

**CURRICULUM**  
**TSLC**  
**Automobile Engineering**  
(Pre-SLC Intake)



Council for Technical Education and Vocational Training  
**Curriculum Development Division**

**Sanothimi, Bhaktapur**

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## Table of Contents

<b>Introduction</b> .....	<b>4</b>
<b>Aims</b> .....	<b>4</b>
<b>Objectives</b> .....	<b>4</b>
<b>Course Duration</b> .....	<b>5</b>
<b>Target group</b> .....	<b>5</b>
<b>Target location</b> .....	<b>5</b>
<b>Medium of Instruction</b> .....	<b>5</b>
<b>Pattern of Attendance</b> .....	<b>5</b>
<b>Group size</b> .....	<b>5</b>
<b>Entry Criteria</b> .....	<b>5</b>
<b>Focus of the Program</b> .....	<b>5</b>
<b>Teacher and Student Ratio</b> .....	<b>6</b>
<b>Instructors' Qualification</b> .....	<b>6</b>
<b>Instructional Media and Materials</b> .....	<b>6</b>
<b>Teaching Learning Methodologies</b> .....	<b>6</b>
<b>Evaluation Details</b> .....	<b>6</b>
<b>Grading System</b> .....	<b>7</b>
<b>Certificate awarded</b> .....	<b>7</b>
<b>Career Path</b> .....	<b>7</b>
<b>Course Structure</b> .....	<b>8</b>
<b>First Year</b> .....	<b>9</b>
<b>Applied English</b> .....	<b>11</b>
<b>प्रयोगात्मक नेपाली</b> .....	<b>13</b>
<b>Applied Mathematics - I</b> .....	<b>15</b>
<b>Applied Science</b> .....	<b>18</b>
<b>Automotive Technology - I</b> .....	<b>22</b>
<b>Engineering Drawing - I</b> .....	<b>37</b>
<b>Computer Application</b> .....	<b>44</b>
<b>Workshop Technology</b> .....	<b>50</b>
<b>A. Bench Work</b> .....	<b>52</b>
<b>B. Sheet Metal</b> .....	<b>57</b>
<b>C. Welding</b> .....	<b>59</b>
<b>Second Year</b> .....	<b>60</b>
<b>Applied Mathematics - II</b> .....	<b>62</b>
<b>Engineering Drawing – II</b> .....	<b>64</b>
<b>Computer Aided Drafting</b> .....	<b>70</b>
<b>Automotive Technology - II</b> .....	<b>77</b>
<b>A. Automotive Engine</b> .....	<b>85</b>
<b>B. Auto Electrical &amp; Electronics System</b> .....	<b>97</b>

<b>Motor Vehicle Driving</b> .....	<b>102</b>
<b>Entrepreneurship Development</b> .....	<b>103</b>
<b>Office Equipment:</b> .....	<b>108</b>
<b>Classroom Equipment:</b> .....	<b>108</b>
<b>Education Material and Tools:</b> .....	<b>108</b>

## **Introduction**

This “Curriculum for TSLC in Automobile Engineering” is designed to produce competent workforce equipped with skills, knowledge and attitudes in the field of automobile engineering. Graduates of this program will be capable to perform basic mechanical works, apply auto mechanical equipment and repair and maintenance of automobile vehicles and related plants. This also provides ample of opportunity for employment in the related sector, mainly self employed as well as the employment in national and international job market. There are altogether fourteen subjects in two academic years, which covers all related areas of the automobile engineering. Though some basic and essential theoretical inputs have been included, yet the focus is given on enhancement of the required skills, enabling techniques and competency building.

This course is based on practical exposure in different areas as required. In every subject, topical explanations will be followed by demonstrations by instructors and in all tasks, students will be asked to practice by themselves through do-it-yourself/hands-on practices so that they can internalize what they learn in the classroom.

## **Aims**

The program aims is preparing competent basic level workforce in the field of automobile engineering.

## **Objectives**

After the completion of this curricular program, the graduates will be able to:

- Perform basic Mechanical Engineering works
- Prepare simple auto mechanical drawing.
- Familiarize with basic computer aided design/drawing.
- Repair and maintain automobile vehicles.
- Repair and maintain mechanical equipment.
- Assemble /disassemble various automobile systems.
- Familiarize with auto electrical and electronics system.
- Troubleshoot the automobile system.

**Course Duration**

This course is completed within 29 months (24 months on institution + 5 months on the job training (OJT). The duration is 52 weeks/1560 hours for each year on institution and 20 weeks/ 800 hours on-the-job assignment for issuing successful completion of the course.

**Target group**

The target group for this pre SLC intake curricular program is all the interested individuals of the country who have SLC exam appeared. Preference is given to the individuals of rural poor, female, Dalit, Janjati, Disadvantaged Groups (DAGs), conflict affected people and the differently able.

**Target location**

The target location of this program will be all over Nepal.

**Medium of Instruction**

The medium of instruction for this training program will be Nepali or English or both.

**Pattern of Attendance**

The students should have 80% attendance in theory classes and 90% in practical/ performance classes to be eligible for internal assessments and final examinations.

**Group size**

The group size of this program is not more than 24 in a batch.

**Entry Criteria**

Individuals who meet the following criteria are allowed to enter into this program:

- SLC pass
- Students should pass entrance examination administered by CTEVT

**Focus of the Program**

This is a competency based curricular program. This program emphasizes on competent performance of the task specified in it. In this programme, 80% time is allotted to the competencies and remaining is allotted to the related technical knowledge. Therefore, this curriculum is designed focussing on the performance of the specified competencies/tasks /skills included in this program.

### **Teacher and Student Ratio**

- 1:8 for practical classes
- Depends on the nature of subject matter and class room situation for theory classes.
- Minimum of 75% of the teachers must be fulltime.

### **Instructors' Qualification**

- Minimum Diploma in Automobile Engineering or equivalent.
- Good communicative & instructional skills.
- Experience in the related field.

### **Instructional Media and Materials**

The following instructional media and materials are suggested for the effective instruction and demonstration.

- Printed Media Materials (Assignment sheets, Case studies, Handouts, Information sheets, Individual training packets, Procedure sheets, Performance Check lists, Textbooks etc.).
- Non-projected Media Materials (Display, Models, Photographs, Flip chart, Poster, Writing board etc.).
- Projected Media Materials (Opaque projections, Overhead transparencies, Slides etc.).
- Audio-Visual Materials (Audiotapes, Films, Slide-tape programs, Videodiscs, Videotapes etc.).
- Computer-Based Instructional Materials (Computer-based training, Interactive video etc.).

### **Teaching Learning Methodologies**

The methods of teachings for this curricular program will be a combination of several approaches such as illustrated lecture, group discussion, demonstration, simulation, guided practice, practical experiences, fieldwork, report writing, tutoring, role-playing, heuristic and other independent learning.

- Theory: lecture, discussion, assignment, group work.
- Practical: demonstration, observation, guided practice and Self-practice.
- On the Job Training (OJT)

### **Evaluation Details**

<b>S.N.</b>	<b>Particulars</b>	<b>Internal Assessment</b>	<b>Final Exam</b>	<b>Pass %</b>
1.	Theory	50%	50%	40%
2.	Practical	50%	50%	60%

- There should be three internal assessments within course duration.
- Every student must pass in each internal assessment to appear the final exam.
- Continuous evaluation of the students' performance is to be done by the related instructor/ trainer to ensure the proficiency over each competency under each area of a subject specified in the curriculum.
- Related technical knowledge learnt by students will be evaluated through written tests.
- There will be three internal assessments and one final examination in each subject. Moreover, the mode of assessment and examination includes both theory and practical or as per the nature of instruction as mentioned in the course structure.
- Students should pass internal assessments both in theory and practical tests in all subjects.
- The ratio between the theory and practical tests will be 20:80 in case of a practical nature subject.
- The on-the-job training has to be evaluated keeping 300 as full marks. The evaluation of the performance of the student is to be carried out by the three agencies; the concerned institute, industry/organization where the student worked and the CTEVT office of the controller of examinations. Here, also the student has to score 60% or above for successful completion of the course.

### **Grading System**

The grading system will be as follows:

<b><u>Grading</u></b>	<b><u>Overall Marks</u></b>
Distinction	80% or above
First division	75% to below 80%
Second division	65% to below 75%
Third division	Pass aggregate to below 65%

### **Certificate awarded**

The council for technical education and vocational training will award certificate in “**Technical School Leaving Certificate in Automobile Engineering**” to those students who successfully complete all the requirements as prescribed by the curriculum.

### **Career Path**

The graduates will be eligible to work in the position of automobile technician in the government related organizations, private company/service centre or as prescribed by the public service commission or the concerned authorities of the republic of Nepal.

## Course Structure

Course structure of TSLC in Automobile Engineering (Pre SLC intake)

### First year

S. N.	Course Title	Nature	Class / Week		Total Class/Year			Full Marks		
			T	P	T	P	Total	T	P	Total
1	Applied English	T	2		78		78	50		50
2	Applied Nepali	T	2		78		78	50		50
3	Applied Mathematics-I	T	2		78		78	50		50
4	Applied Science	T	2		78		78	50		50
5	Engineering Drawing-I	P		3		117	117		75	75
6	Computer Application	P		2		78	78		50	50
7	Workshop Technology	T+P	1	6	39	234	273	25	150	175
	Bench work			4		156				
	Welding			1		39				
	Sheet metal Work			1		39				
8	Automotive Technology-I	T+P	3	17	117	663	780	75	425	500
	Control System			8		312				
	Power Trains			9		351				
	<b>Total</b>		<b>12</b>	<b>28</b>	<b>468</b>	<b>1092</b>	<b>1560</b>	<b>300</b>	<b>700</b>	<b>1000</b>

### Second Year

S. N.	Course Title	Nature	Class / Week		Total Class/Yr			Full Marks		
			T	P	T	P	Total	T	P	Total
1	Applied Math-II	T	2	0	78	0	78	50	0	50
2	Engineering Drawing-II	P		3	0	117	117	0	75	75
3	Computer Aided Drafting	P		2	0	78	78	0	50	50
4	Automotive Technology-II	T+P	4	25	156	975	1131	100	625	725
	Automotive Engine			15	0	585	585	0	0	
	Auto Electrical & Electronics System			10	0	468	468	0	0	
5	Entrepreneurship Development	T+P	1	1	30	48	78	20	30	50
6	Light Vehicle Driving			2	0	78	78	0	50	50
	<b>Total</b>		<b>7</b>	<b>33</b>	<b>264</b>	<b>1296</b>	<b>1560</b>	<b>170</b>	<b>830</b>	<b>1000</b>

Subject Title	Nature of instruction	Duration (Hrs)	Full marks
<b>On the job training (OJT)</b>	<b>Practical</b>	<b>800 (20 weeks)</b>	<b>500</b>

T: Theory, P: Practical

#### Practical areas:

- a) Class and workshop      1560 hrs. in the first year and 1560 in the second year
- b) OJT                              800 hrs. (20 weeks)



# **TSLC in Automobile Engineering**

**First Year**

## **First Year**

<b>Subject</b>	<b>Credit Hrs.</b>
1. Applied English	2
2. Applied Nepali	2
3. Applied Mathematics - I	2
4. Applied Science	2
5. Engineering Drawing - I	3
6. Computer Application	2
7. Workshop Technology	7
8. Automotive Technology- I	20

# Applied English

**Total 78 hrs**  
**Class/week: 2 hrs**

## Course description

This course is designed for the development of English language skills in reading, writing and speaking for the technical school students of Nepal, especially for the technical training center/institutes.

Unit/sub unit	Areas and Topics	Time (hrs.)
<b>1</b>	<b>Introduction</b>	<b>2</b>
1.1	Noun, Verb, Adjective, and Adverb words.	
<b>2</b>	<b>Auxiliary and main verbs – uses</b>	<b>2</b>
2.1	Word identification and practical use	
<b>3</b>	<b>Subject verb agreement</b>	<b>3</b>
3.1	S + V + O	
<b>4</b>	<b>Drill auto-mechanical words</b>	<b>2</b>
4.1	Glossaries of auto-mechanical terms	
<b>5</b>	<b>Tense and sentence structure</b>	<b>8</b>
5.1	Simple, Present and Continuous	
5.2	When + Simple Past + Past Continuous	
5.3	When + Simple Past + Past perfect + Present Perfect + Present Continuous.	
<b>6</b>	<b>Causative Verb</b>	<b>2</b>
<b>7</b>	<b>Punctuation</b>	<b>2</b>
7.1	Rules and Examples	
<b>8</b>	<b>Affirmative / Negative Sentences</b>	<b>2</b>
8.1	Concept + Practical Exercises	
<b>9</b>	<b>'Yes / No' question</b>	<b>2</b>
9.1	Concept + Practical Exercises	
<b>10</b>	<b>'WH' question</b>	<b>3</b>
10.1	Concept + Practical Exercises	
<b>11</b>	<b>'Tag' question</b>	<b>3</b>
11.1	Concept + Practical Exercises	
<b>12</b>	<b>Letter writing</b>	<b>4</b>
12.1	Parts of a letter	
12.2	Types of letter	
12.2.1	Social letter	
12.2.2	Application	
12.2.3	Complaint letter	
12.2.4	Business letter	
<b>13</b>	<b>Memorandum writing</b>	<b>3</b>
13.1	Definition important points	
13.2	Skill in writing a memo	
<b>14</b>	<b>Report writing</b>	<b>3</b>
14.1	Definition and methods of writing a report	
<b>15</b>	<b>Read, understand and use the technical terms used in automobile</b>	<b>2</b>

<b>16</b>	<b>Practical job reports</b>	<b>3</b>
16.1	job order	
16.2	Estimating	
16.3	progress of vehicle repair	
16.4	auto electrical wiring	
<b>17</b>	<b>Read short technical publications and workshop manual</b>	<b>2</b>
<b>18</b>	<b>Read &amp; Follow English language instruction</b>	<b>3</b>
18.1	Techniques of writing instruction	
<b>19</b>	<b>Going to Future</b>	<b>2</b>
19.1	Concept and Uses	
<b>20</b>	<b>Prepare a Speech</b>	<b>2</b>
20.1	5 minute speech on Automobile Pollution, Traffic Control and Modern Technology in Automobile etc.)	
<b>21</b>	<b>Voice – Active &amp; Passive</b>	<b>4</b>
21.1	Introduction	
21.2	Rules of changing active into passive voice	
<b>22</b>	<b>Reported speech</b>	<b>3</b>
22.1	Introduction	
22.2	Rules of changing direct into indirect speech	
22.3	Statement	
22.4	Imperative	
22.5	Interrogative	
<b>23</b>	<b>Rearrangement of words</b>	<b>2</b>
23.1	Techniques	
23.2	Illustration and Practical exercises	
<b>24</b>	<b>Conditional sentences</b>	<b>2</b>
24.1	Types	
24.2	Structure	
24.3	Examples	
24.4	Practice Exercises	
<b>25</b>	<b>Relative clauses</b>	<b>2</b>
25.1	Defining relative clause, sentences examples.	
<b>26</b>	<b>Joining sentences</b>	<b>2</b>
26.1	Joining sentences with why, what, which, whom, and How.	
<b>27</b>	<b>Articles</b>	<b>2</b>
27.1	Types	
27.2	Rules of using it	
27.3	Practice exercises	
<b>28</b>	<b>Preposition – place and time</b>	<b>2</b>
28.1	Definition	
28.2	Places and time preposition	
<b>29</b>	<b>Situational understanding</b>	<b>2</b>
29.1	Definition	
29.2	Types	
<b>30</b>	<b>Comprehension Practice</b>	<b>2</b>
	<b>Total</b>	<b>78</b>

## प्रयोगात्मक नेपाली

जम्मा : ७८ घण्टा  
कक्षा : २ घण्टा/हप्ता

### कोर्ष वर्णन :

प्राविधिक शिक्षालयहरूमा दुइ वर्षे प्राविधिक एस.एल.सी. मा तालीम लिने प्रशिक्षार्थीहरूका लागि नेपालीका व्यावहारिक पक्षमा आवश्यक पर्ने भाषिक सीपको विकासका लागि देहाय बमोजिमको व्यावहारिक नेपाली अध्यापनका लागि तयार गरिएको छ । यसमा व्यावहारिक नेपाली व्याकरण र सामान्य रचना तथा सब-ओभरसियरको कामको सिलसिलामा आवश्यक पर्ने व्यावहारिक कार्यसंग सम्बन्धित विषयहरू समावेश गरिएका छन् ।

विषय	पाठघण्टा
<b>१ व्याकरण</b>	
• पदविचार सम्बन्धी ज्ञान (नाम, सर्वनाम, क्रिया, विशेषण र अव्यय)	४
• शब्द निर्माण प्रक्रिया (उपसर्ग, प्रत्यय र समास)	३
• वाक्य निर्माण सम्बन्धी ज्ञान	२
• वाक्यका किसिम (सामान्य, मिश्र र संयुक्त)	३
• वाक्य परिवर्तन सम्बन्धी ज्ञान (आज्ञार्थक, इच्छार्थक, प्रश्नार्थक, सम्भावनार्थक आदि )	३
• वाक्य परिवर्तन सम्बन्धी ज्ञान र प्रयोग	४
• अटोमोवाइल सम्बन्धी पारिभाषिक शब्दको ज्ञान र तिनको प्रयोग	४
• विपरीतार्थक, पर्यायवाची, श्रुतिसम भिन्नार्थक शब्दको ज्ञान र प्रयोग	४
• अटोमोवाइल क्षेत्रसंग सम्बन्धित र प्रचलित शब्द र तिनको प्रयोग	८
<b>२ भाषा र अभिव्यक्ति</b>	
• अनुच्छेद लेखन प्रक्रियाको ज्ञान र प्रयोग ।	५
• निबन्ध लेखन प्रक्रियाको ज्ञान र प्रयोग ।	५
• पत्र लेखन (घरायसी पत्र, कार्यालयीय पत्र, व्यापारिक पत्र, व्यावसायिक पत्र, संस्मरण (Memo) पत्रको ज्ञान र प्रयोग ।	५
• अटोमोवाइलसंग सम्बन्धित विभिन्न प्रकारका जनचेतना शिक्षा (यसमा सवारी दुर्घटना, प्रदुषण तथा ट्राफिक संकेत चिन्ह र समस्या आदि विभिन्न किसिमका विषयमा १ पेजको लेख लेखाई त्यसबारे आफ्नो कक्षामा बोल्न लगाउने जस्ता सीप दिने र त्यसमा अभ्यास गराउने) ।	४
• अटोमोवाइल क्षेत्रमा हुने सवारी दुर्घटना, वातावरण प्रदुषण र ट्राफिक संकेत चिन्ह आदिका विषयमा जनचेतना शिक्षाका सामाग्रीहरू तयार गर्न लगाउने आदि ।	१

- बूँदा र सारांश लेखनको ज्ञान र प्रयोग २
- प्रश्नको आधारमा उत्तर लेखन प्रक्रियाको ज्ञान र अभ्यास २
- ३ प्रतिवेदन लेखन
  - सामान्य प्रश्नावली तयारी सम्बन्धी ज्ञान र प्रयोग ३
  - कार्य प्रतिवेदन सम्बन्धी ज्ञान र प्रयोग ३
  - कार्यालय व्यवस्थापन सम्बन्धी ज्ञान (व्यावसायिक कार्यशालाको स्थापनाका लागि आवश्यक योजना तयारी गर्ने, यान्त्रिक सम्बन्धी कामका लागि कार्य योजनाको तयारी गर्ने, योजना गरिएको कार्यक्रमका लागि बजेटिङ्ग गर्ने) विषयको ज्ञान र प्रयोग ५
  - मासिक तथा वार्षिक प्रगति प्रतिवेदन सम्बन्धी ज्ञान र प्रयोग । २
- ४ उद्योगबाट उत्पादित सामग्रीको जानकारी/ज्ञान
  - उद्योगबाट उत्पादित वस्तुको प्रयोग अघि त्यसको गुणस्तर बनोट, प्रयोग विधि आदिको विषयमा जानकारी गर्न सामग्री प्रयोग पन्जिका (Catalogue) अध्ययन र प्रयोग गर्ने ज्ञान र अभ्यास । ४
  - टेण्डर तथा बोलपत्र सम्बन्धी ज्ञान २

जम्मा : ७८ घण्टा

# Applied Mathematics - I

**Total: 78 hrs**  
**Class/week: 2 hrs**

## **Description:**

This subject consists of basic mathematical calculation related to automobile engineering students to develop mathematical background helpful for the understanding and practicing auto mechanical engineering works.

