands keep on increasing with new trends.	Communication. Inference.	Quiz Survey	Article. Multimedia.	Acquired knowledge.	



MAINTENANCE

Introduction

Proper maintenance of an automobile reduces the chances of breakdowns and brings down the expenses which may incur in repairs and replacements. Every automobile manufacturer prescribes regular and periodic maintenance schedule in his service hand book. This chapter is developed to create in students the knowledge and skills necessary to perform maintenance activities in various automobiles.

Syllabus

Maintenance

Maintenance of frame, maintenance of Engine, Maintenance of fuel feed systems, Inspection of various filters, fuel lines and carburettor, Maintenance of diesel fuel system- inspection of various filters, fuel lines and injectors.

Maintenance of cooling system, testing of fan belt, testing radiator cap, cleaning of cooling system, checking radiator leak.

Maintenance of lubricating system: Checking oil level, changing oil, changing filter, servicing oil pump.

Maintenance of Ignition system:- Inspect distributor, spark plugs, high tension leads.

Maintenance of Battery:- Visual checkup, check electrolyte, cleaning battery cell- checking the charge of battery.

Maintenance of charging system:- Care and maintenance of dynamo and alternator

Maintenance of starting and other electrical equipments:- care and maintenance of starting and electrical equipment.

Curriculum Objectives

1. To make them able to conduct maintenance of a vehicle independently.

Activities

- Generate a discussion in class room about proper maintenance of various systems in an automobile.

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- Arrange students in groups and ask them to collect data regarding various periodic and routine maintenance activities performed on different vehicles.
 - Compile all the data collected and make them prepare a detailed chart.
 - Conduct a field visit to learn about all aspects of maintenance. Make them prepare a detailed report.
 - Train Students on the maintenance of available vehicle in the school based on the report they have prepared from earlier field visit.

Subject : Maintenance and Repairs of Automobiles

Unit. 8 : Maintenance

Curriculum Objectives	Concepts/ Ideas	Process Skills	Activities	Materials Required	Evaluation	Time
1. To develop expertise in students to conduct vehicle maintenance independently.	Proper maintenance reduces repairs and replacements	Observation Communication. Work skill.	Discussion. Data collection. Chart preparation. Field visit. Practical works.	Articles. Vehicle. Service tools. Service Equipments. Vehicle consumables.	Participation Knowledge. Field visit. Work skill.	

Annexure- 1

Practical Activities

The following practical training must be provided in school workshops.

Unit. 1

Fundamentals of Engineering Drawing.

Demonstration of measuring instruments, tools and servicing equipments.

Unit. 2

- Safety precautions in workshop.
- Marking and filing practice.
- Thread cutting with taps and dies.
- Cutting with hacksaw.
- Soldering practice.
- Hand and Spray painting practice.
- Rivetting practice.
- Drilling with hand and power tool.

Unit. 3

- Overhauling of fuel pump, carburettor and air cleaner.

Unit. 4

- Disassembly and servicing of fuel injection pump.
- Servicing of feed pump, injectors and nozzles.

Unit. 5

- Adjustment of belt tension.
- Disassembly of water pump, service of radiator.
- Disassembly and study of oil pump.

Unit. 6

- Dismantling, disassembly, testing, repairing and remounting of following.
 - a. Ignition coil
 - b. Distributor.
 - c. Spark plug and leads.

Unit. 7

- Dismantling, disassembly and inspection of battery, dynamo, alternator, regulator and starting motor.

Unit. 8

- Maintenance of various systems.

Unit. 9

- Overhauling of engines- diesel and petrol
- Setting of valve timing.
- Removal of broken studs.
- Removal of worn bushes.
- Removing and fitting of bushes.

Unit. 10

- Head lamp focussing.
- Checking and correction of various other lamps.

SAMPLE QUESTIONS

Unit. 1

1. You wish to buy a car. Name your choice of buy and give reason for the selection?
2. When you rub your hands together, they get hot. Why?
3. Why are ventilators placed in upper sides of walls?
4. Suction stroke is from B.D.C to T. D. C. Is it true or false? Explain.
5. A conventional engine has stroke- 6cm, Bore- 5 cm Total cylinder volume: 130 cc, Volumetric efficiency- 100%. Can you identify the fuel for this engine and explain reason?
6. What are your concepts of an engine which is 100% efficient in all aspects? Explain.
7. I believe that in an engine, the piston is moved by the crankshaft. What is your opinion?
8. If you are offered to select between a 150 cc 2 stroke motor cycle and a 350 cc 4 stroke motor cycle, which one will you choose? Give all reasons.
9. Some vehicles have 2 wheels on rearside, some have 4 wheels and some others have 8 wheels. What is the reason of these difference's.
10. Can we replace petrol with diesel in engines or vice-versa? Explain.

Unit. 2

1. You have shifted camshaft from crankcase to cylinder head.
 - a. What are the items you added to engine?
 - b. What are the components which becomes surplus?
2. What is not true about a cylinder liner?
 - a. It contacts cooling water.
 - b. It does not contact cooling water.
 - c. It is immersed in cooling water.
3. Which of these statements is false?
 - a. Piston rotates in the cylinder.
 - b. Connecting rod rotate in the cylinder.
 - c. Crank shaft reciprocate in the crank case.
 - d. All of the above.

