

CURRICULUM

Technical School Leaving Certificate

Automobile Engineering

(18 months program)



Council for Technical Education and Vocational Training
Curriculum Development Division

Sanothimi, Bhaktapur

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Introduction:

Nepal Government, Ministry of Education implemented the letter grading system in SLC from 2072 B.S. The door of TSLC programme is open for those students who have appeared in SLC exam and achieved any GPA and any grade in each subject. Focusing on such students the curriculum of TSLC of 29 months and 15 months have been converted into 18 months to create uniformity among different TSLC programme.

This curriculum is designed to produce basic level human resources in the field of automobile industry equipped with knowledge, skills and attitude necessary for this level of technicians so as to meet the demand of such technician in the country. It 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.

Title:

The title of the programme is TSLC in Automobile Engineering

Aim:

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

Objectives:

After completing this curricular program, the students will be able to:

- Perform bench work and welding works
- Prepare simple auto mechanical drawing.
- Familiarize with basic computer works
- Repair and maintain automobile vehicles.
- Repair and maintain various automobile components.
- Assemble /disassemble various automobile systems.
- Familiarize with auto electrical and electronics system.
- Troubleshoot the automobile system.

Programme Description:

This curriculum 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, and repair and maintenance of automobile vehicles and related plants. There are altogether seven subjects, which covers all related areas of the automobile engineering. The focus on this curriculum is given to enhance practical skills, enable techniques and develop competency.

Course Duration:

This course will be completed within 18 months. There will be 15 months (40 hours/week X 52 weeks = 2060 hrs. class plus 3 months (480 hrs) on the job training (OJT).

Entry criteria:

Individuals with following criteria will be eligible for this program:

- SLC with any grade and any GPA (Since 2072 SLC).
- SLC appeared (Before 2072 SLC)
- Pass entrance examination administered by CTEVT

Group size:

The group size will be maximum 24 (twenty four) in a batch.

Medium of Instruction:

The medium of instruction will be in English and/or Nepali language.

Pattern of Attendance:

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

Instructors' Qualification:

- Instructors should have bachelor degree in auto/mechanical engineering or diploma in automobile engineering with minimum 5 years practical based experiences.
- The demonstrator should have diploma in automobile engineering with minimum 2 years practical based experiences.
- Good communicative/instructional skills

Teacher and Student Ratio:

- Theory: 1:24
- Practical: 1:8
- Minimum 75% of the teachers must be fulltime

Instructional Media and Materials:

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

- Printed media materials (assignment sheets, handouts, information sheets, procedure sheets, performance check lists, textbooks, newspaper etc.).
- Non-projected media materials (display, photographs, flip chart, poster, writing board etc.).
- Projected media materials (multimedia/overhead transparencies, slides etc.).
- Audio-visual materials (films, videodiscs, videotapes etc.).
- Computer-based instructional materials (computer-based training, interactive video etc.)

Teaching Learning Methodologies:

The methods of teaching for this curricular program will be a combination of several approaches such as;

- Theory: lecture, discussion, assignment, group work, question-answer.
- Practical: demonstration, observation, simulation, guided practice and self-practice.

Evaluation Details:

- The marks distribution for theory and practical tests will be as per the marks given in the course structure of this curriculum for each subject. Ratio of internal and final evaluation is as follows:

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

- 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.
- 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.
- The on-the-job training is evaluated in 300 full marks. The evaluation of the performance of the student is to be carried out by the three agencies; the concerned institute, OJT provider industry/organization and the CTEVT office of the controller of examinations. The student has to score minimum 60% for successful completion of the OJT.

Grading System:

The grading system will be as follows:

Grading

Distinction

First division

Second division

Third division

Overall marks

80% or above

75% to below 80%

65% to below 75%

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 graduates who successfully complete the requirements as prescribed by the curriculum.

Job Opportunity:

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 of Nepal.

Course structure of TSLC in Automobile Engineering

S. N.	Course Title	Nature	Class/Week	Total Class			Full Marks		
			Total	T	P	Total	T	P	Total
1	Workshop Technology	T+P	4	52	156	208	40	80	120
	• Bench work				104			50	0
	• Welding				52			30	0
2	Computer Application	P	1	16	36	52		40	40
3	Engineering Drawing	T+P	3		156	156		100	100
4	Applied Math	T	2	104		104	50	0	50
5	Automotive Technology I	T+P	14	104	624	728	100	300	400
	• Control & Suspension System	P			312			150	0
	• Power Trains	P			312			150	0
6	Automotive Technology II	T+P	14	104	624	728	100	300	400
	• Automotive Engine	P			312			150	0
	• Auto Electrical & Electronics System	P			312			150	0
7	Light Vehicle Driving	P	1		52	52		50	50
8	Entrepreneurship Development	T+P	1	22	30	52	10	30	40
	Sub Total		40	386	1694	2080	300	900	1200
	On the Job Training (3 Months)					480			300
	Total					2560			1500

Workshop Technology

Total Class: 52 hrs.
Theory: 1 hr. /week

Course description:

This subject deals with theory and practice on basic hand tools, measuring instrument, power tools required in automobile workshop practice.