<b>Areas and Topics</b>	<b>Time (hrs.)</b>
<b>1. SI units / conversion factors</b>	<b>4</b>
1.1. Basic Units	
1.2. Derived SI units and relationship	
1.3. Decimal, multiples and parts of units	
1.4. Example and Exercises	
<b>2. Other system of units (FPS system, CGS system, Metric system)</b>	<b>4</b>
2.1. Conversion and Comparative table of previous technical units and SI units	
2.2. Example and Exercises	
<b>3. Fractions</b>	<b>4</b>
3.1. Concept and Value of a fraction	
3.2. Multiplication	
3.3. Division	
3.4. Addition	
3.5. Subtraction	
3.6. Example and Exercises	
<b>4. Square root</b>	<b>2</b>
4.1. Square number	
4.2. Splitting up	
4.3. Procedure	
4.4. Example and Exercises	
<b>5. Percentage</b>	<b>2</b>
5.1. Conversion of the percentage into actual number	
5.2. Conversion of the real number into percentage	
5.3. Example and Exercises	
<b>6. Conversion of length measurement</b>	<b>2</b>
6.1. Metric System	
6.2. SI System	
6.3. Examples and Exercises	
<b>7. Circumferences</b>	<b>4</b>
7.1. Definition of circumference	
7.2. Circumference	
7.3. Sector	
7.4. Polygons	
7.5. Examples and Exercises	

<b>8. Pythagoras' Theorem</b>	<b>4</b>
8.1. Terms used in Pythagoras' Theorem	
8.2. Pythagoras formula	
8.3. Summary	
8.4. Examples and Exercises	
<b>9. Unitary method</b>	<b>4</b>
9.1. Concept of Unitary method	
9.2. Variance and types	
9.3. Chain rule	
9.4. Estimate time, money and number of worker for any job	
9.5. Examples and Exercise	
<b>10. Trigonometric functions</b>	<b>4</b>
10.1. Dependency	
10.2. Side ratio	
10.3. Relationships	
10.4. Examples and Exercises	
<b>11. Area of regular quadrilaterals</b>	<b>4</b>
11.1. Square	
11.2. Rhombus	
11.3. Rectangle	
11.4. Parallelogram	
11.5. Examples and Exercises	
<b>12. Area of other shapes</b>	<b>4</b>
12.1. Triangle	
12.2. Trapezium	
12.3. Circle	
12.4. Sector	
12.5. Circular ring	
12.6. Examples and Exercises	
<b>13. Sheet metal requirements and wastage</b>	<b>4</b>
13.1. Division	
13.2. Wastage	
13.3. Examples and Exercises	
<b>14. Volume of prismatic bodies</b>	<b>4</b>
14.1. Concept of cube, prism and cylinder	
14.2. Cube	
14.3. Prism	
14.4. Cylinder	
14.5. Examples and Exercises	
<b>15. Volume of truncated bodies</b>	<b>4</b>
15.1. Cone / Pyramid	
15.2. Truncated cone / Pyramid	
15.3. Summary	
15.4. Examples and Exercises	
<b>16. Taper and inclination</b>	<b>4</b>
16.1. Concept of taper and taper ratio	
16.2. Taper ratio	
16.3. Ratio of inclination	



16.4. Setting angles	
16.5. Taper length	
16.6. Examples and Exercises	
<b>17. Mass</b>	<b>4</b>
17.1. Concept of mass and Density	
17.2. Mass	
17.3. Density	
17.4. Examples and Exercises	
<b>18. Weight and force</b>	<b>4</b>
18.1. Concept of weight and force	
18.2. Weight	
18.3. Force	
18.4. Examples and Exercises	
<b>19. Thermal expansion</b>	<b>2</b>
19.1. Introduction of thermal expansion	
19.2. Coefficient of linear expansion	
19.3. Change in length	
19.4. Final length	
19.5. Examples and Exercises	
<b>20. Heating and fuel consumption</b>	<b>2</b>
20.1. Heat input or specific calorific capacity	
20.2. Fuel consumption or amount of heat require for work done	
20.3. Examples and Exercises	
<b>21. Pressure and gases</b>	<b>8</b>
21.1. Concept of pressure	
21.2. Air pressure	
21.3. Absolute pressure	
21.4. Gauge pressure	
21.5. Examples & Exercises	
	<b>Total</b>
	<b>78</b>

### Book and References

1. H.P. Dahal ,*United's Math in action grade-10* ,United Nepal publication
2. R Awasthi, B.H. Subedi, B. B. Subedi, *UNIQUE Mathematics book-9* ,Unique Educational Publishers Pvt. Ltd.
3. Technical Mathematics book for metal Trade, GTZ
4. **G. Hamm. G. Burk, Tables for the Automobile Trade**, Special edition for the Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ), Wiley Estern Limited, New Delhi, India

## Applied Science

Total Class: 78 hrs.

Weekly Class: 2 hrs.

### Course description:

This subject consists of basic and applied science related to mechanics, heat and thermodynamics, electrical and electronics necessary to develop background in physics that supports for the understanding and practicing auto mechanical engineering works.

Unit	Areas and Topics	Time (hrs.)
<b>1.</b>	<b>Work, power and energy</b>	<b>1.5</b>
1.1.	Definition of work, energy and power	
1.2.	Speed, velocity and acceleration	
<b>2.</b>	<b>Law of motion</b>	<b>2.5</b>
2.1.	First law of motion	
2.2.	Second law of motion & derive the relation of $F=ma$	
2.3.	Third law of motion	
<b>3.</b>	<b>Composition and resolution of forces.</b>	<b>4</b>
3.1.	Vector & scalar	
3.2.	Forces & it's effects	
3.3.	Characteristics of force	
3.4.	Resultant and composition force	
3.5.	Parallelogram law of force	
<b>4.</b>	<b>Heat &amp; temperature</b>	<b>4</b>
4.1.	Introduction of heat and temperature	
4.2.	Measurement of temperature	
4.3.	Conversion of different temperature scale	
4.4.	Conduction , convection and radiation	
4.5.	Thermal expansion of solids	
4.6.	Thermal properties of materials and their applications	
<b>5.</b>	<b>Hydraulics &amp; hydraulic machines</b>	<b>3</b>
5.1.	Introduction	
5.2.	Pascal laws	
5.3.	Properties of fluids	
5.4.	Overview of simple hydraulic machine	
<b>6.</b>	<b>Expansion of gas</b>	<b>5</b>
<b>6.1.</b>	Introduction	
6.2.	Gas law (Boyles law, Charles law, Pressure law, Combined gas law (ideal gas equation))	
<b>7.</b>	<b>Electricity</b>	<b>4</b>
7.1.	Introduction of current ,voltage, resistance, emf., cell, battery,	
7.2.	A.C. current, D.C. current, Voltmeter, Ammeter	
7.3.	Ohm's law	
7.4.	Internal resistance of a cell	
7.5.	Series and parallel circuit	

<b>8. Kirchoff's Law</b>	<b>1.5</b>
8.1. Introduction	
8.2. Kirchoff's law	
8.3. Kirchoff's second law	
<b>9. Magnetism</b>	<b>4</b>
9.1. Introduction	
9.2. Properties of magnet	
9.3. Magnetic field	
9.4. Magnetic effect of current	
9.5. Flemming's left and right hand rules	
9.6. Faraday's law	
9.7. A.C. and D.C. generator	
<b>10. Mechanical properties of materials</b>	<b>4.5</b>
10.1. Elastic body	
10.2. Plastic body	
10.3. Stress and strain	
10.4. Hooke's law	
10.5. Modulus of elasticity	
<b>11. Ferrous metals (composition, properties &amp; uses)</b>	<b>6</b>
11.1. Iron	
Pig iron	
Cast iron	
Wrought iron	
Properties and uses of iron	
11.2. Steel	
Mild Steel (its carbon, properties and uses)	
Medium Steel (its carbon, properties and uses)	
Hard Steel (its carbon, properties and uses)	
Stainless steel (its carbon, properties and uses)	
<b>12. Non-ferrous metal and alloys</b>	<b>4</b>
12.1. Properties of metal and non-metal	
12.2. Aluminum (properties and uses)	
12.3. Zinc (properties and uses)	
12.4. Copper (properties and uses)	
12.5. Alloys	
Benefits of making alloys	
Brass (its properties and uses)	
Bronze (its properties and uses)	
<b>13. Heat treatment</b>	<b>6</b>
13.1. Introduction	
13.2. Purposes of heat treatment	
13.3. Heat treatment of steel	
Hardening	
Annealing	
Normalizing	
Tempering	

<b>14. Corrosion</b>	<b>2</b>
14.1. Introduction	
14.2. Factors influencing corrosion (like: temperature, purity of metals, environments,	
14.3. Controls and preventions of corrosion	
<b>15. Atomic structure and atomic bonding</b>	<b>6</b>
15.1. Structure of Atom	
15.2. Electron, Proton and Neutron	
15.3. Atomic bonding	
15.4. Characteristics of ionic bond, covalent bond with examples	
<b>16. General Electronics:</b>	<b>10</b>
16.1. Resistors	
16.2. Identifying resistor with color code	
16.3. Capacitor	
Charging a capacitor	
Discharging a capacitor	
Specifying capacitor	
16.4. General introduction of transformer.	
Step up transformer	
Step down transformer	
16.5. Semiconductor	
P- type	
N- type	
16.6. Diode : Diode operation	
General introduction of different types of diode ( small signal, power rectification, zener, light-emitting diode, photo diode)	
16.7. Introduction of digital and analog electronics	
16.8. Transistor	
Operation of: NPN & PNP	
16.9. Thyristor ( general working principal)	
<b>17. Sensors:</b>	<b>6</b>
17.1. General operation and principle of basic sensors:	
17.2. Mass air flow sensors	
17.3. Manifold absolute pressure sensor	
17.4. Intake air temperature sensor	
17.5. Engine coolant temperature sensor	
17.6. Crankshaft position sensor	
17.7. Camshaft position sensor	
17.8. Oxygen sensor	
17.9. Knock sensor	
<b>18. Introduction to basic air conditioning &amp; refrigeration system</b>	<b>4</b>
18.1. General introduction of :	
compressor, heat exchanger, expander & refrigerator	
18.2. Working principle of auto air conditioning & refrigeration system	
<b>Total</b>	<b>78</b>

## References:

- A.K Gupta, R.C Gupta, Material Science, S.Chand and Co.Ltd, New Delhi
- Brij Lal & N. Subramanyam, 1989, Numerical examples in physics, S. Chand & Co. Ltd. Ram Nagar, New Delhi
- Choudhary Hajra , 2000,Material science and processes,
- Donall R. Askelad, “The Science and Engineering of Materials”, Chapman and Hall, Madras.
- Garg S.K., 2007, Manufacturing Technology, laxmi publication (p) LTD, India
- H.S. Bawa, Material and Metallurgy, TMG edition, New Delhi
- Keith Johsen 1991, Physics for you
- Khurmi R.S., 1977, Applied Mechanics and Strength of Material, S. Chand & company Ltd.
- Mims Forrest M., III, 1987, Getting started in electronics, Forrest M. Mims, USA
- Mitchell, Automotive fuel & emission System, Prentice Hall, New Jersey, USA
- N. Subramanyam & Brij Lal, 1987, Principles of physics, S. Chand &Co. Ltd Ram Nagar, New Delhi.
- Rathakrishan E., 2000, Fundamental Of engineering thermodynamics, Prentice Hall, India
- Sethi Kakkar, 1998, workshop calculation and science, Tata McGraw-Hill

# Automotive Technology - I

**Total Class: 156 hrs.**

**Weekly Class: 4 hrs.**

## **Course description:**

This subject deals with basic hand tools, measuring instrument, power tools, basic principle of automobile system and their importance, function, working principle, types, trouble shooting and safety precautions related to automobile control and suspension system and auto power trains in the automobile engineering.

## **A. Control system**

1. **Automobile** **2 hrs.**
  - 1.1. Definition
  - 1.2. History
  - 1.3. Types
  
2. **Chassis and frame** **1 hr.**
  - 2.1. Definition of chassis and its functions
  - 2.2. Types of chassis or frame
    - The ladder frame
    - The cruciform frame
    - The perimeter frame
    - The sub frame
  - 2.3. The integral body / frame construction
  - 2.4. Definition and function of frame
  - 2.5. Common defects in frame; methods of alignments of frame and methods for their repairing and straightening
  
3. **Axle** **8 hrs**
  - 3.1. Definition of live and dead axle
  - 3.2. Definition, purpose and function of axle and hub.
  - 3.3. Types of stub/front axle
    - 3.3.1. Elliot stub axle
    - 3.3.2. Reversed elliot stub axle
    - 3.3.3. Lemoine stub axle
    - 3.3.4. Inverted lemoine stub axle
  
4. **Suspension system**
  - 4.1. Definition of the suspension system
  - 4.2. Types of spring
    - 4.2.1. Leaf spring

- 4.2.2. Coil or helical spring
- 4.2.3. Torsion bar
- 4.2.4. Stabilizer bar
- 4.2.5. Rubber
- 4.2.6. Air spring
- 4.2.7. Hydraulic suspension
- 4.2.8. Plastic suspension
- 4.3. Definition of the shock absorber
- 4.4. Types of shock absorber
  - 4.4.1. Friction air or automatic level control
  - 4.4.2. Direct acting or telescopic type hydraulic
- 4.5. Constructional features of a shock absorber
- 4.6. Trouble shooting.
- 4.7. Difference between dependent and independent suspension system.
- 4.8. Types of suspension
  - 4.8.1. Front suspension
  - 4.8.2. Beam axle suspension
  - 4.8.3. Independent suspension
- 4.9. Types of independent suspension system
  - 4.9.1. Parallelogram type
  - 4.9.2. Strut and link type
- 4.10. Types of independent suspension based on construction
  - 4.10.1. Wishbone type
  - 4.10.2. Torsional spring type
  - 4.10.3. Coil spring on upper control arm
  - 4.10.4. McPherson strut system
- 4.11. Types of rear suspension
  - 4.11.1. Leaf spring type
  - 4.11.2. Coil spring type
  - 4.11.3. Torsion bar

## **5. Steering system.**

**18 hrs.**

- 5.1. Principle of ackerman steering
- 5.2. Main components/parts of the steering system.
- 5.3. Introduction of steering gear.
- 5.4. Types of steering gear.
  - 5.4.1. Worm and roller steering gear
  - 5.4.2. Re-circulating ball steering gear
  - 5.4.3. Rack and pinion steering gear
  - 5.4.4. Worm and sector steering gear
  - 5.4.5. Helical grooved cam steering gear
  - 5.4.6. Screw and nut steering gear
- 5.5. Necessity of lubricants in steering gear box.
- 5.6. Common troubles and remedies in steering gear box.
- 5.7. Introduction of front end geometry (steering geometry)
  - 5.7.1. Camber
  - 5.7.2. King pin inclination (steering axis)
  - 5.7.3. Included angle
  - 5.7.4. Caster

- 5.7.5. Toe-in
- 5.7.6. Toe-out on turns
- 5.7.7. Definition and purpose of wheel alignment.
- 5.8. Definition, purpose and importance of wheel balancing.
- 5.9. Working principle of power steering
- 5.10. Purpose and importance of power steering
- 5.11. Types of power steering
  - 5.11.1. Hydraulic
  - 5.11.2. Electric
- 5.12. Component and function of power steering system
- 5.13. Characteristics of hydraulic oil
- 5.14. Common troubles and their remedies on power steering.
- 5.15. Introduction of wheels and tyres.
- 5.16. Types of wheel
  - 5.16.1. Wire (spoke) wheel
  - 5.16.2. Disc wheel
  - 5.16.3. Alloy wheel
- 5.17. Types of rims.
  - 5.17.1. Drop centre rim
  - 5.17.2. Flat base rim
  - 5.17.3. Semi-drop centre rim
  - 5.17.4. Divided type rim
- 5.18. Purpose and construction of tyre.
- 5.19. Tread pattern of tyre.
- 5.20. Types of tyre
  - 5.20.1. Inner tube with tyre
  - 5.20.2. Tubeless tyre
- 5.21. Types of tyre according to the ply
  - 5.21.1. Bias or cross ply tyre
  - 5.21.2. Radial ply tyre
- 5.22. Specification of tyre or tyre size and marking
- 5.23. Importance of inflating tyres to the correct pressure.
- 5.24. Purpose and methods of tyre rotation.
- 5.25. Trouble shooting on wheel and tyre.

## **6. Braking System**

**27 hrs.**

- 6.1. Introduction of brake
- 6.2. Purpose of brake.
- 6.3. Principle of brake.
- 6.4. Types of brakes based on various aspects
  - 6.4.1. Based on purpose of application
    - Hand Brake or Parking brake
    - Foot brake or service brake
  - 6.4.2. Based on mechanism used for friction
    - Contracting type brake
    - Expanding type brake
  - 6.4.3. Based on place of its situation
    - Wheel brake



- Transmission brake
- 6.4.4. Based on its construction
  - Drum brake
  - Disc brake
  - Drum in disc
- 6.4.5. Based on mechanism or system used for power transfer
  - Mechanical brake system
  - Hydraulic brake system
  - Pneumatic Brake system
  - Air assisted hydraulic brake system
  - Electrical brake system
- 6.5. Purpose and method of brake adjustment
- 6.6. Function and construction of master cylinder
- 6.7. Types of master cylinder
  - 6.7.1. Single piston master cylinder
  - 6.7.2. Tandem master cylinder
  - 6.7.3. Stepped master cylinder
- 6.8. Purpose and function of wheel cylinder
- 6.9. Types of Wheel cylinder
  - 6.9.1. single acting
  - 6.9.2. double acting
- 6.10. Principle of hydraulic brake
- 6.11. Advantages and disadvantages of hydraulic brake
- 6.12. Properties of brake fluid
- 6.13. Purpose and procedure of brake bleeding
- 6.14. Types of Disc brakes
  - 6.16.1. Floating caliper disc brake
  - 6.16.2. Sliding caliper disc brake
  - 6.16.3. Fixed caliper disc brake
- 6.15. Comparison or difference between various types of brake
- 6.16. Various parts of air brake
  - 6.18.1. Air Compressor
  - 6.18.2. Drying and Distribution unit ( System protection valve, governor, unloader, purge tank)
  - 6.18.3. Quick Release valve
  - 6.18.4. Auto load sensing valve
  - 6.18.5. Relay
  - 6.18.6. Pressure switches and gauges
  - 6.18.7. Unloaded valve
  - 6.18.8. Reservoir (Air Tank)
  - 6.18.9. Brake chamber
  - 6.18.10. Slack Adjuster
- 6.17. Purpose and function of Mechanical brake or Parking brake
- 6.18. Importance and function of brake booster
- 6.19. Working principle of Anti-lock Brake System (ABS)
- 6.20. Components of ABS
  - 6.20.1. Wheel speed sensor
  - 6.20.2. Hydraulic unit

## **B. Power Trains**

### **1. Transmission**

#### **1.1. Transmission System** **2 hrs**

- Need of transmission system in a vehicle
- Different layout of the power transmission in a vehicle

### **2. Clutch** **11 hrs**

- 2.1. Necessity for a clutch in a vehicle
- 2.2. Types of clutch used in vehicle
- 2.3. Function of the clutch
- 2.4. Various types of clutch actuation system
- 2.5. Function of mechanically operated clutch
- 2.6. Function of hydraulically operated clutch
- 2.7. Trouble shooting of clutch

### **3. Gearbox** **12 hr**

- 3.1. Various resistance in vehicular motion
  - Necessity of a gear box in a vehicle
  - Different types of gear boxes
  - Various components and their functions in a sliding mess gearbox
  - Various components and their functions in a constant mess gearbox
  - Various components and their function of synchromesh gearbox
  - Advantages and disadvantages of different types of gear box
  - Different types of gear
  - Epicyclic gear mechanism
  - Introduction to automatic transmission
  - Trouble shooting of gearbox

### **4. Gear shifting mechanism** **4 hrs**

- 4.1. Various types of gear shift mechanism
- 4.2. Working principle of gear shift mechanism
- 4.3. Trouble shooting of gear shifting

### **5. Propeller shaft** **3 hrs**

- 5.1. Function of the propeller shaft
- 5.2. Various components used in the power transmission
- 5.3. Need for centre bearing.
- 5.4. Introduction of hotchkiss drive
- 5.5. Introduction of torque tube drive
- 5.6. Trouble shooting related to propeller shaft

### **6. Universal Joint and Slip Joint** **3 hrs**

- 6.1. Need for a universal joint
- 6.2. Function of a universal joint
- 6.3. Various types of universal joint
- 6.4. Constructional features of the different types of universal joints

- 6.5. Functions of the different types of universal joints
  - 6.6. Need for a slip joint
  - 6.7. Function of a slip joint
  - 6.8. Trouble shooting related to slip joint
- 7. Rear Axle Assembly** **6 hrs**
- 7.1. Various types of axle housings
  - 7.2. Various types of rear axles
  - 7.3. Merits and demerits of each types of the rear axle
  - 7.4. Trouble shooting related to rear axle
- 8. Final drive** **10 hrs**
- 8.1. Introduction to transaxle
  - 8.2. Need for a differential
  - 8.3. Constructional features of differential
  - 8.4. Function of the differential
  - 8.5. Differential adjustments
  - 8.6. Trouble shooting
- 9. Four wheel drive and Transfer case** **6hrs**
- 9.1. Difference between two wheel drive and four wheel drive
  - 9.2. Need of transfer case
  - 9.3. Trouble shooting on four wheel drive