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4. You have a bar of steel and machinery to perform forging. If the crankshaft for a 4 cylinder engine is to be made, make a sketch of your forging. What are the machinery operation to be done after forging.
 5. Illustrate the advantages and disadvantages of using Aluminium alloy as material for piston.
 6. You have an inlet valve and exhaust valve of the same engine. Can you distinguish them. How?
 7. You are asked to make a piston. You have following materials. Brass, Cast Iron, Aluminium alloy. Which one will be your choice? Justify your selection.
 8. Engine crankshaft rotate in clockwise direction when the car is moving forward. It rotates in anticlockwise direction when the car is moving backward. Is it true? Give your clarification.
 9. At the time of assembly, I accidentally interchanged the crankshaft timing gear and crankshaft timing gear. What will be the result?
 10. Is it true that crank shaft will be rotating in one direction for the forward motion of vehicle and in the opposite direction for reverse motion?

Unit. 3

1. You have many barrels of fuel. One of them is petrol. Discuss various parameters that make it different.
2. Why is the term 'Turbulence' relevant in combustion? How is it achieved? Create illustrations?
3. Fuel pumps are installed prior to fuel filters. Why?
4. You are asked to conduct a thorough check up on fuel system of a car. How will you do it.
5. Your friend replaced Air filter of his car with a new one. He complains the vehicle has developed starting troubles. What are your assumptions?
6. Petrol of high — — — — — number is more desirable in automobiles.
7. Unlike conventional transmission shafts crankshaft has a different shape. Why?
8. While assembling an engine the mechanic accidentally forget to place cylinder head gasket. What will happen when the engine starts running?
9. The piston crown of a 2 stroke engine is shaped differently from the piston of a 4 stroke engine. Why?
10. When we operate a single cylinder engine and 2 cylinder engine, which engine vibrate more. Why?
11. What will happen if the valve clearance exceeds the limit?
12. While overhauling a 4 stroke engine the mechanic accidentally placed the flywheel of a 2 stroke engine. What will happen?

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13. What will happen if the thermostat of a cooling system fails to operate? Explain.
 14. Cooling is necessary for the working of an engine. What is the effect of over cooling in an engine?
 15. There is no oil gallery or oil circulation system in 2 stroke engines. Then how does the lubrication system in 2 stroke engine works.
 16. What are the effects of the failure in lubrication system?

Unit. 4

1. The term CRDI stands for — — — — .
2. Why don't we use glow plugs in engines with out auxiliary combustion chamber? Can you identify piston of a diesel engines from the pictures shown below.
3. Speed of the diesel car increases when driver depresses accelerator pedal. Give reasons. (The car has an inline diesel pump)

Unit. 5

1. Objective of cooling system is primarily not for cooling, but to maintain engine at proper — — — — , — — — —
2. There is a small valve in cooling system of engine, which plays the most important role of maintaining proper working temperature. Can you give its name.
3. A cap open one way when there is pressure and it opens the other way, when there is suction. It is in cooling system. What is it and why is it designed thus?
4. Sketch a Thermostat valve to show its working?

Unit. 6

1. It absorbs lot of primary current. But conventionally it does not act as a storage for electricity. If it is in Ignition system, what is its function?
2. Centrifugal force makes an object to fly out wards. Where and how do we use this force in an Ignition distributor?
3. Without a condenser, the — — — — may get welded together.
4. You know that spark must be provided in cylinders of a multicylinder petrol engines at correct time and at correct intervals. Can you describe the functioning of a conventional mechanism which perform this task?
5. Generation of spark in cylinder of a multicylinder petrol engine does not have a fixed timing. It varies whenever the accelerator pedal is moved. Why is it so? How is it achieved? Simple sketches may be used to explain.

Unit. 7

1. Why do we call individual lids of cells in a battery as vent plugs?
2. Irrespective of the number of plates in it, a — — — — of battery carries — — — — volts.
3. What are the materials you need, to prepare an automobile battery? Make a sketch illustrating the assembly.

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4. The capacity of a battery is rated in terms of — — — — —, — — — — —
 5. If it is not dynamo, then the generator of current in car must be — — — — —
 6. Dynamo has — — — — — rings, while an alternator — — — — — has rings.
 7. Why is it not possible for an alternator to generate direct current?
 8. One day I collected my recharged battery from the shop. At the time of fixing it I had a confusion that which terminal to be earthed? Give your clarification. 1
 9. Battery charge remains low continuously. What precautions are to be taken before recharging the battery? 2
 10. After an accident the battery of a bike was separated. But the engine was still working. What is the reason? 2
 11. I noticed that the circuit from alternator of my car is separated but I continued the journey. What will happen? 6

Unit. 8

1. A thick dark smoke is coming from the exhaust pipe of old vehicles running on the roads. What can be the reason? Give your opinion.
2. I brought a new motorbike. I got a mileage of 50km/litre during the initial servicing time. After second service, (after 2000km) I got a mileage of 60km/litre. But now I had completed more than 80,000 km. But now I am getting a mileage of 45km/litre only. What will be the reasons of above difference in mileage? Give your opinion?
3. Mileage will be very low at slow speed and at high speed. If you agree with the above statement give reasons?
4. There are different types of vehicles which are running in our cities/village. Can you classify them.
5. Raman owns a 2 stroke motorbike and Krishnan owns a four stroke motorbike. They run 100km/day. By analysing the performance of each vehicle, who gets more profits in short run and who gets more profit in long run?

OR

6. Your friend intends to buy an autorickshaw from the market. There are different types of autorickshaws available viz, 2 stroke petrol, 4 stroke petrol and 4 stroke diesel. He is in a confusion and contacts you. Can you explain him the advantages and disadvantages of each model and your most preferred vehicle.
7. A vehicle designer, after designing the functional areas of a car, gets a few spaces to fit an engine. Can you suggest an engine vehicle delivers maximum power by occupying the limited space.
8. Consider you have two old engines - one diesel and one petrol of the same capacity. If the scrap value per kg. of each engine is same, which engine will fetch more money?



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