**References:**

1. Boyce Dwiggins, Automobile Repair Guide, D.B. Taraporevala Sons & Co. Pvt. Ltd., Bombay, India
2. Dr. Kripal Singh, Automobile Engineering Volume I, Standard Publishers Distributors, Naisarak, Post box 1066, Delhi, 110006
3. G.B. S. Narang, Automobile Engineering, Khanna Publishers
4. H. Gerscher, Technology for Automotive Trade Volume 1 & 2, GTZ
5. H.M. Sethi, Automotive Technology, Tata McGraw-Hill Publishing Company Ltd., New Delhi
6. Harbans Singh Reyat, The Automobile, S. Chand and Company Ltd., New Dilhi
7. K. M. Moeed, Automobile Engineering, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
8. P. S. Gill, A Text book of Automobile Engineering Volume I, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
9. R.K. Mohanty, Automobile Engineering Volume I, Standard Book House, 1705A Naisarak, Delhi, 110006
10. R.K. Singal, Automobile Engineering, S. K. Kataria and sons, New Delhi, 110002
11. William H. Crouse and Anglin, Automotive Mechanics, Tata McGraw Hill Company, New Delhi

## Practical

### Module 1: Suspension and control system

Task	Related Technical Knowledge	Time (Hrs)		
		T	P	Total
1. Identify various units of vehicles.	<ul style="list-style-type: none"> <li>• Left hand drive / right hand drive steering</li> <li>• Front / rear engine</li> <li>• Introduce clutch / gearbox / transfer case / propeller shaft / differential / rear axle and wheels / Radiator / water pump / fuel tank / carburetor / silencer / battery / generator / alternator / regulator / cut-out / starter motor.</li> <li>• Chassis and frame used</li> </ul>	1	4	5
2. Identify the defects in frame and body.	<ul style="list-style-type: none"> <li>• Chassis and their functions.</li> <li>• Types of chassis or frame.               <ul style="list-style-type: none"> <li>➤ The ladder frame</li> <li>➤ The cruciform frame.</li> <li>➤ The perimeter frame.</li> <li>➤ The sub frame.</li> </ul> </li> <li>• The integral body / frame construction.</li> <li>• Function of frame.</li> <li>• Methods of alignments of frame and methods for their repairing and straightening.</li> </ul>	1	5	6
3. Overhaul front axle hub.	<ul style="list-style-type: none"> <li>• Live and dead axle</li> <li>• Purpose and function of axle as well as hub.</li> <li>• Front axle</li> <li>• Function of stub axle</li> <li>• Types of stub axle               <ul style="list-style-type: none"> <li>➤ Elliot stub axle</li> <li>➤ Reversed elliot stub axle</li> <li>➤ Lemoine stub axle</li> <li>➤ Inverted lemoine stub axle</li> </ul> </li> </ul>	1	7	8
4. Overhaul Front Suspension.	<ul style="list-style-type: none"> <li>• Suspension system</li> <li>• Differentiate between dependent and independent suspension system.</li> </ul>	2	12	14

	<ul style="list-style-type: none"> <li>• Types of suspension <ul style="list-style-type: none"> <li>➤ Front suspension</li> <li>➤ Beam axle suspension</li> <li>➤ Independent suspension</li> </ul> </li> <li>• Types of front independent suspension system. <ul style="list-style-type: none"> <li>➤ Parallelogram type</li> <li>➤ Strut and link type</li> </ul> </li> <li>• Types of front independent suspension based on construction. <ul style="list-style-type: none"> <li>➤ Wishbone type</li> <li>➤ Beam axle or leaf spring type</li> <li>➤ Coil spring on upper control arm</li> <li>➤ McPherson strut system</li> </ul> </li> <li>• King pin, ball joint</li> <li>• Rear axle and suspension <ul style="list-style-type: none"> <li>➤ Hotchkiss open drive</li> <li>➤ Torque tube drive</li> </ul> </li> <li>• Front wheel assembly.</li> </ul>			
5. Overhaul Leaf /coil /torsion springs.	<ul style="list-style-type: none"> <li>• Types of spring <ul style="list-style-type: none"> <li>➤ Leaf spring</li> <li>➤ Coil or helical spring</li> <li>➤ Torsion bar</li> <li>➤ Stabilizer bar</li> <li>➤ Rubber</li> <li>➤ Air spring</li> <li>➤ Hydraulic suspension</li> <li>➤ Plastic suspension</li> </ul> </li> <li>• Types of rear suspension <ul style="list-style-type: none"> <li>➤ Leaf spring type</li> <li>➤ Coil spring type</li> <li>➤ Torsion spring type</li> </ul> </li> </ul>	4	28	32
6. Replace shock absorber and bushes.	<ul style="list-style-type: none"> <li>• Shock absorber</li> <li>• Types of shock absorber. <ul style="list-style-type: none"> <li>➤ Friction air or automatic level control</li> <li>➤ Direct acting or telescopic type hydraulic</li> </ul> </li> <li>• Constructional features of a shock absorber.</li> <li>• Trouble shooting.</li> </ul>	1	4	5
7. Service / replace Steering Linkages.	<ul style="list-style-type: none"> <li>• Principle of ackerman.</li> <li>• Main parts of the steering system.</li> </ul>	2	12	14

	<ul style="list-style-type: none"> <li>• Wheel alignment.</li> </ul>			
8. Overhaul different types of steering gear boxes (worm & roller, recirculating ball, worm & nut, cam & peg, rack & pinion, worm & sector)	<ul style="list-style-type: none"> <li>• Steering gear.</li> <li>• Types of steering gear. <ul style="list-style-type: none"> <li>➤ Worm and roller steering gear</li> <li>➤ Re-circulating ball steering gear</li> <li>➤ Rack and pinion steering gear</li> <li>➤ Worm and sector steering gear</li> <li>➤ Helical grooved cam steering gear</li> <li>➤ Screw and nut steering gear</li> </ul> </li> <li>• Necessity of lubricants in steering gear box.</li> <li>• Common troubles and remedies in steering gear box.</li> </ul>	4	32	36
9. Check /Rectify Wheel alignment & steering geometry.	<ul style="list-style-type: none"> <li>• Front end geometry (steering geometry) such as <ul style="list-style-type: none"> <li>➤ Camber</li> <li>➤ King pin inclination (steering axis)</li> <li>➤ Included angle</li> <li>➤ Caster</li> <li>➤ Toe-in</li> <li>➤ Toe-out on turns</li> </ul> </li> <li>• Purpose and importance of wheel balancing.</li> </ul>	3	15	18
10. Overhaul / Service Power Steering Gearbox.	<ul style="list-style-type: none"> <li>• Working principle of power steering.</li> <li>• Purpose and importance of power steering.</li> <li>• Necessity of bleeding in power steering.</li> <li>• Characteristics of hydraulic oil.</li> </ul>	3	15	18
11. Overhaul / Service Power Steering Pump.	<ul style="list-style-type: none"> <li>• Function of power steering pump.</li> <li>• Common troubles and their remedies on power steering.</li> </ul>	2	15	18
12. Rectify Wheels, Tires and Steering Troubles.	<ul style="list-style-type: none"> <li>• Wheels and tyres.</li> <li>• Types of wheel <ul style="list-style-type: none"> <li>➤ Wire wheel</li> </ul> </li> </ul>	4	20	24

	<ul style="list-style-type: none"> <li>➤ Disc wheel</li> <li>• Types of rims. <ul style="list-style-type: none"> <li>➤ Drop centre rim</li> <li>➤ Flat base rim</li> <li>➤ Semi-drop centre rim</li> <li>➤ Divided type rim</li> </ul> </li> <li>• Purpose of tyres and general ideas on their construction.</li> <li>• Construction and tread pattern of tyre.</li> <li>• Types of tyre <ul style="list-style-type: none"> <li>➤ Inner tube with tyre</li> <li>➤ Tubeless tyre</li> </ul> </li> <li>• Types of tyre according to the ply <ul style="list-style-type: none"> <li>➤ Bias or cross ply tyre</li> <li>➤ Radial ply tyre</li> </ul> </li> <li>• Specification of tyre or tyre size and marking</li> <li>• Importance of inflating tyres to the correct pressure.</li> <li>• Rotation of tyre</li> <li>• Methods of tyre rotation.</li> <li>• Trouble shooting on wheel and tyres.</li> </ul>			
13. Locate Component of Brake System.	<ul style="list-style-type: none"> <li>• Brake.</li> <li>• Purpose of brake.</li> <li>• Principle of brake.</li> <li>• Types of brakes <ul style="list-style-type: none"> <li>➤ Based on purpose of application <ul style="list-style-type: none"> <li>▪ Hand Brake or Parking brake</li> <li>▪ Foot brake or service brake</li> </ul> </li> <li>➤ Based on mechanism used for friction <ul style="list-style-type: none"> <li>▪ Contracting type brake</li> <li>▪ expanding type brake</li> </ul> </li> <li>➤ Based on place of its situation <ul style="list-style-type: none"> <li>▪ Wheel brake</li> <li>▪ Transmission brake</li> </ul> </li> <li>➤ Based on its construction <ul style="list-style-type: none"> <li>▪ Drum brake</li> <li>▪ Disc brake</li> </ul> </li> </ul> </li> </ul>	2	4	5

	<ul style="list-style-type: none"> <li>➤ Based on mechanism or system used for power transfer <ul style="list-style-type: none"> <li>▪ Mechanical brake system</li> <li>▪ Hydraulic brake system</li> <li>▪ Pneumatic Brake system.</li> <li>▪ Air assists hydraulic brake system.</li> <li>▪ Electrical brake system.</li> </ul> </li> </ul>			
14. Adjust Brake Pedal Free Play.	<ul style="list-style-type: none"> <li>• Brake pedal adjustment &amp; its purpose</li> </ul>	1	4	5
15. Overhaul Brake Master Cylinder.	<ul style="list-style-type: none"> <li>• Function and construction of master cylinder</li> <li>• Types of master cylinder <ul style="list-style-type: none"> <li>➤ Single piston master cylinder</li> <li>➤ Tandem master cylinder</li> <li>➤ Stepped master cylinder</li> </ul> </li> </ul>	2	15	17
16. Overhaul Brake Wheel Cylinder.	<ul style="list-style-type: none"> <li>• Purpose and function of wheel cylinder</li> <li>• Types of wheel cylinder <ul style="list-style-type: none"> <li>➤ single acting</li> <li>➤ double acting</li> </ul> </li> </ul>	1	10	11
17. Bleed Brake System.	<ul style="list-style-type: none"> <li>• Principle of hydraulic brake</li> <li>• Advantages and disadvantages of hydraulic brake</li> <li>• Properties of brake fluid</li> <li>• Procedure of brake bleeding</li> </ul>	2	8	10
18. Reline Brake Shoes.	<ul style="list-style-type: none"> <li>• Methods of fitting brake lining</li> </ul>	1	4	5
19. Overhaul Front & Rear Brakes.	<ul style="list-style-type: none"> <li>• Inspection and maintenance of brake parts.</li> </ul>	2	20	22
20. Service Disk Brake.	<ul style="list-style-type: none"> <li>• Types of Disc brakes <ul style="list-style-type: none"> <li>➤ Floating caliper disc brake</li> <li>➤ Sliding caliper disc brake</li> <li>➤ Fixed caliper disc brake</li> </ul> </li> <li>• Compare or Difference between drum and disc brake</li> </ul>	2	10	12
21. Overhaul Air Brake.	<ul style="list-style-type: none"> <li>• Parts of air brake <ul style="list-style-type: none"> <li>➤ Air Compressor</li> <li>➤ Unloaded valve</li> </ul> </li> </ul>	2	10	12



	<ul style="list-style-type: none"> <li>➤ Reservoir (Air Tank)</li> <li>➤ Brake chamber</li> <li>➤ Slack Adjuster</li> </ul>			
22. Overhaul Hand Brake.	<ul style="list-style-type: none"> <li>• Purpose and function of Mechanical brake or Parking brake</li> </ul>	1	4	5
23. Overhaul Hydraulic Vacuum Assisted Brake Booster.	<ul style="list-style-type: none"> <li>• Importance and function of brake buster.</li> </ul>	1	10	11
24. Check Wheel Speed Sensor Air Gap.	<ul style="list-style-type: none"> <li>• Anti-Lock Brake System (ABS)</li> <li>• Function and purpose of wheel speed sensor.</li> <li>• Necessity of air gap.</li> </ul>	1	4	5
25. Check Wheel Speed Sensor.	<ul style="list-style-type: none"> <li>• Wheel speed sensor, its purpose and its working principle.</li> <li>• Process of checking wheel speed sensor and its tolerance.</li> </ul>	1	4	5
26. Check ABS Pump Motor.	<ul style="list-style-type: none"> <li>• Anti-Lock Brake System (ABS)</li> <li>• Purpose and function of ABS pump motor.</li> <li>• Testing procedure of ABS pump motor.</li> </ul>	1	4	5
27. Check ABS Relay.	<ul style="list-style-type: none"> <li>• Purpose and function of providing ABS relay.</li> <li>• Process of checking ABS relay with the help of multi-meter or ohmmeter.</li> </ul>	1	4	5
28. Check ABS Pump Motor relay.	<ul style="list-style-type: none"> <li>• Purpose and function of providing ABS pump motor relay.</li> <li>• Process of checking ABS pump motor relay with the help of multi-meter or ohmmeter.</li> </ul>	1	4	5
29. Check ABS ECU Relay.	<ul style="list-style-type: none"> <li>• Purpose and function of providing ABS ECU relay.</li> <li>• Process of checking ABS ECU relay with the help of multi-meter or ohmmeter.</li> </ul>	1	4	5
30. Check Electronic Control Unit (ABS-ECU).	<ul style="list-style-type: none"> <li>• Purpose and function of providing ABS ECU.</li> <li>• Process of checking ABS ECU with the help of multi-meter or ohmmeter.</li> </ul>	1	4	5

31. Check Hydraulic Modulator Solenoid Valves	<ul style="list-style-type: none"> <li>• Purpose and function of providing Hydraulic Modulator Solenoid Valves</li> <li>• Process of checking Hydraulic Modulator Solenoid Valves</li> </ul>	1	4	5
32. Adjust drum and parking brakes.	<ul style="list-style-type: none"> <li>• Purpose, function and types of parking brakes.</li> <li>• Requirements for brake adjustment.</li> </ul>	1	4	5
33. Rectify Brake Troubles.	<ul style="list-style-type: none"> <li>• Trouble shooting of brake system</li> </ul>	1	8	9
		<b>55</b>	<b>312</b>	<b>367</b>

*Note: Related safety precaution should provide while performing the task.*

## Module 2: Power Train

Task	Related Technical Knowledge	Time (Hrs)		
		T	P	Total Hrs
1. Replace gearbox with linkages.	<ul style="list-style-type: none"> <li>• Layout of Transmission System.</li> <li>• Need for transmission system in a vehicle.</li> <li>• Different layout of the power transmission in a vehicle.</li> </ul>	2	12	14
2. Replace coil spring (release finger) type clutch.	<ul style="list-style-type: none"> <li>• Necessary for a clutch in a vehicle.</li> <li>• List out the different types of clutch used in vehicle.</li> <li>• Function of the clutch.</li> <li>• Types of clutch actuation system.</li> <li>• Function of mechanically operated clutch.</li> <li>• Hydraulically operated clutch.</li> </ul>	4	10	14
3. Replace the diaphragm/coil spring type clutch.	<ul style="list-style-type: none"> <li>• Working principle of each type of pressure plate.</li> </ul>	2	10	14
4. Overhaul clutch assembly.	<ul style="list-style-type: none"> <li>• Conditions to be overhauled clutch assembly.</li> </ul>	2	25	27
5. Bleed hydraulic clutch system.	<ul style="list-style-type: none"> <li>• Necessity of bleeding.</li> <li>• Trouble shooting of clutch.</li> </ul>	2	10	12
6. Overhaul clutch master	<ul style="list-style-type: none"> <li>• Working principle and function</li> </ul>	1	5	6

cylinder and slave cylinder.	of master cylinder and slave cylinder.			
7. Overhaul sliding mesh / synchromesh / constant mesh gearbox	<ul style="list-style-type: none"> <li>• Various resistances in vehicular motion.</li> <li>• Necessity of a gear box in a vehicle.</li> <li>• Different types of gear boxes.</li> <li>• Various components and their functions in a sliding mess gearbox.</li> <li>• Various components and their functions in a constant mess gearbox.</li> <li>• Various components and their function of synchromesh gearbox.</li> <li>• Advantages of a constant mesh gear box.</li> <li>• Power flow sketch in various gears.</li> <li>• Different types of gear.</li> <li>• Trouble shooting of gearbox.</li> </ul>	12	75	<b>87</b>
8. Remove Inspect and Refit propeller shaft.	<ul style="list-style-type: none"> <li>• Function of the propeller shaft.</li> <li>• Various components used in the power transmission.</li> <li>• Need for centre bearing.</li> <li>• Hotchkiss drive.</li> <li>• Torque tube drive.</li> <li>• Trouble shooting.</li> </ul>	<b>3</b>	14	<b>17</b>
9. Overhaul Universal and slip joints.	<ul style="list-style-type: none"> <li>• Need for a universal joint.</li> <li>• Function of a universal joint.</li> <li>• Various types of universal joint.</li> <li>• Constructional features of the different types of universal joints.</li> <li>• Functions of the different types of universal joints.</li> <li>• Need for a slip joint.</li> <li>• Function of a slip joint.</li> <li>• Trouble shooting.</li> </ul>	<b>3</b>	14	<b>17</b>
10. Remove and refit rear axle assembly.	<ul style="list-style-type: none"> <li>• Various types of axle housings.</li> <li>• Various types of rear axles.</li> <li>• Merits and demerits of each types of the rear axle</li> <li>• Trouble shooting.</li> </ul>	<b>3</b>	14	<b>17</b>
11. Overhaul rear axle and hub.	<ul style="list-style-type: none"> <li>• Conditions for overhauling.</li> </ul>	<b>3</b>	14	<b>17</b>

12. Overhaul Differential assembly.	<ul style="list-style-type: none"> <li>• Need for a differential.</li> <li>• Constructional features of differential.</li> <li>• Function of the differential.</li> <li>• Trouble shooting.</li> </ul>	<b>8</b>	75	
13. Rectify Transmission troubles.	<ul style="list-style-type: none"> <li>• Trouble shooting.</li> </ul>	<b>2</b>	10	<b>12</b>
14. Overhaul Gear Linkages (Parts).	<ul style="list-style-type: none"> <li>• Various types of gear shift mechanism.</li> <li>• Working principle of gear shift mechanism.</li> <li>• Trouble shooting.</li> </ul>	<b>4</b>	21	
15. Overhaul Transfer case/transaxle.	<ul style="list-style-type: none"> <li>• Difference between two wheel drive and four wheel drive.</li> <li>• Need of transfer case.</li> <li>• Trouble shooting.</li> </ul>	<b>6</b>	42	<b>48</b>
		<b>57</b>	351	<b>408</b>

*Note: Related safety precaution should provide while performing the task.*

#### **References:**

- Boyce Dwiggin, **Automobile Repair Guide**, D.B. Taraporevala Sons & Co. Pvt. Ltd., Bombay, India
- W. Chrouse, **Automotive Technology**, MC Graw Hill Publication P. Ltd.

## Engineering Drawing - I

**Total Class: 117 hrs.**

**Weekly Class: 3 hrs.**

**Full Marks:75**

### Course Description:

This course deals with geometrical construction, orthographic projections and basic techniques of freehand sketch. The course provides training in the under pinning skills and knowledge for gradual development of people wishing to read and understand the automobile and workshop drawing.

- |   |               |
|---|---------------|
| <b>1. Introduce engineering drawing</b>                                       | <b>6 hrs</b>  |
| 1.1. Introduce drawing  |               |
| 1.2. Introduce engineering instrument   |               |
| 1.3. Introduce conventional line types  |               |
| 1.4. Introduce drawing scale  |               |
| 1.5. Introduce drawing sheet size   |               |
| <b>2. Handle engineering drawing instruments</b>                              | <b>12 hrs</b> |
| 2.1. Set up paper in drawing board  |               |
| 2.2. Prepare a drawing sheet using T set and set square                       |               |
| 2.3. Draw representative lines  |               |
| 2.4. Draw circle using compass  |               |
| 2.5. Draw square / rectangle using set square and T set.                      |               |
| 2.6. Draw triangle using T set, set-square and protractor.                    |               |
| 2.7. Write engineering letter   |               |
| <b>3. Construct Geometric Drawing</b>   | <b>18 hrs</b> |
| 3.1. Bisect/trisect a line.   |               |
| 3.2. Bisect/trisect an angle  |               |
| 3.3. Draw perpendicular and parallel line                                     |               |
| 3.4. Construct regular polygons(inscribed/circumscribed/T-set and set square) |               |
| 3.5. Draw tangents(circle to circle, line to circle, arc to line)             |               |
| 3.6. Construct ellipse(four center method/rhombus method)                     |               |
| 3.7. Construct oval   |               |
| <b>4. Draw orthographic view</b>  | <b>24 hrs</b> |
| 4.1. Draw three view drawings from given isometric/oblique drawing            |               |
| 4.2. Draw two view drawings of cylindrical object                             |               |
| 4.3. Draw missing views   |               |
| <b>5. Apply dimension</b>   | <b>12 hrs</b> |
| 5.1. Dimension in drawing   |               |
| 5.2. Apply tolerances   |               |
| 5.3. Apply surface roughness  |               |

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|--|----------------|
| <b>6. Draw pictorial projection</b>                                    | <b>24 hrs</b>  |
| 6.1. Draw oblique projection   |                |
| 6.2. Draw isometric projection   |                |
| <b>7. Draw section views</b>   | <b>15 hrs.</b> |
| 7.1. Draw full section views   |                |
| 7.2. Draw half section views   |                |
| 7.3. Draw part section views   |                |
| <b>8. Draw auxiliary views</b>   | <b>9 hrs</b>   |
| 8.1. Identify shapes obtained by cutting planes a right cylinder/prism |                |
| 8.2. Exercise in auxiliary drawing of different types of machine parts |                |

**1. DUTY: INTRODUCE ENGINEERING DRAWING****6 hrs**

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Introduce drawing	<ul style="list-style-type: none"> <li>▪ Concept</li> <li>▪ Introduction</li> <li>▪ Types</li> <li>▪ Importance</li> </ul>	2 H	
2.	Introduce engineering instrument	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Care and uses</li> </ul>	1 H	
4.	Introduce drawing scale	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> </ul>	1 H	1 H
5.	Introduce drawing sheet size	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Sizes</li> </ul>	1 H	

**2. DUTY:HANDLE ENGINEERING DRAWING INSTRUMENTS****12 hrs**

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Set paper in drawing board.	<ul style="list-style-type: none"> <li>• Concept.</li> <li>• Uses of base paper.</li> <li>▪ Uses of T-set.</li> <li>▪ Uses of drawing tape</li> </ul>	0.5 H	1 H
2.	Prepare a drawing sheet using T set and set square.	<ul style="list-style-type: none"> <li>• Introduction of title box</li> <li>• Standard size and type of title box</li> <li>• Set square/T-set and its uses.</li> </ul>	0.5 H	1 H
3.	Draw representative lines.	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Application/uses</li> </ul>	0.5 H	1 H
4.	Draw circle-using compass.	<ul style="list-style-type: none"> <li>• Uses of compass and representative of circles in workshop drawings.</li> <li>• Instruments that used to draw circles in drawing.</li> </ul>	0.5 H	1 H
5.	Draw square / rectangle using set square and T set.	<ul style="list-style-type: none"> <li>• Instruments that uses to draw square / rectangles in drawing.</li> </ul>	0.5 H	1 H
6.	Draw Triangle using T-set, set square and protractor.	<ul style="list-style-type: none"> <li>• Drawing geometrical shapes.</li> <li>• Taking a measurement of</li> </ul>	0.5 H	1 H

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
		angles and triangles.		
7.	Write engineering letter.	<ul style="list-style-type: none"> <li>• Strokes</li> <li>• Case</li> <li>• Importance</li> <li>• Method of writing</li> </ul>	1 H	2 H

### 3. CONSTRUCT GEOMETRIC DRAWING

18 hrs

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Bisect/trisect a line.	<ul style="list-style-type: none"> <li>▪ Concept</li> </ul>	0.5 H	1 H
2.	Bisect/trisect an angle	Concept	0.5 H	1 H
3.	Draw perpendicular and parallel line	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5H	1 H
4.	Construct regular polygons	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Uses</li> <li>• Methods</li> </ul>	1 H	5 H
5.	Draw tangents(circle to circle, line to circle, arc to line)	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> </ul>	0.5 H	2.5 H
6.	Construct ellipse	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Methods(four center method/rhombus method)</li> </ul>	1H	2 H
7.	Construct oval	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Application</li> </ul>	0.5 H	1 H

### 4. Draw Orthographic View

24hrs

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Draw three view drawings from given isometric/oblique drawing	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction of projection</li> <li>• Types of projection</li> <li>• Symbol used to represent projection</li> <li>• Method of obtaining orthographic projections in first angle.</li> </ul>	3 H	13 H



S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
		<ul style="list-style-type: none"> <li>Layout of three view drawing.</li> </ul>		
2.	Draw Two view drawings of cylindrical object	<ul style="list-style-type: none"> <li>Concept</li> <li>Introduction of two view</li> <li>Method of obtaining measurement of circular object.</li> </ul>	1 H	3 H
3.	Draw Missing Views	<ul style="list-style-type: none"> <li>Concept</li> </ul>	1 H	3H

### 5. Apply dimensions

12hrs

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Dimension in drawing	<ul style="list-style-type: none"> <li>Introduction of dimension</li> <li>Importance of dimension.</li> <li>Components/elements of dimension</li> <li>Types of dimension</li> <li>System of dimension</li> <li>Rules of dimension</li> <li>Dos or Do not of dimension</li> <li>Dimensioning on               <ul style="list-style-type: none"> <li>Orthographic views</li> <li>Pictorial drawing</li> <li>Sectional drawing</li> </ul> </li> </ul>	2 H	3 H
2.	Apply tolerances	<ul style="list-style-type: none"> <li>Introduction of limit</li> <li>Types of limit</li> <li>Introduction of fit</li> <li>Types of fit</li> <li>Introduction of tolerances</li> <li>Basis of tolerances</li> <li>Importance of limit, fit and tolerances</li> </ul>	2 H	2 H
3.	Apply surface roughness	<ul style="list-style-type: none"> <li>Introduction</li> <li>Importance of roughness on drawing</li> <li>Types</li> <li>Symbol used on drawing</li> </ul>	1 H	2 H

**6. Draw pictorial projection****21 hrs**

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Draw oblique projection	<ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Axis of oblique</li> <li>• Method of constructing projections.</li> <li>• Application of projection.</li> <li>• Cavalier and cabinet</li> </ul>	3 H	3 H
2.	Draw isometric projection	<ul style="list-style-type: none"> <li>• Introduction of pictorial</li> <li>• Types of Pictorial views.</li> <li>• Axis of isometric</li> <li>• Practice on Rectangular/stepped/circular object</li> </ul>	3 H	12 H

**7. Draw section views****15 hrs.**

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Draw full section views	<ul style="list-style-type: none"> <li>• Introduction of section</li> <li>• Importance of drawing in section.</li> <li>• Types of section</li> <li>• Layout of three sectional views.</li> </ul>	2 H	7 H
2.	Draw half section views.	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	1 H	2 H
3.	Draw part section views.	<ul style="list-style-type: none"> <li>• concept</li> </ul>	1 H	2 H

**8. Draw auxiliary views****9 hrs**

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Identify shapes obtained by cutting planes a right cylinder/prism	<ul style="list-style-type: none"> <li>• Introduction of auxiliary</li> <li>• Importance of section.</li> <li>•</li> </ul>	2 H	4H
2.	Exercise of auxiliary drawing of different types of machine parts	<ul style="list-style-type: none"> <li>•</li> </ul>		3 H

## References:

SN	Name of the Book	Name of Author	Publication
1.	Engineering Drawing	B Agrawal, CM Agrawal	TATA McGraw Hill
2.	Engineering Drawing	P S Gill,	S K Kataria & Sons
3.	Engineering Drawing for Mechanical Trade		Instructional Material for Vocational Training, India
4.	Elements of Mechanical Drafting	Samual Yaslov	Delmar Publishers

## REQUIRED TOOLS MATERIALS AND EQUIPMENT

S. N.	Description	Size	Remarks
1	Drawing class room		
2	Set square		
3	T-set		
4	Drawing pin		
5	Drawing tape		
6	Compass		
7	Protractor		
8	Divider		
9	Drawing board		
10	Overhead Projector		
11	Pencil 0.3 mm	HB, B	
12	Pencil 0.5 mm	HB, B	
13	Pencil 0.7 mm	HB, B	
14	Pencil 0.5 mm	H	
15	Pencil sharpener		
16	Eraser	A-20	
17	Base paper		
18	Drawing paper		
19	Tracing paper		
20	Drawing pen	Set	
21	Erasing template		
22	Lettering template	Set	
23	Circle template	Set	
24	Ellipse template	Set	
25	Drawing template	Set	

# Computer Application

**Total: 78 hrs**  
**Class/week: 2 hrs**

**Course Description:**

This course intends to impart the competencies required to prepare document, spreadsheets, presentations slides and database management sheets by using different computer application packages.

**Module: 1 Maintain computer system**

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
1.	Install computer peripheral	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Identify input devices (keyboard, mouse, joystick, and scanner), output devices (monitor, printer/plotter, sound card, and speaker), central processing unit, memory unit, and auxiliary storage devices (hard disk, CD/DVD/Blue Ray, pen drive, memory card).</li> <li>▪ Explain different types of ports (Parallel, serial, USB, IEEE 1394 and slots)</li> <li>▪ Explain the precaution to be taken while installing computer peripheral.</li> </ul>	0.50	1.00
2.	Install operating system	<ul style="list-style-type: none"> <li>▪ Explain operating system including its role.</li> <li>▪ Describe different types of operating systems (MS-DOS, Windows, Unix, Linux)</li> <li>▪ Enlist the function of DOS Commands (COPY, REN, DIR, TYPE, CD, MD and BACKUP).</li> <li>▪ Explain precautions to be taken while installing operating system.</li> <li>▪ Make a list of tasks to be performed before, during and after installation of MS Window operating system.</li> </ul>	0.50	4.00

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
3.	Install application/driver Software	<ul style="list-style-type: none"> <li>▪ Differentiate application software and driver software.</li> <li>▪ Describe the uses of antivirus program.</li> <li>▪ Explain the procedure for installing application/driver software</li> <li>▪ Describe the features of control Panel</li> </ul>	0.5	2.00
4.	Uninstall software/application			1.00
5.	Format external mass storage			0.50
	<b>Sub total</b>		<b>1.50</b>	<b>8.5</b>

#### Module: 2 Prepare Documents using Word Processing Package

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
6.	Perform typing practice	<ul style="list-style-type: none"> <li>▪ Explain the interface of word processing including different tools/menu.</li> <li>▪ Describe how to open, save document and exit.</li> <li>▪ Explain the procedure to type document in word processing software</li> <li>▪ Demonstrate systematic way of typing.</li> </ul>	0.50	2.00
7.	Setup page in word processing.	<ul style="list-style-type: none"> <li>▪ Explain different features and attributes of “page setup” box.</li> <li>▪ Explain how to setup margins, orientation, size and columns.</li> <li>▪ Define breaks, line numbers and Hyphenation.</li> <li>▪ Explain the procedure to setup page.</li> </ul>	0.25	1.00
8.	Insert object/picture/photo			1.00
9.	Insert header/footer	<ul style="list-style-type: none"> <li>▪ Differentiate header and footer.</li> <li>▪ Explain the procedure to insert different header and footer in different pages.</li> </ul>	0.25	1.00

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
10.	Insert table	<ul style="list-style-type: none"> <li>▪ Explain row and column.</li> <li>▪ State the procedure to insert table</li> <li>▪ Describe table formatting procedure (border and color).</li> </ul>	0.50	1.00
	<b>Sub total</b>		<b>1.50</b>	<b>6.00</b>

### Module: 3 Prepare Spreadsheets using Spreadsheet Package

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
11.	Create workbook.	<ul style="list-style-type: none"> <li>▪ Explain the concept and uses of Spreadsheet.</li> <li>▪ Interpret Spreadsheet's Interface.</li> <li>▪ Differentiate among column, row, cell, workbook, worksheet, labels, values, dates and formulas.</li> </ul>	0.50	2.00
12.	Analyze data using basic formula/function	<ul style="list-style-type: none"> <li>▪ Interpret "insert function" box.</li> <li>▪ Differentiate relative and Absolute cell reference</li> <li>▪ Explain the procedure to insert formula/function</li> </ul>	0.50	1.00
13.	Create chart/graph	<ul style="list-style-type: none"> <li>▪ Explain differentiate types of charts/graph.</li> <li>▪ State the procedure to create chart/graph.</li> </ul>	0.25	1.00
14.	Filter data	<ul style="list-style-type: none"> <li>▪ Differentiate between filtering and sorting.</li> <li>▪ Explain the purpose of filtering.</li> <li>▪ Interpret filtered data.</li> </ul>	0.25	1.00
15.	Sort data	<ul style="list-style-type: none"> <li>▪ Explain the purpose of sorting.</li> <li>▪ Interpret sorted data.</li> </ul>	0.25	1.00
16.	Setup page in spreadsheet	<ul style="list-style-type: none"> <li>▪ Explain different features and attributes of "page setup" box.</li> <li>▪ Explain how to setup margins, orientation, size and columns.</li> <li>▪ Explain the procedure to setup page.</li> </ul>	0.25	1.00
	<b>Sub total</b>		<b>2.00</b>	<b>7.00</b>

**Module: 4 Create Presentation using Presentation Package**

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
17.	Prepare master slide	<ul style="list-style-type: none"> <li>▪ Interpret presentation package interface including tools/menu.</li> <li>▪ Differentiate among slides, master slide, outline, notes page, handout master, notes master and slide sorter.</li> <li>▪ Explain the purpose of preparing master slide.</li> <li>▪ Enlist the procedure to prepare master slide including formatting and editing.</li> </ul>	1.00	1.00
18.	Prepare slides	<ul style="list-style-type: none"> <li>▪ Explain the procedures to insert text, pictures/objects/ sound and charts/graphs.</li> </ul>	0.50	2.00
19.	Animate the content of slide.	<ul style="list-style-type: none"> <li>▪ Define animation.</li> <li>▪ Explain the procedure to apply animation to the content of slide.</li> <li>▪ Differentiate between transition and animation.</li> </ul>	0.50	1.00
20.	Perform on-screen presentation	<ul style="list-style-type: none"> <li>▪ Explain the procedure to perform on-screen presentation.</li> <li>▪ State the precautions to be taken while connecting computer with Multimedia projector for presentation.</li> </ul>	0.50	2.00
	<b>Sub total</b>		<b>2.50</b>	<b>6.00</b>

**Module: 5 Maintain Database Management System using Database Package.**

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
21.	Create database table	<ul style="list-style-type: none"> <li>▪ Define database.</li> <li>▪ Explain the purpose of database Management system</li> <li>▪ Interpret the interface of Database package including tools/menu.</li> <li>▪ Differentiate table, query, form and report.</li> <li>▪ Enlist the procedure to create</li> </ul>	1.00	2.00

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
		database table.		
22.	Create query	<ul style="list-style-type: none"> <li>▪ Explain the procedure to create query.</li> </ul>	0.50	1.00
23.	Generate report	<ul style="list-style-type: none"> <li>▪ State the procedure to generate report.</li> <li>▪ Explain the procedure to print report.</li> </ul>	0.50	1.00
	<b>Sub total</b>		<b>2.00</b>	<b>4.00</b>

**Module: 6 Manage e-mail/internets.**

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
24.	Browse information through internet	<ul style="list-style-type: none"> <li>▪ Differentiate among web server, web browser, web site, domain name system (DNS), WWW, search engine and internet service provider.</li> <li>▪ State the precaution to be taken while browsing through internet.</li> <li>▪ List the steps for information browsing through internet.</li> </ul>	0.50	1.00
25.	Send mail through internet.	<ul style="list-style-type: none"> <li>▪ Explain the concept of e-mail.</li> <li>▪ Differentiate web based e-mail and POP e-mail.</li> <li>▪ Explain the procedure to send mail through internet.</li> </ul>	0.50	1.00
	<b>Sub total</b>		<b>1.00</b>	<b>2.00</b>



### Project works

26.	Following projects are to be prepared and submitted (e-copy) using different packages. <ul style="list-style-type: none"><li>• Create a bio-data in word processing giving educational and personal details.</li><li>• Create a spreadsheet worksheet entering marks of five subjects of 20 students. Perform sorting according to their rank and generate a suitable graph for the same data.</li><li>• Design a presentation with not less than 10 slides on trade specific topic.</li><li>• Create a database in database package with not less than 20 entries. Query and then generate the report.</li></ul>		34.00
	<b>Sub total</b>	<b>0</b>	<b>34.00</b>
	<b>Total</b>	<b>10.50</b>	<b>67.5</b>
	<b>Grand total</b>	<b>78</b>	

### Reference books:

1. B Ram, "*Computer Fundamentals*", Willey Eastern Publishers
2. P.K Sinha, "Computer Fundamentals"
3. Rajaraman, "*Fundamentals of Computers*", Prentice-Hall of India
4. S Saxena, "*A First Course in Computers*", Vikash Publishing

## Workshop Technology

**Total Class: 39 hrs.**

**Theory: 1 hr/week**

### **Course description:**

This subject deals with theory and practice on basic hand tools, measuring instrument, power tools, basic principle of automobile system and their importance, function, working principle, types, trouble shooting and safety precautions related to automobile control and suspension system and auto power trains in the automobile engineering.

<u>Topics</u>	<u>Time</u>
<b>A. Bench work, sheet metal and welding theory</b>	
<b>1. General safety</b>	<b>3 hrs.</b>
1.1. General workshop safety	
1.2. Occupational safety and health	
1.3. Electrical safety	
1.4. Possible hazards	
1.5. Fire hazards and fighting equipment's	
<b>2. Files and filing operation</b>	<b>4 hrs.</b>
2.1. Hacksaws and sawing	
2.2. File and filing	
2.3. Size of file	
2.4. Types of file (According to cross section, cut of teeth, grade cut)	
2.5. Methods of filling	
2.6. Safety precautions	
<b>3. Bench work hand tools</b>	<b>10 hrs.</b>
3.1. Hammer (types, uses)	
3.2. Chisels and chippings (types, uses)	
3.3. Punches (types, uses)	
3.4. Pliers and cutters (types, uses)	
3.5. Taps and dies (types, uses)	
3.6. Size of tap drills and thread extractor	
3.7. Wrench and spanners (types, uses)	
3.8. Vices (types, uses and main parts)	
3.9. C-clamps (types, uses)	
3.10. V- Block with clamps	
3.11. Safety precautions	
<b>4. Measuring instruments</b>	<b>10 hrs.</b>
4.1. Scales and meters (uses, importance, purpose, types)	
4.2. Calipers (uses, types)	
4.3. Vernier calipers and Micrometers	

- 4.4. Gauges (feeler gauge, radius gauge, pitch and wire gauge) and their uses
- 4.5. Angle measuring instruments
- 4.6. Safety precaution

**5. Drills and drilling operation** **4 hrs.**

- 5.1. Drill bits (types and parts)
- 5.2. Drill machines (types and parts)
- 5.3. Cutting speed feed and RPM
- 5.4. Drilling operations
- 5.5. Safety precautions

**6. Sheet Metal** **4 hrs.**

- 6.1. Sheet metal works
- 6.2. Hand tools used in sheet metal work
- 6.3. Different types of tools and machines for sheet metal work
- 6.4. Punches and punch tools
- 6.5. Riveting
- 6.6. Soldering and its types
- 6.7. Size and gauges of sheet metals
- 6.8. Safety precautions

**7. Welding** **4 hrs.**

- 7.1. Welding and types
- 7.2. Different types of welding machine
- 7.3. Current, voltage and ampere
- 7.4. Different parts of welding transfer
- 7.5. Types, size and use of electrodes
- 7.6. List of welding tools
- 7.7. Welding joints, symbols and positions
- 7.8. Welding defects and their control
- 7.9. Safety precautions

## A. Bench Work

**Total Class: 156 hrs.**  
**Practical: 4 hrs/week**

### Course Description:

The subject aims at imparting knowledge and practice components to the student making them competent and potential in the field of applied mechanical fitting works. The course is offered as hands on skills on auto mechanical repair and maintenance works.

<u>Tasks Areas</u>	<u>Time</u>
<b>B. Bench work practice</b>	
<b>1. Measure and perform filing</b>	
1.1. Mark the given work piece.	3
1.2. File flat surface	15
1.3. File external radius	7
1.4. File internal profiles	7
1.5. Produce rectangular block	16
<b>2. Perform hand punching</b>	
2.1. Punch letters/numbers on metal plates	6
2.2. Punch dot/center	4
<b>3. Perform sawing</b>	
3.1. Saw the metals by hand hacksaw.	6
<b>4. Perform chiseling</b>	
4.1. Perform flat chipping	5
<b>5. Perform drilling</b>	
5.1. Drill a hole	5
5.2. Countersunk on hole	3
<b>6. Cuts threads by hand</b>	
6.1. Cuts internal threads using hand taps	8
6.2. Cuts external threads using threading dies	6
<b>7. Perform offhand grinding</b>	
7.1. Grind round tools (center punch, marking scriber...)	6
7.2. Grind flat tools (chisel....)	4
<b>8. Perform measurement</b>	
8.1. Measure the dimensions using Vernier caliper	5
<b>9. Perform Project Works</b>	
9.1. Manufacture C – clamp	25
9.2. Manufacture steel hammer of 500gm	25
<b>Total</b>	<b>156</b>

**Duty: - Perform measuring and marking**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Measure and mark the given work piece.	<ul style="list-style-type: none"> <li>Types of measuring and marking instrument.</li> <li>Units and measurement</li> <li>Basic unit of length measurement and its multiples.</li> <li>Features of steel rule.</li> </ul>	2 H	1 H
2.	File flat surface.	<ul style="list-style-type: none"> <li>Work-piece clamping devices</li> <li>Position of body and arm for guiding the file.</li> <li>Position of holding the file</li> <li>Introduction of file</li> <li>Common methods of filing flat surface.</li> <li>Procedure of filing plain and even surface.</li> <li>General safety precaution</li> </ul>	13 H	2 H
3.	File external radius	<ul style="list-style-type: none"> <li>Introduction of marking and layout.</li> <li>Radius gauge.</li> <li>Methods of filing radius surface.</li> <li>State the features of compass.</li> <li>Procedure of filing radius surface.</li> </ul>	6 H	1 H
4.	File internal profile	<ul style="list-style-type: none"> <li>Procedure of filing internal profiles.</li> <li>Using round file, half round and triangular file</li> </ul>	6 H	1 H
5.	Produce rectangular block	<ul style="list-style-type: none"> <li>Checking surface flatness.</li> <li>Checking right-angle of work-piece</li> </ul>	15 h	1 H

**Duty :- Perform hand punching**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Punch letters/numbers on metal plates	<ul style="list-style-type: none"> <li>Letters and numbers punches.</li> <li>Punching and its process.</li> <li>Three step stroking Procedure of stamping and number punching.</li> </ul>	5 H	1 H

2.	Punch dot/center	<ul style="list-style-type: none"> <li>• Uses of center/prick punch</li> <li>• Procedure and types of Punch for marking. (centre &amp; prick)</li> </ul>	3 H	1 H
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**Duty :- Perform sawing by hand hacksaw.**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Saw the metal by hand hacksaw	<ul style="list-style-type: none"> <li>• Introduction of Hacksaw frame &amp; blade.</li> <li>• Holding different sections of work-piece for hack sawing.</li> <li>• Procedure of sawing the metal by hand.</li> <li>• Types of hacksaw blades</li> </ul>	5 H	1 H

**Duty :- Perform chiseling.**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Perform flat chipping	<ul style="list-style-type: none"> <li>• Introduction of chisel and its types.</li> <li>• Fundamental of chipping.</li> <li>• Use of chisels.</li> <li>• Procedure of chipping flat</li> </ul>	4 H	1 H

**Duty :- Perform drilling**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Drill a hole	<ul style="list-style-type: none"> <li>• Introduction of drill machine and drill bits</li> <li>• Twist drills types and parts.</li> <li>• Calculate RPM, feed and cutting speed.</li> <li>• Types of drill machine and its main parts.</li> <li>• Center drill and its use.</li> <li>• Procedure of drilling a hole on pedestal drilling machine.</li> </ul>	4 H	1 H
2.	Perform countersunk on hole	<ul style="list-style-type: none"> <li>• Introduction to countersink &amp; its types.</li> <li>• Uses of countersink.</li> <li>• Procedure of countersinking on a drilled hole.</li> </ul>	2 H	1 H

**Duty :- Perform threads by hand.**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Cut internal thread using hand taps	<ul style="list-style-type: none"> <li>• Introduction of tap and tap handle</li> <li>• Calculate hole size to tapping</li> <li>• Offhand tapping procedure</li> <li>• Procedure of broken screw extracting.</li> </ul>	7 H	1 H
2.	Cut external thread using threading dies.	<ul style="list-style-type: none"> <li>• Introduction of threading dies and die handle.</li> <li>• Identify blank size.</li> <li>• Procedure of thread cutting by dies and dies handling.</li> </ul>	5 H	1 H

**Duty :- Perform grinding.**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Grind round tools (center punch, scriber...)	<ul style="list-style-type: none"> <li>• Introduction and uses of center punch/scriber.</li> <li>• Uses of center punch.</li> <li>• Procedure of grinding center punch/scriber.</li> </ul>	5 H	1 H
2.	Grind flat tools (chisel...)	<ul style="list-style-type: none"> <li>• Introduction of chisels</li> <li>• Distinguish the features of chisels.</li> <li>• Procedure of re-sharpen the flat chisel.</li> </ul>	3 H	1 H

**Duty :- Perform measurement.**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Measure the dimensions using vernier caliper	<ul style="list-style-type: none"> <li>• Introduction of vernier caliper and its types.</li> <li>• Features of vernier caliper.</li> <li>• Reading the scale.</li> <li>• Uses of vernier caliper.</li> <li>• Least count of vernier caliper.</li> <li>• Care and maintain of vernier caliper.</li> <li>• Procedure of measuring dimensions by using vernier caliper.</li> </ul>	4 H	1 H

**Duty :- Perform project works.**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Manufacture a C – Clamp	<ul style="list-style-type: none"> <li>• Planning for project works</li> </ul>	24 H	1 H
2.	Manufacture a steel hammer of 500 gm.	<ul style="list-style-type: none"> <li>• Reporting for project works</li> </ul>	24 H	1 H

**References:**

SN	Name of the Book	Name of Author	Publication
1.	Fitter trade Practical		- CIMI, Madras.
2.	Mechanical engineering.	ILO learning element	
3.	All about MACHINE TOOLS	- Heinrich Gerling	
4.	Elementary Metal Course Training Section I	- BBF.	



## B. Sheet Metal

**Total class: 39 hrs.**  
**Practical: 1 hr/week**

### Course Description:

The subject aims at imparting knowledge and skill components to the student making them competent and potential in the field of sheet metal fabrication works. The course is offered as hands on skills on auto mechanical repair and maintenance works.

<u>Duties &amp; Tasks</u>	<u>Time</u>
<b>Sheet metal practice</b>	
<b>1. Perform cutting and notching</b>	
1.1. Cut straight edge by hand	2
1.2. Cut round edge by hand	2
1.3. Cut a irregular segments	1
<b>2. Perform seaming</b>	
2.1. Fold segment by hand tools	3
2.2. Fold by folding machine	3
2.3. Perform single groove seam	3
2.4. Perform straight beading	3
2.5. Perform round beading	2
<b>3. Perform fastening</b>	
3.1. Perform soldering joint	4
3.2. Perform riveted joint	4
<b>4. Fabricate sheet metal</b>	
5. Fabricate rectangular box	6
6. Fabricate funnel	6
<b>Total</b>	<b>39 hrs.</b>

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Cut straight edge by hand	<ul style="list-style-type: none"> <li>• Define sheet metal</li> <li>• Size and gauges of sheet available in the market.</li> <li>• Introduction of snips and its types.</li> <li>• Marking and layout.</li> <li>• Hand tools and machines used in sheet metal work.</li> <li>• Calculate sheet gauge</li> </ul>	1 H	1H
2.	Cut round edge by hand	<ul style="list-style-type: none"> <li>• Marking procedure for sheet metal works</li> </ul>	2 H	0 H
3.	Cut irregular segments	<ul style="list-style-type: none"> <li>• Snip handling procedure during irregular shape cutting</li> </ul>	1 H	0 H

4.	Fold segment by hand tools	<ul style="list-style-type: none"> <li>• Uses and importance of folding.</li> <li>• Process of folding sheet metal pieces by hand tools.</li> </ul>	2 H	1 H
5.	Fold by folding machine	<ul style="list-style-type: none"> <li>• Introduce folding machine,</li> <li>• Process of folding a sheet metal on folding machine.</li> </ul>	2 H.	1 H.
6.	Perform single groove seam	<ul style="list-style-type: none"> <li>• Types of seam joint and performances.</li> <li>• Process of seaming.</li> </ul>	2 H	1 H
7.	Perform straight beading	<ul style="list-style-type: none"> <li>• Introduce beading machine.</li> <li>• Process of beading straightness.</li> </ul>	2 H	1 H
8.	Perform round beading	<ul style="list-style-type: none"> <li>• Importance of round beading</li> </ul>	2 H	0 H
9.	Perform soldering joint.	<ul style="list-style-type: none"> <li>• Introduction of solder.</li> <li>• Process of soldering single layer</li> <li>• Process of soldering double layer.</li> </ul>	3 H	1 H
10.	Perform riveted joint	<ul style="list-style-type: none"> <li>• Introduction of rivets and rivet punches.</li> <li>• Different rivet joints</li> <li>• Calculation of rivet length.</li> <li>• Process of riveting joints (solid/pop).</li> </ul>	3 H	1 H
11.	Fabricate a rectangular box	<ul style="list-style-type: none"> <li>• Mass production technique.</li> </ul>	5 H	1 H
12.	Fabricate a funnel.	<ul style="list-style-type: none"> <li>• Pattern making concept.</li> </ul>	6 H	0 H

### References:

SN	Name of the Book	Name of Author	Publication
1.	Elementary Metal Course Training Section I	- BBF.	
2.	All about MACHINE TOOLS	- Heinrich Gerling	

## C. Welding

### Course Description:

The subject aims at imparting knowledge and skill components to the student making them competent and potential in the field of basic welding works. The course is offered as hands on skills on auto mechanical repair and maintenance works.

**Total class: 39 hrs.**  
**Practical: 1 hrs/week**

<u>Tasks</u>	<u>Time</u>
<b>C. Welding practice</b>	
1. Perform striking	5
2. Perform surface weld	15
3. Grind off surfaces weld.	4
4. Perform multi run straight beads	7
5. Weld corner joint	5
6. Make a screw clamp.	3
<b>Total</b>	<b>39 hrs.</b>

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Perform striking.	<ul style="list-style-type: none"> <li>• Introduction of welding and its types.</li> <li>• Types of arc welding machine</li> <li>• Arc welding machines / transformers and main parts.</li> <li>• Use of welding tools.</li> <li>• Striking method.</li> </ul>	4 H	1 H
2.	Perform surface weld.	<ul style="list-style-type: none"> <li>• Define current, voltage and ampere</li> <li>• Types and size of electrode.</li> </ul>	14 H	1H
3.	Grind off surfaces welds.	<ul style="list-style-type: none"> <li>• Welding joints, symbols and positions</li> <li>• Hand grinding machine and grinding wheel.</li> <li>• Changing procedure of grinding wheel.</li> </ul>	3 H	1 H
4.	Perform multi run straight beads	<ul style="list-style-type: none"> <li>• Arc wave and travel speed.</li> <li>• Deposition of beads and overlaps.</li> </ul>	6 H	1 H
5.	Weld corner joint	<ul style="list-style-type: none"> <li>• Defect of arc welding</li> </ul>	4 H	1 H
6.	Make a screw clamp	<ul style="list-style-type: none"> <li>• Use of Screw clamp.</li> <li>• Safety procedure</li> </ul>	3 H.	0 H

# **TSLC in Automobile Engineering**

**Second Year**

## Second Year

<b>Subject</b>	<b>Credit Hrs.</b>
1. Applied Mathematics - II	2
2. Engineering Drawing – II	3
3. Computer Aided Drafting	2
4. Automotive Technology – II	4
5. Motor Vehicle Repair & maintenance – II	25
a. Auto Engine	15
b. Auto Electrical & Electronics System	10
6. Light Vehicle Driving	2
7. Entrepreneurship Development	2
<b>Total</b>	<b>40</b>

## Applied Mathematics - II

**Total Class: 78 hrs.**  
**Weekly Class: 2 hrs.**

### **Description:**

This subject consists of basic calculation related to work, energy and power, force, speed, velocity and engine necessary to develop mathematical background helpful for the understanding and practicing automobile engineering works.

- |  |                |
|--|----------------|
| <b>1. Uniform speeds</b>                             | <b>8 hrs.</b>  |
| 1.1. Laws of motion                                  |                |
| 1.2. Velocity in straight line, circular path        |                |
| 1.3. Acceleration                                    |                |
| 1.4. Examples & exercises                            |                |
| <b>2. Average speed</b>                              | <b>6 hrs.</b>  |
| 2.1 Stroke speed                                     |                |
| 2.2 Piston speed                                     |                |
| 2.3 Examples & exercises                             |                |
| <b>3. Work, power and efficiency</b>                 | <b>8 hrs.</b>  |
| 3.1. Work  |                |
| 3.2. Power   |                |
| 3.3. Efficiency                                      |                |
| 3.4. Examples & exercises                            |                |
| <b>4. Effects of force calculation</b>               | <b>10 hrs.</b> |
| 4.1 Representation                                   |                |
| 4.2 Line of application                              |                |
| 4.3 Equi-directional force                           |                |
| 4.4 Opposite forces                                  |                |
| 4.5 Force at an angle                                |                |
| 4.6 Resolution of forces                             |                |
| 4.7 Supports reaction                                |                |
| 4.8 Equilibrium                                      |                |
| 4.9 Examples & exercises                             |                |
| <b>5. Simple pulley and belt drive calculation</b>   | <b>6 hrs.</b>  |
| <b>6. Multiple pulley and belt drive calculation</b> | <b>6 hrs.</b>  |
| <b>7. Gear wheel dimension calculation</b>           | <b>6 hrs.</b>  |
| <b>8. Simple gear drive calculation</b>              | <b>6 hrs.</b>  |
| 8.1 Dependency of pitch diameter and revolution      |                |
| 8.2 Transmission ratio                               |                |
| 8.3 Distance between axis                            |                |
| 8.4 Examples & exercises                             |                |

- 9. Multiple gear drive calculation** **10 hrs.**
- 9.1 Components of transmission
  - 9.2 Total transmission
  - 9.3 Examples & exercises
- 10. Engine capacity calculation** **12 hrs.**
- 10.1. Clearance volume
  - 10.2. Swept volume
  - 10.3. Engine capacity
  - 10.4. Piston displacement
  - 10.5. Examples & Exercises

**References:**

## Engineering Drawing – II

**Total Class: 117 hrs.**

**Weekly Class: 3 hrs.**

### Course Description:

This course deals with sectional view, pictorial projections, development of surfaces and auto electrical circuits and automobile parts drawing. The course provides training in the underpinning skills and knowledge for gradual development of people wishing to read and understand the automobile and workshop drawing work to undertake drafting and designing sketch of automobile machinery parts, electrical circuits related to automobile repairing work.

- |   |                |
|---|----------------|
| <b>1. Machine drawing</b>   | <b>24 hrs</b>  |
| 1.1. Detail workshop drawing of machine parts                                     |                |
| 1.2. Assembly drawing   |                |
| 1.3. Exploded drawing of simple machine   |                |
| <b>2. Auto electrical/electronic drawing</b>                                      | <b>18 hrs</b>  |
| 2.1. Symbols of auto electrical.  |                |
| 2.2. Parking/head light circuit   |                |
| 2.3. Turn light/hazard light circuit  |                |
| 2.4. Brake/reverse light circuit  |                |
| 2.5. Ignition circuit   |                |
| 2.6. Starting circuit   |                |
| 2.7. Charging circuit (alternator/dynamo)   |                |
| 2.8. Various indicators and meter circuits.                                       |                |
| 2.9. Complete auto electrical system  |                |
| <b>3. Surface development</b>   | <b>21 hrs</b>  |
| 3.1. Development of prismatic (square base, circular, hexagonal) object           |                |
| 3.2. Development of pyramidal (square base, circular, hexagonal) object           |                |
| 3.3. Development of truncated prismatic (square base, circular, hexagonal) object |                |
| 3.4. Development of truncated pyramidal (square base, circular, hexagonal) object |                |
| <b>4. Machine elements drawing</b>  | <b>30 hrs.</b> |
| 4.1. Screw, thread, nut and bolt  |                |
| 4.2. Gear   |                |
| 4.3. Keys, splines, cutter and pin  |                |
| 4.4. Bearing, coupling, journal   |                |
| 4.5. Spring   |                |
| 4.6. Connecting rod   |                |
| 4.7. Pistons  |                |
| 4.8. Eccentric shaft/cam shaft  |                |
| 4.9. Rivets   |                |
| 4.10. Welding and material symbols  |                |



## **5. Automotive parts drawing**

**24 hrs.**

- 5.1. Simple sketch of
  - 5.1.1. Four stroke Diesel/petrol engine.
  - 5.1.2. Two stroke engine
  - 5.1.3. Valve diagram
  - 5.1.4. Hydraulic clutch operation
  - 5.1.5. Hydraulic brake operation
  - 5.1.6. Diesel fuel line
  - 5.1.7. Transmission system
  - 5.1.8. Steering geometric angle

### **Reference Books:**

1. Machine Drawing, N Sidhewar, P. Kanniah, V.V.S. sastry, TaTa McGraw
2. Machine Drawing, P.S. Gill, Katsan Publishing House, Ludiana
3. A Text book of Engineering Drawing, R.B. Gupta, Satya Prakasan, Technical India
4. Mechanical Draughtsmanship, G.L. Tamta, Dhanpat Rai & Sons, Delhi
5. Geometrical and Machine Drawing, N.D. Bhatt, Cheroter book stalls, Anand, West Railway
6. Engineering Drawing, D.N. Ghose, Dhanpat Rai & Sons, Delhi
7. Automotive Technology, W. Chrouse, MC Graw Hill Publication p. Ltd.

**1. DRAW MACHINE DRAWING****24 hrs**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Draw detail workshop drawing of machine parts	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Detail drawing of               <ul style="list-style-type: none"> <li>• Machine Vice</li> <li>• Plummer Block</li> <li>• Universal Coupling</li> <li>• Spigot &amp; Cotter joint</li> <li>• Connecting rod</li> </ul> </li> </ul>	1 H	7H
2.	Draw assemble drawing from detail drawing	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Assemble drawing of               <ul style="list-style-type: none"> <li>• Sleeve &amp; Cotter joint</li> <li>• Knuckle joint</li> <li>• Stuffing Box</li> <li>• Screw Jack</li> <li>• Foot step bearing</li> </ul> </li> </ul>	1 H	7H
3.	Draw exploded drawing of simple machine	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Importance</li> <li>• Exploded drawing               <ul style="list-style-type: none"> <li>• Shock</li> <li>• Crank</li> <li>• Cam</li> </ul> </li> </ul>	1 H	7H

**2. DRAW AUTO ELECTRICAL/ELECTRONIC DRAWING****18 hrs**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Draw symbols of auto electrical.	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5 H	1.5 H
2.	Draw parking/head light circuit	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5 H	1.5 H
3.	Draw turn light/hazard light circuit	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5 H	1.5 H
4.	Draw brake/reverse light circuit	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5 H	1.5 H
5.	Draw ignition circuit	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5 H	1.5 H
6.	Draw starting circuit	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5 H	1.5 H
7.	Draw charging circuit	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5 H	1.5 H

	(alternator/dynamo)			
8.	Draw various indicators and meter circuits.	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5 H	1.5 H
9.	Draw complete auto electrical system	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	0.5 H	1.5 H

### 3. DRAW DEVELOPMENT

21 hrs

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Develop a pattern of square box (prism).	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Pattern</li> <li>• Template</li> <li>• Margin</li> </ul>	2 H	1H
2.	Develop a pattern of right cone	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Pattern</li> <li>• Template</li> <li>• Margin</li> </ul>	1 H	2 H
3.	Develop a pattern of right square/hexagonal pyramid	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Pattern</li> <li>• Template</li> <li>• Margin</li> </ul>	1 H	2 H
4.	Develop a pattern of right cylinder	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Pattern</li> <li>• Template</li> <li>• Margin</li> </ul>	1 H	2 H
5.	Develop a pattern of truncated cone	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Pattern</li> <li>• Template</li> <li>• Margin</li> <li>• True shape</li> <li>• Truncated</li> </ul>	1 H	2 H
6.	Develop a pattern of truncated pyramid	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Pattern</li> <li>• Template</li> <li>• Margin</li> </ul>	1 H	2 H
7.	Develop a pattern of truncated	<ul style="list-style-type: none"> <li>• Concept</li> </ul>	1 H	2 H

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
	cylinder	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Pattern</li> <li>• Template</li> <li>• Margin</li> </ul>		

#### 4. Draw Machine Elements

30 hrs.

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	Draw screw, thread, nut and bolt	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Representation of thread</li> </ul>	1 H	2H
2.	Draw gear	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Gear nomenclature</li> <li>• Types some</li> </ul>	1 H	2H
3.	Draw keys, splines, cutter and pin	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Types</li> </ul>	1 H	2H
4.	Draw bearing, coupling, journal	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Types</li> </ul>	1 H	2H
5.	Draw spring	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> <li>• Types</li> </ul>	1 H	2H
6.	Draw connecting rod	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> </ul>	1 H	2H
7.	Draw pistons	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> </ul>	1 H	2H
8.	Draw eccentric shaft/cam shaft	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Introduction</li> </ul>	1 H	2H
9.	Draw rivets and riveted joint	<ul style="list-style-type: none"> <li>• Concept of rivet</li> <li>• Importance</li> <li>• Types</li> <li>• Application</li> <li>• Types of some joint(But/Lap)</li> </ul>	1 H	2H
10.	Draw welding and material symbols	<ul style="list-style-type: none"> <li>• Concept</li> <li>• Importance</li> <li>• Types</li> <li>• Application</li> </ul>	1 H	2H

**5. Automotive parts drawing****24 hrs.**

S.No.	Tasks Statements	Related Technical Knowledge	Time	
			Demo	Practice
1.	5.1. Draw simple sketch of <ul style="list-style-type: none"><li>• Four stroke Diesel/petrol engine.</li><li>• Two stroke engine</li><li>• Valve diagram</li><li>• Hydraulic clutch operation</li><li>• Hydraulic brake operation</li><li>• Diesel fuel line</li><li>• Transmission system</li><li>• Steering geometric angle</li></ul>	<ul style="list-style-type: none"><li>• Concept</li><li>• Introduction</li><li>• Representation</li></ul>	5H	19H

# Computer Aided Drafting

**Total class: 78 hrs**

**Class/week: 2 hrs**

**Course Description:**

This course intends to impart the knowledge and skills required to create two dimensional (2D) drawing and drafting using Computer Aided Drafting (CAD) software with a focus mainly on civil engineering drawings. The course is designed to fulfill specific needs of student who wants the transition from a paper to electronic drawing world by means of using CAD as a drafting tool. Students develop competencies focusing mainly on different features such as Geometric shapes, Layers and Line types, annotating a drawing with Text, Hatching and Dimensioning and creating output.

**Prerequisite:**

- Engineering Drawing
- Basic Computer Application

**Module: 1 Computer Fundamentals (Review)**

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
1.	Apply basic computer skills	<ul style="list-style-type: none"> <li>▪ Overview of a computer operating system and peripherals (printers and plotters, system settings and the windows environment)</li> <li>▪ Application Packages (Microsoft office package or equivalent)                             <ul style="list-style-type: none"> <li>• Word Processing package (MS Word or equivalent)</li> <li>• Spreadsheet Package (MS Excel or equivalent)</li> <li>• Presentation Package (MS Power Point or equivalent)</li> </ul> </li> <li>▪ Basic concept of E-mail/ Internet</li> <li>▪ Computer handling</li> <li>▪ Open, save, save as, cut, copy, paste etc</li> </ul>	2	1
	<b>Sub total</b>		<b>2.00</b>	<b>1.00</b>

**Module: 2 Familiarize Computer Aided Drafting (CAD) Software**

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
1.	Startup Computer Aided Drafting (CAD) software	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Enlist different types of CAD software.</li> <li>▪ System requirement for CAD</li> <li>▪ Startup CAD by start menu</li> <li>▪ Interpret CAD graphics window including screen layout, pull-down menus, screen icons, command line and dialogue boxes.</li> <li>▪ Modify display</li> <li>▪ Introduce and arrange toolbar</li> <li>▪ Managing unit/limit</li> <li>▪ Start, organize and save file</li> </ul>	1	1
2.	Setup a Drawing	<ul style="list-style-type: none"> <li>▪ Explain how to start drawing from scratch, using wizard and, using and creating a template file.</li> <li>▪ Describe setting preferences (units, angle, direction, area)</li> </ul>	0.25	0.5
3	Manage toolbar	<ul style="list-style-type: none"> <li>▪ Standard tool bar</li> <li>▪ Draw tool bar</li> <li>▪ Modify toolbar</li> <li>▪ Dimensioning tool bar</li> <li>▪ Other</li> </ul>	0.25	0.5
	<b>Sub total</b>		<b>1.50</b>	<b>2.00</b>

**Module: 3 Construct 2-D drawing using CAD Software**

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
1.	Draw lines	<ul style="list-style-type: none"> <li>▪ Different system Relative, Cartesian and absolute coordinate system.</li> <li>▪ Start and end point of a line</li> <li>▪ Different methods of drawing a line in CAD</li> <li>▪ Options available in drawing line in CAD (Undo, Close)</li> </ul>	1.50	1.00
2.	Draw rectangle	<ul style="list-style-type: none"> <li>▪ Corner points (first and other)</li> <li>▪ Options available in drawing rectangle (chamfer, fillet)</li> </ul>	0.25	0.50

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
		<ul style="list-style-type: none"> <li>▪ Chamfer distance</li> <li>▪ Fillet radius</li> </ul>		
3.	Draw arc	<ul style="list-style-type: none"> <li>▪ Identify arc among various types of geometric shapes.</li> <li>▪ Describe different options for drawing arc (3 points method, Start Center method, Start End method, Center Start method)</li> </ul>	0.25	0.75
4.	Draw circle	<ul style="list-style-type: none"> <li>▪ Describe different options for drawing arc (Center Radius method, Center Diameter method, 2P method, 3P method, Tan, Tan Radius method, Tan, Tan, Tan method)</li> </ul>	0.25	0.50
5.	Draw polygon	<ul style="list-style-type: none"> <li>▪ Describe different options for drawing polygon (center, edge)</li> </ul>	0.25	0.50
6.	Manage lines	<ul style="list-style-type: none"> <li>▪ Line properties</li> <li>▪ Line weight</li> <li>▪ Line color</li> <li>▪ Line loading</li> </ul>	0.25	0.50
7.	Draw an isometric drawing	<ul style="list-style-type: none"> <li>▪ Concept Isometric snap and rectangular snap</li> <li>▪ Setting of isometric snap</li> </ul>	0.50	1.00
8.	Draw ellipse	<ul style="list-style-type: none"> <li>▪ Ellipse in rectangular snap <ul style="list-style-type: none"> <li>• Center Radius method</li> <li>▪ Center Diameter method</li> </ul> </li> <li>▪ Ellipse in isometric snap</li> </ul>	0.50	0.75
	<b>Sub total</b>		<b>2.00</b>	<b>4.00</b>

#### Module: 4 Edit drawing using CAD Software

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
1.	Relocate object using Move command	<ul style="list-style-type: none"> <li>▪ Different methods of selecting objects for editing such as window, crossing, fence, all ... <ul style="list-style-type: none"> <li>• Base point</li> <li>▪ Second point of displacement</li> </ul> </li> </ul>	0.25	0.50



S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
2.	Relocate object using rotate command	<ul style="list-style-type: none"> <li>▪ Define rotation angle</li> <li>▪ Explain Reference Point.</li> </ul>	0.25	0.50
3.	Duplicate object using Copy command	<ul style="list-style-type: none"> <li>▪ Differentiate between multiple copy and Single copy.</li> <li>▪ Explain the procedure for duplicating object using copy command.</li> </ul>	0.25	0.50
4.	Duplicate object using Mirror command	<ul style="list-style-type: none"> <li>▪ State the purpose of Mirror.</li> <li>▪ Explain First point and Second point of mirror line</li> <li>▪ Second point of mirror line</li> <li>▪ Describe options available in mirror command</li> </ul>	0.25	1.00
5.	Duplicate object using Offset command	<ul style="list-style-type: none"> <li>▪ Describe options available for <ul style="list-style-type: none"> <li>▪ Offset distance</li> <li>▪ Through</li> </ul> </li> </ul>	0.25	1.00
6.	Duplicate object using Array command	<ul style="list-style-type: none"> <li>▪ Differentiate Rectangular Array and Polar Array</li> <li>▪ Explain Rows, Columns and Distance, Center point, number, angle and rotation</li> </ul>	0.25	1.00
7.	Modify object using trim command	<ul style="list-style-type: none"> <li>▪ Define Cutting edge</li> <li>▪ Explain the options available for trimming object (project, edge, undo)</li> </ul>	0.25	0.50
8.	Modify object using extend command	<ul style="list-style-type: none"> <li>▪ Define Boundary edge</li> <li>▪ State the procedure for modifying object using Extend command.</li> </ul>	0.25	1.00
9.	Modify object using fillet command	<ul style="list-style-type: none"> <li>▪ Differentiate Chamfer and Fillet.</li> <li>▪ Explain the options available for filleting object i.e. fillet radius</li> </ul>	0.25	0.50
10.	Modify object using chamfer command	Explain the options available for chamfering object i.e. Distance, angle	0.25	0.50
	<b>Sub total</b>		<b>2.50</b>	<b>7.00</b>

**Module: 5 Annotate a drawing with Text, layer, lock, Hatching and Dimensioning**

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
1.	Create a Layer	<ul style="list-style-type: none"> <li>▪ Define Layer.</li> <li>▪ Explain different attributes and properties of a Layer (Line type, line weight, Global Scale Factor, Current Object Scale, Names, Of/Off, Freeze/Thaw, Lock/unlock, Color, Plot style, Plot/don't plot)</li> <li>▪ Explain the procedure for creating a layer.</li> </ul>	0.75	2.00
2.	Create text styles.	<ul style="list-style-type: none"> <li>▪ Differentiate Single line text [TEXT] and Multiline Text [MTEXT]</li> <li>▪ Explain Style name, Font Name, Style and Height</li> <li>▪ Describe Font effect, Width factor and Oblique angle</li> <li>▪ Explain the procedure for creating text styles.</li> </ul>	0.50	1.00
3.	Add Single/Multiple line text to a drawing		0.25	1.00
4.	Edit text using these commands and methods.	<ul style="list-style-type: none"> <li>▪ Multiline Text Editor                             <ul style="list-style-type: none"> <li>• Character</li> <li>• Properties</li> <li>• Line spacing</li> <li>• Find/replace, import text</li> </ul> </li> <li>Layer and symbol</li> </ul>	0.25	1.00
5.	Hatch the sectional area	<ul style="list-style-type: none"> <li>▪ Define hatching.</li> <li>▪ Differentiate ISO Hatch Pattern, User Defined Hatch Pattern, Pre-Defined Hatch and Associative Hatch</li> <li>▪ Explain Boundary set, copying of hatch properties, pick point, hatch angle, scale, pattern, and object selection.</li> <li>▪ modify the hatched pattern</li> </ul>	0.50	2.00

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
6.	Create Block	<ul style="list-style-type: none"> <li>▪ Definition</li> <li>▪ Name</li> <li>▪ Pick point</li> <li>▪ selection</li> </ul>	0.25	1.00
7.	Add dimensions to a drawing	<ul style="list-style-type: none"> <li>▪ Interpret dimension elements (dimension text, lines and arrowheads, leader, extension lines, units, tolerance and center marks)</li> <li>▪ Describe dimension types (linear, aligned, ordinate, radius, diameter, angular, baseline and continue)</li> <li>▪ Dimension dialog box <ul style="list-style-type: none"> <li>▪ Lines and arrow</li> <li>▪ Dimension and text</li> <li>▪ Fit</li> <li>▪ Unit</li> <li>▪ Tolerances</li> </ul> </li> <li>▪ Modify Dimension style</li> <li>▪ Dimension in isometric drawing</li> </ul>	0.50	2.00
	<b>Sub total</b>		<b>3.00</b>	<b>10.00</b>

**Module: 6 Create output**

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
1.	Configure Plotters/Printers	<ul style="list-style-type: none"> <li>▪ Define Plotter Manager</li> <li>▪ Explain Plot Style Manager</li> <li>▪ State the Printer/Plotter Installation process</li> </ul>	0.5	1.0

S.N.	Task Statements	Related Technical Knowledge	Time (hrs)	
			T	P
2.	Plot drawing	<ul style="list-style-type: none"> <li>▪ Explain paper size and paper units, drawing orientation, plot area and plot scale, plot offset.</li> <li>▪ Describe the procedure for printing a drawing.</li> </ul>	0.5	1.0
	<b>Sub total</b>		<b>1.00</b>	<b>2.00</b>

### Project works

1.	Following drawings are to be prepared and submitted (e-copy and hard copy both) using CAD software. <ul style="list-style-type: none"> <li>• Draw an Isometric drawing</li> <li>• Draw an Oblique drawing</li> <li>• Draw Orthographic drawing</li> <li>• Draw Workshop drawing</li> <li>• Give dimension(Orthographic, Isometric)</li> </ul>	0	42.0
	<b>Sub total</b>	<b>0</b>	<b>42.0</b>
	<b>Total</b>	<b>12</b>	<b>68</b>
	<b>Grand total</b>	<b>78</b>	

### Suggested texts and references:

- Kognet learning solution, *Simple steps in AutoCAD*, Dream tech press, India
- George Omura, *Mastering AutoCAD 2013 and AutoCAD LT 2013*, India

## Automotive Technology - II

Total Class: 29 hrs./week  
Theory: 4 hrs/week  
Practical: 25 hrs/week

### Course description:

This subject deals with main components of automobile system with their importance, function, working principle, types, trouble shooting and safety precautions related to automobile engine and auto electrical and electronics system.

### Theory

#### A. Automobile engine

#### 1. Engine

18 hrs.

- 1.1. Introduction, history and development of automobile engine.
- 1.2. Technical terms used in related to the automobile engine.
- 1.3. Types of internal combustion engine.
  - Spark ignition engine.
  - Compression ignition engine.
- 1.4. Two stroke and four stroke cycle engine.
- 1.5. Operation of spark ignition engine and compression ignition engine
- 1.6. Function and types of combustion chamber.
- 1.7. Importance, function and types of engine components.
- 1.8. Turbo charger & supercharger.

#### 2. Valve and valve mechanism

4 hrs.

- 2.1. Functions of valves.
- 2.2. Construction of valve
- 2.3. Types of valve operating mechanism.
  - 2.3.1. Side valve mechanism
  - 2.3.2. Overhead valve mechanism
- 2.4. Importance of valve timing.
- 2.5. Valve timing diagram & valve overlap
- 2.6. Trouble shooting.

#### 3. Piston and piston rings.

6 hrs.

- 3.1. Function of piston
- 3.2. Construction & types of piston
- 3.3. Function of piston rings.
- 3.4. Construction and types of piston rings
- 3.5. Piston ring gap & side play, clearance
- 3.6. Trouble shooting.

#### 4. Connecting rod, piston pin, and crankshaft

6 hrs.

- 4.1. Function of connecting rod
- 4.2. Construction of connecting rod.
- 4.3. Function of piston pin.

- 4.4. Function of crankshaft.
  - 4.5. Construction of crankshaft
  - 4.6. Construction of main and connecting rod bearing/shells.
  - 4.7. Trouble shooting.
- 5. Flywheel** **2 hrs.**
- 5.1. Function and construction of flywheel.
  - 5.2. Significance of the timing mark on the flywheels.
- 6. Vibration damper.** **4 hrs.**
- 6.1. Need of vibration damper
  - 6.2. Following types of vibration damper
    - 6.2.1. Rubber type vibration damper.
    - 6.2.2. Friction - type vibration damper
    - 6.2.3. Fluid - type vibration damper
- 7. Camshaft** **2 hrs.**
- 7.1. Function of camshaft.
  - 7.2. Construction of camshaft.
  - 7.3. Following types of camshaft drive mechanism.
    - 7.3.1. Camshaft gear drive
    - 7.3.2. Camshaft chain or sprockets drive
    - 7.3.3. Camshaft toothed pulley and belt drive
  - 7.4. Trouble shooting.
- 8. Cooling system** **8 hrs.**
- 8.1. Operation of the cooling system
  - 8.2. Following types of cooling system.
    - 8.2.1. Direct air cooling system
    - 8.2.2. Indirect or liquid (coolant) cooling system
      - Thermo siphon system
      - Pump circulation system
    - 8.2.3. Pressure sealed cooling system
    - 8.2.4. Evaporative cooling or steam cooling system
  - 8.3. Following components of water cooling system.
    - 8.3.1. Radiator (Tube and fine type, Film type, Air tube type)
    - 8.3.2. Water pump (Impeller type, Centrifugal type)
    - 8.3.3. Fan (Belt drive, Electric drive, Viscous)
    - 8.3.4. Thermostat (Bellows - type thermostat, Wax - element type thermostat)
    - 8.3.5. Thermo time switch
  - 8.4. Function of radiator cap.
  - 8.5. Water jacket
  - 8.6. Coolant
  - 8.7. Identify the causes for the engine overheating and their remedies.
- 9. Lubricating system** **12 hrs.**
- 9.1. Working principle of lubrication system.
  - 9.2. Function of engine oil.

- 9.3. Properties of engine oil
- 9.4. Viscosity rating or number or grades of oil
  - 9.4.1. API
  - 9.4.2. SAE
- 9.5. Viscosity index (IV)
- 9.6. Reasons for using following engine oil additives
  - 9.6.1. Film strength agents
  - 9.6.2. Oxidation inhibitors.
  - 9.6.3. Corrosion and rust inhibitors
  - 9.6.4. Forming resistance
  - 9.6.5. Extreme - pressure resistance
- 9.7. Types of lubrication system.
  - 9.7.1. Oil mixed with petrol or mist lubrication system.
  - 9.7.2. Splash lubrication system
  - 9.7.3. Pressure lubrication system
- 9.8. Main parts of lubrication system.
  - 9.8.1. Oil sump or oil pan (Dry sump, Wet sump)
  - 9.8.2. Oil pump (Gear pump, Rotor pump, Plunger pump, Vane type pump)
  - 9.8.3. Pressure relief valve
  - 9.8.4. Oil filter
  - 9.8.5. Oil gallery
  - 9.8.6. Oil cooler
- 9.9. Types of filtration system.
  - 9.9.1. By pass system
  - 9.9.2. Full flow system
- 9.10. Function of oil pressure indicator
- 9.11. Function of crankcase ventilation system
- 9.12. Trouble shooting of lubricating system.

#### **10. Air cleaner and exhaust muffler**

**4 hrs.**

- 10.1. Introduction
- 10.2. Function of air cleaner
- 10.3. Types of air cleaner
  - 10.3.1. Dry type air cleaner
  - 10.3.2. Oil bath type air cleaner
  - 10.3.3. Oil saturated type air cleaner
  - 10.3.4. Thermostatically controlled air cleaner
- 10.4. Function and construction of exhaust manifold, exhaust pipe, and muffler.

#### **11. Petrol fuel system**

**14 hrs.**

- 11.1. Define the petrol fuel system
- 11.2. Following main parts of the petrol fuel system
  - 11.6.1. Fuel tank
  - 11.6.2. Fuel pipe line of filter
  - 11.6.3. Fuel pump (Mechanical fuel pump, Electrical fuel pump)
- 11.3. Introduction to carburetor
- 11.4. Function of carburetor
- 11.5. Principle of simple carburetor

- 11.6. Classification of carburetor.
  - 11.6.1. According to the air flow
    - Up draft
    - Down draft
    - Horizontal or side draft
  - 11.6.2. According to the arrangement of float chamber
    - Eccentric
    - Concentric
  - 11.6.3. According to the types of metering system
    - Metering pin type
    - Air bleed jet
  - 11.6.4. According to the number of units
    - Single
    - Double
    - Four barrel
  - 11.6.5. According to the types of venturi
    - Plain venturi
    - Double venturi
    - Vane venturi
  - 11.6.6. According to the types of fuel pressure in the float chamber.
    - Unbalanced carburetor or
    - Balanced carburetor
  - 11.6.7. According to the types of power system
    - Manually operated
    - Vacuum controlled
- 11.7. Fuel supply circuits of carburetor
  - 11.7.1. Idling or slow running fuel supply circuit
  - 11.7.2. Main metering of fuel supply circuit
  - 11.7.3. Power fuel supply circuit
  - 11.7.4. Accelerating pump circuit
    - Plunger type
    - Mechanically actuated diaphragm type
    - Pneumatically operated.
  - Choke circuit or cold starting circuit
    - Manual choke
    - Automatic choke
- 11.8. Trouble shooting.

## 12. Diesel fuel system

12 hrs.

- 12.1. Following main parts of the diesel fuel feed system
  - 12.1.1. Fuel tank
  - 12.1.2. Fuel lines
  - 12.1.3. Pre - filter
  - 12.1.4. Fuel feed pump or transfer pump
  - 12.1.5. Fuel filter
  - 12.1.6. Injection pump
  - 12.1.7. Injectors
  - 12.1.8. Water separator



- 12.2. Function and types of diesel fuel filter
- 12.3. Function and construction of fuel feed pump
- 12.4. Function and types of injection pump.
- 12.5. Function and types of governor of injection pumps
- 12.6. Hydraulic advance mechanism of delivery in distributor pump
- 12.7. Function and types of fuel injector.
- 12.8. Trouble shooting.

## **B. Auto Electrical and Electronics System**

### **13. Automobile electrical/electronics**

**6 hrs.**

- 13.1. Simple electric circuit
  - 13.1.1. Series circuit
  - 13.1.2. Parallel circuit
  - 13.1.3. Open circuit
  - 13.1.4. Short circuit
- 13.2. Direct and indirect currents
- 13.3. Measuring instruments:-
  - 13.3.1. Ammeter
  - 13.3.2. Voltmeter
  - 13.3.3. Ohmmeter
- 13.4. Ohm's law
- 13.5. Types of resistance
  - Series circuit resistance
  - Parallel circuit resistance
  - Series - parallel circuit resistance
- 13.6. Insulators and conductors
- 13.7. Electrical symbols used in automobile.

### **14. Automobile Battery**

**4 hrs.**

- 14.1. Introduce the battery
- 14.2. Cell and plates
- 14.3. Electrolyte.
- 14.4. Construction of battery
  - Plats
  - Cell elements
  - Cell covers
  - Cell connector
- 14.5. Chemical action during discharging and charging
- 14.6. General maintenance of battery
- 14.7. Methods of battery charging
  - Slow charge method
  - Quick charge method
  - Trickle charge method
- 14.8. Testing methods of charged battery
  - Specific gravity test
  - High rate discharge test
  - Voltage test

### **15. Ignition system**

- 15.1. Define the ignition system

- 15.2. Function of ignition system.
- 15.3. Components of ignition system.
  - Ignition coil
  - Condenser
  - Distributor
  - Spark plug
- 15.4. Operating principle of ignition system.
- 15.5. Ignition circuits
  - Primary
  - Secondary
- 15.6. Spark advance mechanism.
  - Vacuum
  - Centrifugal
- 15.7. Setting ignition timing and checking dwell angle (cam angle)
- 15.8. Overview of spark plug.
- 15.9. Electronic ignition system.
  - Hall
  - Induction
- 15.10. Identify the causes and their remedies ignition system.

## **16. Charging system**

**12 hrs.**

- 16.1. Function of charging system
- 16.2. Charging circuits
- 16.3. Basic principle of generator
- 16.4. Main parts of simple generator
  - Armature
  - Pole shoes
  - Commutator
  - Carbon brushes
  - Field circuit
  - Body or housing
  - Auxiliary units
  - Cutout relay
  - Voltage regulator
  - Current regulator
- 16.5. Introduction to alternator
- 16.6. Basic principle of alternator
- 16.7. Basic construction of alternator
  - Rotor assembly
  - Stator assembly
  - Diodes
- 16.8. Types of alternator regulator
- 16.9. Disadvantages of D.C. generator
- 16.10. Advantages of A.C. Generator (alternator)
- 16.11. Identify the causes of their remedies the charging system.

## **17. Starting system**

**10 hrs.**

- 17.1. Introduction to starting system
- 17.2. Function of starter motor
- 17.3. Starter motor circuits
  - The four - pole two winding type

- The four - pole four winding type
  - Six - pole six - winding type
  - Series - shunt would type
- 17.4. Starter motor drives
- 17.5. Types of starter motor drives
- Bendix drive
  - Barrel bendix drive
  - Bendix folo - thru drive
  - Over running clutch drive
  - Reduction gear starter motor
- 17.6. Starter motor controls and circuits.
- 17.7. Construction of the solenoid switch
- 17.8. Function of the solenoid switch
- 17.9. Identify the causes and their remedies for starting system

## **18. Lighting and auxiliary equipment**

**8 hrs.**

- 18.1. Exterior lights generally used on the car.
- Head light
  - Reverse light
  - Park, tail and number plate light
  - Stop light
  - Turn signal light/hazard light.
  - Fog light, Dom light
- 18.2. Purpose and operation of the exterior light
- 18.3. Interior light generally used on the car.
- Dash lights
  - Engine oil pressure indicator
  - Engine coolant temperature indicator
  - Charging indicator
  - Fuel gauge
  - Speedometer
  - Brake failure warning light
  - Turn signal indicator
  - High beam warning light
  - Park brake "on" indicator
  - The window demister "ON" indicator
  - The tachometer or clock
  - The courtesy lights
- 18.4. Major components of car operated by electricity
- Horn
  - Windscreen wipers and washers
  - Heater and demisters
  - Power window,
  - Center locking
  - Immobilizer
- 18.5. Following ancillaries
- Cigarette lighter
  - Clock
  - Radio / cassette player
  - Extra light or fog light

- 18.6. Purpose and function of fuses
- 18.7. Relation between cable sizes and current carrying capacity of cables.
- 18.8. Trouble shooting.

### **19. Multi Point/port Fuel Injection System**

**12 hrs.**

- 19.1. Overview of MPFI/EFI/CRDI system.
- 19.2. Overview of electronic ignition system.
- 19.3. Engine management system.
- 19.4. Overview of emission control system.
- 19.5. Components/devices used to control pollution.
- 19.6. Function and types of sensors and actuators.
- 19.7. Trouble shooting.

### **References Books:**

1. William H. Crouse, Automotive Engines, Tata McGraw Hill Company, New Delhi
2. Crouse, Anglin, Automotive Mechanics, Tata McGraw Hill Company, New Delhi
3. K. M. Moeed, Automobile Engineering, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
4. R.K. Mohanty, Automobile Engineering Volume I & II, Standard Book House, 1705A Naisarak, Delhi, 110006
5. P. S. Gill, A Text book of Automobile Engineering Volume I & II, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
6. Dr. Kripal Singh, Automobile Engineering Volume I & II, Standard Publishers Distributors, Naisarak, Post box 1066, Delhi, 110006
7. A. S. Rangwala, Trends in Automobile Engineering, New Age International Publishers
8. R.K. Singal, Automobile Engineering, S. K. Kataria and sons, Ansari Road, Daryagunj, New Delhi, 110002
9. G.B. S. Narang, Automobile Engineering, Khanna Publishers
10. Dr. Harbans Singh Reyat, The Automobile, S. Chand and Company Ltd., New Delhi
11. V.M. Domkundwar, A Course in International Combustion Engine, Dhanpat Rai & Company, New Delhi
12. H. Gerscher, Technology for Automotive Trade Volume 1 & 2, GTZ
13. H.M. Sethi, Automotive Technology, Tata MCGraw-Hill Publishing Company Ltd., New Delhi
14. S. Srinivasan, Automotive Mechanics, Tata Mc Graw Hill Publishing Company Limited, New Delhi
15. P. L. Kohli, Automotive Electrical Equipment, Tata Mc Graw Hill Publishing Company Limited, New Delhi

## Practical

### A. Automotive Engine

Duty: - Service and Repair Engine

S. N.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Apply safety measures handle of tools, measuring instruments & engine	<ul style="list-style-type: none"> <li>• Safety rules.</li> <li>• Safety precautions.</li> <li>• Care and uses of hand tools.</li> <li>• Handle of special servicing tools.</li> <li>• Handle of measuring instruments</li> <li>• Working principles of an engine.</li> <li>• Reading of workshop manuals</li> </ul>	12 H	3 H
2.	Remove/ Replace turbo charger/super charger.	<ul style="list-style-type: none"> <li>• Interpretation of service manual.</li> <li>• Purpose, application and identification of turbocharger/supercharger/Intercooler</li> <li>• Working principles and functions of turbocharger/supercharger.</li> <li>• Technical terms associated with turbocharger/supercharger.</li> <li>• Difference between naturally aspirated and turbo charged engine.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	8 H	2 H
3.	Remove/ Replace manifolds	<ul style="list-style-type: none"> <li>• Importance and identification of manifolds.</li> <li>• Function and types of manifolds.</li> <li>• Purpose, uses and types of manifold gaskets.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	4 H	1 H
4.	Remove/ Replace/assemble cylinder head	<ul style="list-style-type: none"> <li>• Importance and identification of cylinder head components.</li> <li>• Function and types of valves.</li> <li>• Valve guide replacing process.</li> <li>• Valve seat cutting/ remove</li> <li>• Valve lapping and oil clearance.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	10 H	2 H

5.	Remove/ Replace piston rings	<ul style="list-style-type: none"> <li>• Introduction, identification of piston &amp; rings.</li> <li>• Types of piston/rings.</li> <li>• Importance of piston rings.</li> <li>• Measure piston rings end gap &amp; piston to cylinder bore</li> <li>• Seating piston rings &amp; piston.</li> <li>• Trouble shooting.</li> <li>• Safety precaution.</li> <li>• Function and types of piston rings.</li> </ul>	12 H	2 H
6.	Replace connecting rod bearings	<ul style="list-style-type: none"> <li>• Working principle of connecting rod.</li> <li>• Purpose, importance of bearings.</li> <li>• Check side play &amp; replace connecting rod.</li> <li>• Trouble shooting.</li> </ul>	8 H	2 H
7.	Replace crank oil seal	<ul style="list-style-type: none"> <li>• Purpose, importance of oil seal.</li> <li>• Crank oil seal replacing process</li> <li>• Trouble shooting.</li> </ul>	6 H	2 H
8.	Replace main bearings	<ul style="list-style-type: none"> <li>• Working principle of crankshaft and connecting rods.</li> <li>• Purpose, importance of main bearings.</li> <li>• Technical terms associated with main bearings.</li> <li>• Types and sizes of main bearings.</li> <li>• Concept of measurement and measuring instrument.</li> <li>• Handling of measuring instrument and measuring process.</li> <li>• Trouble shooting.</li> </ul>	5 H	2 H
9.	Install piston and connecting rod.	<ul style="list-style-type: none"> <li>• Introduction, identification of engine.</li> <li>• Engine terminology and parameters.</li> <li>• STD and oversize of ring piston.</li> <li>• Measurement and measuring tools.</li> <li>• Measuring technique tighten torque.</li> <li>• Trouble shooting.</li> <li>• Safety precaution.</li> </ul>	10 H	2 H

10.	Replace crank pulley and vibration damper	<ul style="list-style-type: none"> <li>• Interpretation of manufacturer's service manuals.</li> <li>• Importance and identification of crank pulley and vibration damper.</li> <li>• Working principles, function and types of crank pulley and vibration damper.</li> <li>• Replace crank pulley &amp; vibration damper.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	8 H	2 H
11.	Replace camshaft tappets	<ul style="list-style-type: none"> <li>• Types of camshaft tappets.</li> <li>• Purpose, importance, types and identification of camshaft.</li> <li>• Technical terms associated with camshaft.</li> <li>• Concept of measurement and measuring instrument.</li> <li>• Handling of measuring instrument and measuring process.</li> <li>• Replace camshaft tappets</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	8 H	1 H
12	Measurements of Engine components	<ul style="list-style-type: none"> <li>• Measurement of Ovality and Taperness of <ul style="list-style-type: none"> <li>• Main journals</li> <li>• Big End Journals</li> <li>• Camshaft journal</li> <li>• Cylinder Bore</li> </ul> </li> <li>• Measurement of Piston Diameter</li> </ul>	8 H	2 H
13	Remove/replace Air cleaner	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Identification, types and uses of Air cleaner</li> <li>• .Clean/ Remove/replace Air cleaner</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	2 H	1 H
14.	Replace oil filter	<ul style="list-style-type: none"> <li>• Purpose, importance and types of oil filter.</li> <li>• Replace oil filter</li> <li>• Trouble shooting.</li> </ul>	5 H	2 H
15.	Replace flywheel housing	<ul style="list-style-type: none"> <li>• Importance, identification and Working principle of flywheel.</li> <li>• Purpose and function of power balance.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	6 H	1 H

16.	Replace fuel injection pump of CI engine	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Identification, types and uses of electrical connectors.</li> <li>• Purpose, identification, types and applications of fuel injection pumps.</li> <li>• Working principles and functions of the fuel injection pump.</li> <li>• Fuel injection pumps timing process.</li> <li>• Identification, types and parts of fuel injection pumps.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	10 H	2 H
17.	Change gasket set	<ul style="list-style-type: none"> <li>• Interpretation of manufacturer's service manuals.</li> <li>• Identify the types and parts of gasket, oil seal and o-rings.</li> <li>• Identify and demonstrate methods of engine rebuilding.</li> <li>• Recognize, analyze and solve or trouble shoot.</li> <li>• Apply safety precautions.</li> </ul>	12 H	3 H
18.	Set timing gears, chain/belt	<ul style="list-style-type: none"> <li>• Interpret manufacturer's service manuals.</li> <li>• Define the technical terms associated with engine.</li> <li>• Identify the types and parts of valve timing.</li> <li>• Identify timing marks.</li> <li>• Set timing gears, chain/belt</li> <li>• Recognize, analyze and solve or trouble shoot problems.</li> <li>• Apply safety precautions.</li> </ul>	20 H	3 H
19.	Set/ adjust tappet /valve clearance	<ul style="list-style-type: none"> <li>• Importance, identification and Working principle of four-stroke cycle.</li> <li>• Purpose and function of valve /tappet clearance.</li> <li>• Methods of tappet adjustment process.</li> <li>• Shim Selection in overhead cam shaft.</li> <li>• Knowledge of HLA ( Hydraulic Lash Adjuster)</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	15 H	1 H



20.	Service/ repair spark plug	<ul style="list-style-type: none"> <li>• Interpretation of service manual</li> <li>• Working principle of spark plug</li> <li>• Selection of spark plug</li> <li>• Cleaning &amp; adjusting gap.</li> <li>• Safety precautions.</li> </ul>	5 H	2 H
21.	Inspect/change glow plug	<ul style="list-style-type: none"> <li>• Principle of working of glow plug</li> <li>• Principle of relay and its function</li> <li>• Principle of resistor and its function</li> <li>• Inspect/change glow plug</li> <li>• Safety precautions</li> </ul>	7 H	3 H
22.	Perform emissions testing using smoke analyzer	<ul style="list-style-type: none"> <li>• National emission norms</li> <li>• Principle of smoke analyzer</li> <li>• Use &amp; handle smoke Analyzer.</li> <li>• Safety precautions</li> </ul>	12 H	3 H
23.	Adjust injection timing	<ul style="list-style-type: none"> <li>• Principle of rotary fuel injection pump</li> <li>• Setting injection timing</li> <li>• Interpretation of service manual</li> </ul>	17 H	3 H
24.	Adjust idle speed and maximum speed	<ul style="list-style-type: none"> <li>• Principle of tachometer</li> <li>• What is idle speed and maximum engine speed</li> </ul>	5 H	2 H
25.	Check compression pressure	<ul style="list-style-type: none"> <li>• Operation of engine</li> <li>• Function of compressor and oil ring</li> <li>• Checking method of compression pressure.</li> <li>• Terms related to engine compression</li> <li>• Interpretation of service manual</li> <li>• Safety precautions</li> </ul>	10 H	3 H
26.	Diagnose engine problems	<ul style="list-style-type: none"> <li>• Engine mechanical</li> <li>• Ignition system</li> <li>• Fuel system</li> <li>• Cooling system</li> <li>• Engine electronics</li> <li>• Emission control devices</li> </ul>	42 H	8 H

**Duty: Service and Repair Cooling System.**

S. No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Change thermostat	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Importance, functions and types of cooling system</li> <li>• Principle of temp control sensor</li> <li>• Technical terms associated with cooling system.</li> <li>• Operating principles, function and types of thermostat.</li> <li>• Methods of testing thermostat.</li> <li>• Troubleshooting.</li> </ul>	5 H	2 H
2.	Seal leakage in cooling system	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Importance, functions, types and parts cooling system.</li> <li>• Technical terms associated with cooling system.</li> <li>• Methods of testing pressure and temperature.</li> <li>• Causes and effects of leaks.</li> <li>• Troubleshooting.</li> <li>• Safety precautions.</li> </ul>	12 H	3 H
3.	Repair/replace water pump	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Importance, types and parts of water pump.</li> <li>• Working principles and functions of water pump.</li> <li>• Technical terms associated water pump.</li> <li>• Water pump repairing/Replace process.</li> <li>• Troubleshooting.</li> <li>• Safety precautions.</li> </ul>	10 H	3 H

4.	Repair/replace radiator	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Importance, function, types and parts of radiator.</li> <li>• Working principles and functions of radiator.</li> <li>• Technical terms associated with radiator.</li> <li>• Radiator repairing/testing process.</li> <li>• Troubleshooting.</li> <li>• Safety precautions.</li> </ul>	8 H	2 H
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#### Duty: Service and Repair Lubricating System

S. No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Replace oil cooler	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Importance, advantages, functions of oil cooler.</li> <li>• Operating principles, types and parts of oil cooler.</li> <li>• Technical terms associated with oil cooler.</li> <li>• Process of repairing/testing cooler.</li> <li>• Troubleshooting.</li> <li>• Safety precautions.</li> </ul>	5 H	0 H
2.	Replace oil pump	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Working principles, function and types of oil pumps (gear type, vane type, rotor type, piston type etc.)</li> <li>• Importance, functions and parts of oil pump.</li> <li>• Working principle, functions and types of oil pump.</li> <li>• Principle of oil pressure sensors</li> <li>• Technical terms associated with oil pump.</li> <li>• Methods of repairing/testing oil pump.</li> <li>• Trouble shooting.</li> </ul>	5 H	2 H

**Duty: Service and Repair of Fuel System**

S. No.	Tasks Statements	Related Technical Knowledge	Time	
			Exercise	Demo
1.	Replace FI pump	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Identification, types and uses of electrical connectors.</li> <li>• Importance, purpose and applications of fuel injection pumps.</li> <li>• Working principles, functions and types of the fuel injection pump.</li> <li>• FI pump removing and replacing process.</li> <li>• Identification, types and parts of fuel injection pumps.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	13 H	2 H
2.	Repair/Replace/Set injector pressure	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Technical terms associate with injector.</li> <li>• Operating principles, functions and types of injector</li> <li>• Injector testing/Replace process.</li> <li>• Identification, types and parts of injector.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	12 H	8 H
3.	Remove/replace fuel tank	<ul style="list-style-type: none"> <li>• Interpretation service manuals.</li> <li>• Technical terms associate with fuel tank.</li> <li>• Identification the parts of fuel tank.</li> <li>• Working principles, functions and types of fuel tank.</li> <li>• Fuel tank removing, cleaning and replacing tank process.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	8 H	2 H

4.	Remove/replace EGR valve	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Importance and issues of vehicles pollution.</li> <li>• Technical terms associated with emission control system.</li> <li>• Purpose, operation and types of the EGR valve.</li> <li>• Technical terms associate with EGR valve.</li> <li>• Identification and parts of EGR valves.</li> <li>• Operating principles and functions of EGR valves.</li> <li>• Emission standards and government rules.</li> </ul>	4 H	1 H
5.	Vehicle Emission/Remove/replace Catalytic Converter	<ul style="list-style-type: none"> <li>• Interpretation service manuals.</li> <li>• Importance and purpose of emission / Pollution control and pollutant gases.</li> <li>• Present scenario of vehicle emission.</li> <li>• Purpose and operation of catalytic converter.</li> <li>• Technical terms associate with emission control.</li> <li>• Identification, types and parts of emission control devices.</li> <li>• Operating principles and functions of catalytic converter.</li> <li>• Emission gases testing process.</li> <li>• Gas analyzer</li> </ul>	7 H	5 H

6.	Remove/replace fuel feed pump	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Importance, purpose and types of fuel pumps.</li> <li>• Identification, selection and set up fuel pump.</li> <li>• Interpret the results of fuel pump tests.</li> <li>• Identification, types and uses of hose/electrical connectors and clamps.</li> <li>• Purpose and function of mechanical and electrical fuel pumps.</li> <li>• Technical terms associated with fuel pumps.</li> <li>• Types and parts of fuel pumps.</li> <li>• Working principles and functions of fuel pumps.</li> <li>• Fuel pump removing, replacing and testing process.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	20 H	3 H
7.	Overhaul Carburetor	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Technical terms associated with carburetors.</li> <li>• Importance, purpose, types of carburetors.</li> <li>• Working principles and functions of the carburetors.</li> <li>• Parts identification of carburetors.</li> <li>• Carburetor circuits.</li> <li>• Carburetor tuning process.</li> <li>• Trouble shooting.</li> </ul>	18 H	5 H

8.	Set diesel fuel injection pump timing	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Identification the types and applications of fuel injection pumps.</li> <li>• Working principles, functions and types of the fuel injection pump.</li> <li>• FI pump timing setting process.</li> <li>• Timing Marks.</li> <li>• Drop Setting</li> <li>• Interpretation the results of fuel injection test equipment.</li> <li>• Technical terms associated with fuel injection pumps.</li> <li>• Trouble shooting.</li> <li>• Safety precautions.</li> </ul>	20 H	3 H
9.	Bleed fuel system	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Identification the types of fuel system.</li> <li>• Importance and purpose and functions of bleeding fuel systems.</li> <li>• Technical terms associated with bleeding the fuel system.</li> <li>• Trouble shooting.</li> </ul>	8 H	2 H
10.	Replace fuel level sending unit	<ul style="list-style-type: none"> <li>• Interpretation of manufacturer's service manuals.</li> <li>• Identification, selection and set up fuel level sending unit and gauge.</li> <li>• Interpretation the results of fuel level sending unit tests.</li> <li>• Operating principles, functions and types of fuel level sending unit.</li> <li>• Technical terms associated with fuel level sending units.</li> <li>• Trouble shooting.</li> </ul>	8 H	2 H

11.	Read memory switch mode (Blink code method)	<ul style="list-style-type: none"> <li>• Interpretation of service manuals.</li> <li>• Basic electricity and electronics.</li> <li>• Introduction, importance, advantages and types of MPFI system.</li> <li>• Technical terms associated MPFI system.</li> <li>• Working principles, functions and parts of MPFI system.</li> <li>• Importance, functions and types of Input, output sensors, actuators and control devices.</li> <li>• OBD and diagnostic tester operating procedure.</li> <li>• Checking process of Blink Code.</li> <li>• Trouble shooting procedure.</li> <li>• Safety precautions.</li> </ul>	15 H	5 H
12.	Service/ Repair/ Testing MPFI System	<ul style="list-style-type: none"> <li>• Identification and Function of MPFI System Components (Sensor, ECU, Actuators)</li> <li>• Layout of MPFI System</li> <li>• Electrical Circuit Diagram of MPFI System</li> <li>• Methods of checking Continuity, Resistance, Voltage , Current and Short Circuit in MPFI System</li> <li>• Do's and Don'ts in MPFI System</li> <li>• Fault Finding using digital multimeter and Diagnostic software</li> </ul>	35 H	5 H



## B. Auto Electrical & Electronics System

**Duty: Service & repair charging system.**

S. No.	Tasks Statements	Related Technical Knowledge	Time	
			Practical	Demo
1.	Service/Repair/Testing Charging System	<ul style="list-style-type: none"> <li>• Check Battery, Specific gravity,</li> <li>• Inspect drive belt</li> <li>• Check field current, rectifier, stator, rotor</li> <li>• Inspect regulator</li> <li>• Circuit diagram of Charging system</li> <li>• Check alternator output</li> </ul>	50 H	3 H
2.	Service/Repair/Testing Starting System	<ul style="list-style-type: none"> <li>• Inspect pull in coil, hold in coil, armature, field coil, carbon brush and holder</li> <li>• Inspect pinion gear and gear teeth.</li> <li>• Inspect ignition switch and starter relay</li> <li>• Circuit diagram of different types of starting system</li> </ul>	50 H	3 H

3.	Service/Repair/Testing Lighting System and Auxiliary Equipment	<ul style="list-style-type: none"> <li>• Identification, function and inspection of following electrical circuits in lighting system <ul style="list-style-type: none"> <li>- Head light</li> <li>- parking light</li> <li>- Brake light</li> <li>- Turn Signal</li> <li>- Hazard warning</li> <li>- Licence Plate</li> <li>- Reverse light</li> <li>- Meter and Dome light</li> <li>- Instrument Panels combination meters and gauges</li> </ul> </li> <li>• Circuit Diagram of Lighting System and Auxiliary Equipment</li> <li>• Identification , Function and Inspection of Gauges and Electrical Circuits in Instrument Panels <ul style="list-style-type: none"> <li>- Speedometer</li> <li>- Tacho Meter</li> <li>- Volt Gauge</li> <li>- Coolent Gauge</li> <li>- Fuel Gauge</li> <li>- Oil Pressure Gauge</li> <li>- Oil Pressure warning light</li> <li>- Charge warning light</li> <li>- High Beam Indicator</li> <li>- Fuel Warning light</li> <li>- Brake Warning light</li> <li>- Door Indicator light</li> <li>- Front signal indicator light</li> <li>- Wiper and Washer</li> <li>- Wiper and Washer Switch</li> <li>- Wiper Relay and Wiper motor</li> <li>- Heater, Heater switch , Relay and motors</li> </ul> </li> </ul>	140 H	8 H
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4	Service, Repair and Replace of Fuse, Fusible link, circuit breaker switch and relays	<ul style="list-style-type: none"> <li>• Identification and function of Fuse, Fusible link, circuit breaker switch and relays.</li> <li>• Inspection of fuse, fusible link, circuit breaker switches and relays.</li> </ul>	8H	1H
5	Service/Repair /Testing of Distributer type Ignition System with C.B. Point	<ul style="list-style-type: none"> <li>• Layout of ignition system</li> <li>• Identification and function of ignition system components <ul style="list-style-type: none"> <li>• Battery</li> <li>• Ignition Switch</li> <li>• Ignition Coil</li> <li>• Distributor</li> <li>• HT Cable</li> <li>• Spark Plug</li> </ul> </li> <li>• Circuit Diagram of Ignition System</li> <li>• Dismantling of Distributer</li> <li>• Inspection of Distributor components <ul style="list-style-type: none"> <li>• CB Point</li> <li>• Rotor</li> <li>• Vacuum and centrifugal advance mechanism</li> <li>• Condenser</li> </ul> </li> <li>• Setting of CB Point</li> <li>• Setting of ignition timing</li> <li>• Setting of firing order</li> <li>• Usages of Timing light, Vacuum gauge, feeler gauge, coil tester, plug cleaner.</li> <li>• Inspection of HT Cable</li> <li>• Inspection of Ignition coil</li> <li>• Inspection of Spark Plug</li> </ul>	30 H	5 H

6.	Service/Repair /Testing of Distributer-less Ignition System	<ul style="list-style-type: none"> <li>• Layout of distributor-less ignition system controlled by ECU</li> <li>• Circuit Diagram of distributor-less Ignition System</li> <li>• Inspection of Distributor components <ul style="list-style-type: none"> <li>• Coil</li> <li>• HT Cable</li> <li>• Spark Plug</li> <li>• ECU</li> </ul> </li> </ul>	8 H	1 H
07.	Troubleshoot Engine management system( EMS)- (DICOR)	<ul style="list-style-type: none"> <li>• Identification and function of Engine Management System Components.</li> <li>• Layout of Engine Management System Components.</li> <li>• Electrical Circuit Diagram of EMS.</li> <li>• EMS Cleanliness instruction.</li> <li>• Do's and Don'ts in EMS.</li> <li>• Methods of Checking Resistance, Voltage, Current, Short Circuits and Continuity in EMS.</li> <li>• Testing of EMS by using Digital Multi-meter and Diagnostic Software</li> </ul>	35 H	4H
08	Troubleshooting Electrical Diesel Control System (EDC)	<ul style="list-style-type: none"> <li>• Identification and function of Electronic Diesel Control System.</li> <li>• Function of EDC System.</li> <li>• Layout of EDC System.</li> <li>• Electrical Circuit Diagram of EDC System.</li> <li>• Method of Checking Continuity, resistance, voltage, current and short-circuit in EDC System.</li> <li>• Do's and Don'ts in EDC System.</li> <li>• Fault finding using digital Multimeter and Diagnostic Software.</li> </ul>	35H	4H

9	Service/ Repair and Test of Immobilizer Control unit	<ul style="list-style-type: none"> <li>• Working principle of Immobilizer System.</li> <li>• Different condition of LED</li> <li>• Pairing of EMS-ECU and Immobilizer Control Unit</li> <li>• Key learning procedure</li> </ul>	8H	1H
10	Service/Repair/replace power window winding	<ul style="list-style-type: none"> <li>• Components identification ( Window winding motor with regulator, window winding controller, relay and switch)</li> <li>• Circuit Diagram of power window winding</li> <li>• Inspection of window winding components and circuits</li> </ul>	25H	2H
11	Service/Repair of Center Locking System	<ul style="list-style-type: none"> <li>• Components identification ( Window door switches, Master center locking follower, BCM, Lock-Unlock Relay and Motors)</li> <li>• Circuit Diagram of Center locking system</li> <li>• Inspection of components and circuits</li> </ul>	25 H	2 H
12	Remove/Replace/Testing of BCM ( Body Control Module)	<ul style="list-style-type: none"> <li>• Function, Remote Learning and Diagnosis of BCM</li> </ul>	18 H	2H

# Motor Vehicle Driving

**Total class: 78 hrs**

<u>Skills Lists</u>	<u>Time</u>
1. Perform pre starting checkup of vehicle.	1 hr.
2. Start the engine	1 hr.
3. Perform pre driving checkup of the vehicle.	1 hr.
4. Control steering practice in the field.	7 hrs.
5. Perform vehicle driving from stationary.	1 hr.
6. Perform running practice in first gear on the field.	7 hrs.
7. Perform running practice in second gear on the field.	7 hrs.
8. Perform full driving practices on the field.	7 hrs.
9. Perform full driving practice on the road.	7 hrs.
10. Perform straight reverse driving practice.	7 hrs.
11. Perform bend reverse driving practice.	7 hrs.
12. Perform bent reverse parking practice in various patterns.	7 hrs.
13. Drive vehicle on the highway road.	7 hrs.
14. Drive vehicle on the city road.	7 hrs.
15. Read traffic Rules and regulations.	2 hrs.
16. Interpret traffic sign and symbols.	2 hrs.

# Entrepreneurship Development

**Total: 78 hrs**

**Class/week: 2 hrs**

## **Course description**

This course is designed to impart the knowledge and skills on formulating business plan and managing small business in general. This course intends to deal with exploring, acquiring and developing enterprising competencies, identification of suitable business idea and developing of business plan.

## **Course objectives**

After completion of this course students will be able to:

1. Understand the concept of business and entrepreneurship
2. Explore entrepreneurial competencies
3. Analyze business ideas and viability
4. Formulate business plan
5. Learn to manage small business

S.No.	Task statements	Related technical knowledge	Time (hrs)		
			T	P	Tot
Unit 1: Introduction to Entrepreneurship			5.75	4.08	9.83
1	Introduce business	Introduction of business: <ul style="list-style-type: none"> <li>• Definition of business/enterprise</li> <li>• Types of business</li> <li>• Classification of business</li> <li>• Overview of MSMEs(Micro, Small and Medium Enterprises) in Nepal</li> </ul>	1.5		1.5
2	<i>Define entrepreneur/entrepreneurship</i>	<u>Definition of entrepreneur:</u> <ul style="list-style-type: none"> <li>• <i>Definition of entrepreneur</i></li> <li>• <i>Definition of entrepreneurship</i></li> <li>• <i>Entrepreneurship development process</i></li> </ul>	0.5	0.5	1.0
3	<i>Describe entrepreneur's characteristics</i>	<u>Entrepreneur's characteristics:</u> <ul style="list-style-type: none"> <li>• <i>Characteristics of entrepreneurs</i></li> <li>• Nature of entrepreneurs</li> </ul>	0.67	0.83	1.5
4	<i>Assess entrepreneur's characteristics</i>	<u>Assessment of entrepreneur's characteristics:</u> <ul style="list-style-type: none"> <li>• <i>List of human characteristics</i></li> <li>• <i>Assessment of entrepreneurial characteristics</i></li> </ul>	0.5	1.0	1.5
5	Compare entrepreneur with other occupations	<u>Entrepreneur and other occupations:</u> <ul style="list-style-type: none"> <li>• Comparison of entrepreneur with other occupations</li> <li>• Types and styles of entrepreneurs</li> </ul>	1.0		1.0
6	Differentiate between entrepreneur and employee	<u>Entrepreneur and employee:</u> <ul style="list-style-type: none"> <li>• Difference between entrepreneur and employee</li> <li>• Benefit of doing own business</li> </ul>	0.5	0.5	1.0
7	Assess "Self"	<u>"Self" assessment:</u> <ul style="list-style-type: none"> <li>• Understanding "self"</li> <li>• Self disclosure and feedback taking</li> </ul>	0.6	0.4	1.0
8	<b>Entrepreneurial personality test:</b> <ul style="list-style-type: none"> <li>• Assess "Self" inclination to business</li> </ul>	<u>Entrepreneurial personality test:</u> <ul style="list-style-type: none"> <li>• Concept of entrepreneurial personality test</li> <li>• Assessing self entrepreneurial inclination</li> </ul>	0.67	0.83	1.5
<b>Unit 2: Creativity and Assessment</b>			<b>6.5</b>	<b>4.0</b>	<b>10.5</b>



9	Create viable business idea	<p><b><u>Creativity:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of creativity</li> <li>• Barriers to creative thinking</li> </ul>	1.67	0.33	2.0
10	Innovate business idea	<p><b><u>Innovation:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of innovation</li> <li>• SCAMPER Method of innovation</li> </ul>	0.83	0.67	1.5
11	Transfer ideas into action	<p><b><u>Transformation of idea into action:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of transferring idea into action</li> <li>• Self assessment of creative style</li> </ul>	1.0	0.5	1.5
12	Assess personal entrepreneurial competencies	<p><b><u>Personal entrepreneurial competencies:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of entrepreneurial competencies</li> <li>• Assessing personal entrepreneurial competencies</li> </ul>	0.5	1.0	1.5
13	Assess personal risk taking attitude	<p><b><u>Risk taking attitude:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of risk</li> <li>• Personal risk taking attitude</li> <li>• Do and don't do while taking risk</li> </ul>	1.5	1.0	2.5
14	Make decision	<p><b><u>Decision making:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of decision making</li> <li>• Personal decision making attitude</li> <li>• Do and don't do while making decision</li> </ul>	1.0	0.5	1.5
<b>Unit 3: Identification and Selection of Viable Business Ideas</b>			<b>0.83</b>	<b>3.42</b>	<b>4.25</b>
15	<p>Identify/ select potential business idea</p> <ul style="list-style-type: none"> <li>• Analyze strength, Weakness, Opportunity and Threat (SWOT) of business idea</li> </ul>	<p><b><u>Identification and selection of potential business:</u></b></p> <ul style="list-style-type: none"> <li>• Sources of business ideas</li> <li>• Points to be considered while selecting business idea</li> <li>• Business selection process</li> <li>• Potential business selection among different businesses</li> <li>• Strength, Weakness, Opportunity and Threats (SWOT) analysis of business idea</li> <li>• Selection of viable business idea matching to "self"</li> </ul>	0.83	3.42	4.25

<b>Unit 4: Business Plan</b>			<b>16.67</b>	<b>36.58</b>	<b>53.25</b>
16	Assess market and marketing	<p><b><u>Market and marketing:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of market and marketing</li> <li>• Marketing and selling</li> <li>• Market forces</li> <li>• 4 Ps of marketing</li> <li>• Marketing strategies</li> </ul>	1.33	0.75	2.08
17	<p><b>Business exercise:</b></p> <p>Explore small business management concept</p>	<p><b><u>Business exercise:</u></b></p> <ul style="list-style-type: none"> <li>• Business exercise rules</li> <li>• Concept of small business management</li> <li>• Elements of business management <ul style="list-style-type: none"> <li>• Planning</li> <li>• Organizing</li> <li>• Executing</li> <li>• Controlling</li> </ul> </li> </ul>	1.58	1.67	3.25
18	Prepare market plan	<p><b><u>Business plan/Market plan</u></b></p> <ul style="list-style-type: none"> <li>• Concept of business plan</li> <li>• Concept of market plan</li> <li>• Steps of market plan</li> </ul>	2.0	2.0	4.0
19	Prepare production plan	<p><b><u>Business plan/Production plan:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of production plan</li> <li>• Steps of production plan</li> </ul>	1.25	1.5	2.75
20	Prepare business operation plan	<p><b><u>Business plan/Business operation plan:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of business operation plan</li> <li>• Steps of business operation plan</li> <li>• Cost price determination</li> </ul>	2.5	2.67	5.17
21	Prepare financial plan	<p><b><u>Business plan/Financial plan:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of financial plan</li> <li>• Steps of financial plan</li> <li>• Working capital estimation</li> <li>• Pricing strategy</li> <li>• Profit/loss calculation</li> <li>• BEP and ROI analysis</li> <li>• Cash flow calculation</li> </ul>	4.5	7.5	12.0
22	Collect market information /prepare business plan	<p><b><u>Information collection and preparing business plan:</u></b></p> <ul style="list-style-type: none"> <li>• Introduction</li> </ul>	2.0	13.0	15.0

		<ul style="list-style-type: none"> <li>• Market survey <ul style="list-style-type: none"> <li>• Precaution to be taken while collecting information</li> <li>• Sample questions for market survey</li> <li>• Questions to be asked to the customers</li> <li>• Questions to be asked to the retailer</li> <li>• Questions to be asked to the stockiest/suppliers</li> </ul> </li> <li>• Preparing business plan</li> </ul>			
23	Appraise business plan	<p><b><u>Business plan appraisal:</u></b></p> <ul style="list-style-type: none"> <li>• Return on investment</li> <li>• Breakeven analysis</li> <li>• Cash flow</li> <li>• Risk factors</li> </ul>	0.5	5.5	6.0
24	Maintain basic book keeping	<p><b><u>Basic book keeping:</u></b></p> <ul style="list-style-type: none"> <li>• Concept and need of book keeping</li> <li>• Methods and types of book keeping</li> <li>• Keeping and maintaining of day book and sales records</li> </ul>	1.0	2.0	3.0
<b>Total:</b>			<b>30</b>	<b>48</b>	<b>78</b>

**Text book:**

क) प्रशिक्षकहरूका लागि निर्मित निर्देशिका तथा प्रशिक्षण सामग्री, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्

२०६९

ख) प्रशिक्षार्थीहरूका लागि निर्मित पाठ्यसामग्री तथा कार्यपुस्तिका, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्

(अप्रकाशित), २०६९

**Reference book:**

Entrepreneur's Handbook, Technonet Asia, 1981.

## **Basic Requirement for TSLC in Automobile Engineering Course Implementation Requirements**

### **Office Equipment:**

There should be well-arranged equipment for training and office management.

- a. Desktop Computer
- b. Scanner
- c. Multi – media projector
- d. Laser color / mono printer
- e. Fax mail
- f. Photo Copy Machine (color / mono)

### **Classroom Equipment:**

There should be well-arranged modern facilities for training and instruction management.

1. White Board
2. Soft Board
3. Multi – media projector screen
4. Single chair and Desks.
5. Overhead projector

### **Education Material and Tools:**

- Tools and equipment according to the TSLC in Automobile Engineering curriculum.
- Tools and equipment according to the mechanical fitting.

## **Basic Requirement for TSLC in Automobile Engineering Implementation Requirements**

### **Physical facilities:** (rooms and workshop/lab)

- Well equipped workshop -1
  - Class room -1
  - Office room -1
- Principle room -1
- Reception room -1

### **Equipment, tools and materials**

1. Mechanical tools
  - i) Bench vice
  - ii) Open ended wrench
  - iii) Ring ended wrench
  - iv) Adjustable wrench
  - v) Hand drill machine
  - vi) Hack saw

- vii) Allen key set
- viii) Ball pin hammer
- ix) Mallet hammer
- x) Files set
- xi) Chisel
- xii) Center punch
- xiii) Snip
- xiv) Measuring tape or ruler
- xv) Leveling instrument

2. Welding equipment

- i) Welding machine
- ii) Oxy-acetylene or LPG gas regulator torch set
- iii) Tong
- iv) Wire Brush
- v) Chipping hammer
- vi) Welding shield/glass
- vii) Welding apron

3. **Motor Vehicle Repair & Maintenance**

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| 1. Open ended and ring spanner set | 33. Valve grinding/refacing machine |
| 2. Spark plug spanner              | 34. Valve grinding solvent          |
| 3. Socket spanner                  | 35. Valve lapping paste             |
| 4. Hammer                          | 36. Valve lapping stick             |
| 5. Mallet hammer                   | 37. Carburettor service kit         |
| 6. Pliers                          | 38. Air compressor                  |
| 7. Arbor press                     | 39. Cleaning brush                  |
| 8. Screw jack                      | 40. Fuel pressure gauge             |
| 9. Screwdrivers                    | 41. Volt meter                      |
| 10. Compression tester             | 42. Injector cleaning kit           |
| 11. Vacuum gauge                   | 43. Injector spanner                |
| 12. Circlip plier                  | 44. Dial gauge                      |
| 13. Feeler gauge                   | 45. Tripod                          |
| 14. Timing light                   | 46. Brake repair kit                |
| 15. Tachometer                     | 47. Wheel balancer                  |
| 16. Torque wrench                  | 48. Balancing leads                 |
| 17. Measuring tape                 | 49. Wheel wrench                    |
| 18. Emery paper                    | 50. Wheel alignment gauge           |
| 19. Hydrometer                     | 51. Rope/wire                       |
| 20. Injection tester               | 52. Spring balance                  |
| 21. Spark plug cleaner/tester      | 53. Dwell angle tester              |
| 22. Multi meter                    | 54. Exhaust gas analyzer            |
| 23. Valve spring compressor        | 55. Manual vacuum pump              |
| 24. Bearing puller                 | 56. Belt tension adjuster           |
| 25. Piston ring compressor         | 57. Multi - meter                   |
| 26. Floor crane                    | 58. Line tester                     |
| 27. Inside and out side caliper    | 59. Combination plier               |
| 28. Vernier caliper                | 60. Nose plier                      |
| 29. Inside and out side Micrometer | 61. Wire stripper                   |
| 30. Bore gauge                     | 62. Side cutter                     |

- 31. Ring expander
- 32. Workshop manual

- 63. Soldering gum
- 64. Screw driver set

#### **4. Consumable Materials**

##### **i) Materials for Bench work, Sheet metal and welding**

- U Channel
- Flat Strip
- Rivet, Drill Bit, Hacksaw Blade
- Emery papers
- Welding Electrode
- GI/Black Sheet

##### **ii) Materials for Motor Vehicle Repair & Maintenance**

- Screws/nut & bolts
- Circlip & lock ring as per size.
- Bulbs different watt & volts
- Fuses various ampere
- Washers & cotter pins.
- Kerosene
- Petrol
- Diesel
- Engine oil
- Brake fluid
- Gear oil
- Grease
- Cotton clothes/jutes
- Gasket set
- Gasket paper
- Asbestos paper
- Oil seal as per size
- Ring
- Spare parts
- Bearing, ball, bushes etc
- Electric cable, wire
- Miscellaneous