Theory

- 1. General safety & First Aid** **10 hrs.**
 - 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
 - 1.6. First Aid on simple cut and injuries
 - 1.7. First Aid on bleeding
 - 1.8. First Aid on shock

- 2. Files and filing operation** **8 hrs.**
 - 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

- 3. Bench work hand tools** **10 hrs.**
 - 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

- 4. Measuring instruments** **12 hrs.**
 - 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** **5 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. Welding** **7 hrs.**
- 6.1. Welding and types
 - 6.2. Different types of welding machine
 - 6.3. Current, voltage and ampere
 - 6.4. Different parts of welding transfer
 - 6.5. Types, size and use of electrodes
 - 6.6. List of welding tools
 - 6.7. Welding joints, symbols and positions
 - 6.8. Welding defects and their control
 - 6.9. Safety precautions

References:

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.

Practical

A. Bench Work

Total Class: 104 hrs.
Practical: 2 hrs. /week

Course Description:

The subject aims at imparting knowledge and skills to the student making them competent and potential in the field of applied mechanical fitting works.

<u>List of tasks</u>	<u>Time (hrs.)</u>
1. Measure and perform filling	
1.1. Mark the given work piece.	2
1.2. File flat surface	10
1.3. File external radius	4
1.4. File internal profiles	4
1.5. Produce rectangular block	10
2. Perform hand punching	
2.1. Punch letters/numbers on metal plates	4
2.2. Punch dot/center	3
3. Perform sawing	
3.1. Saw the metals by hand hacksaw.	4

4. Perform chiseling	
4.1. Perform flat chipping	4
5. Perform drilling	
5.1. Drill a hole	4
5.2. Countersunk on hole	2
6. Cuts threads by hand	
6.1. Cuts internal threads using hand taps	6
6.2. Cuts external threads using threading dies	4
7. Perform grinding	
7.1. Grind round tools (center punch, marking scriber...)	3
7.2. Grind flat tools (chisel....)	3
8. Perform measurement	
8.1. Measure the dimensions using Vernier caliper	5
9. Perform Project Works	
9.1. Manufacture C – clamp	16
9.2. Manufacture steel hammer of 300gm	16

B. Welding

Total class: 52 hrs.
Practical: 1 hr. /week

Course Description:

The subject aims at imparting knowledge and skill to the student making them competent and potential in the field of basic welding works.

<u>List of tasks</u>	<u>Time (hrs.)</u>
1. Perform striking	7
2. Perform surface weld	20
3. Grind off surfaces weld.	4
4. Perform multi run straight beads	10
5. Weld corner joint	6
6. Make a screw clamp.	5

Computer Application

Total: 52 hrs.

Class/week: 1 hrs.

Course Description:

This course intends to impart the competencies required to prepare document, spreadsheets, presentations slides, internet and e-mail 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"> ▪ Introduction ▪ 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). ▪ Explain different types of ports (Parallel, serial, USB, IEEE 1394 and slots) ▪ Explain the precaution to be taken while installing computer peripheral. 	1	
2.	Install operating system	<ul style="list-style-type: none"> ▪ Explain operating system including its role. ▪ Describe different types of operating systems (MS-DOS, Windows, Unix, Linux) ▪ Enlist the function of DOS Commands (COPY, REN, DIR, TYPE, CD, MD and BACKUP). ▪ Explain precautions to be taken while installing operating system. ▪ Make a list of tasks to be performed before, during and after installation of MS Window operating system. 	1	
3.	Install application/driver Software	<ul style="list-style-type: none"> ▪ Differentiate application software and driver software. 	1	

S.N.	Task Statements	Related Technical Knowledge	Time (hrs.)	
			T	P
		<ul style="list-style-type: none"> ▪ Describe the uses of antivirus program. ▪ Explain the procedure for installing application/driver software ▪ Describe the features of control Panel 		
4.	Uninstall software/application & Format external mass storage			
	Sub total		3	

Module 2: Prepare Documents using Word Processing Package

S.N.	Task Statements	Related Technical Knowledge	Time (hrs.)	
			T	P
5.	Perform typing practice	<ul style="list-style-type: none"> ▪ Explain the interface of word processing including different tools/menu. ▪ Describe how to open, save document and exit. ▪ Explain the procedure to type document in word processing software ▪ Demonstrate systematic way of typing. 	1	
6.	Setup page in word processing.	<ul style="list-style-type: none"> ▪ Explain different features and attributes of “page setup” box. ▪ Explain how to setup margins, orientation, size and columns. ▪ Define breaks, line numbers and Hyphenation. ▪ Explain the procedure to setup page. 	0.5	
7.	Insert object/picture/photo			
8.	Insert header/footer	<ul style="list-style-type: none"> ▪ Differentiate header and footer. ▪ Explain the procedure to insert different header and footer in different pages. 	0.5	
9.	Insert table	<ul style="list-style-type: none"> ▪ Explain row and column. ▪ State the procedure to insert table ▪ Describe table formatting procedure (border and color). 	1	
	Sub total		3	

Module 3: Prepare Spreadsheets using Spreadsheet Package

S.N.	Task Statements	Related Technical Knowledge	Time (hrs.)	
			T	P
10.	Create workbook.	<ul style="list-style-type: none"> ▪ Explain the concept and uses of Spreadsheet. ▪ Interpret Spreadsheet's Interface. ▪ Differentiate among column, row, cell, workbook, worksheet, labels, values, dates and formulas. 	1	
11.	Analyze data using basic formula/function	<ul style="list-style-type: none"> ▪ Interpret "insert function" box. ▪ Differentiate relative and Absolute cell reference ▪ Explain the procedure to insert formula/function 	1	
12.	Create chart/graph	<ul style="list-style-type: none"> ▪ Explain differentiate types of charts/graph. ▪ State the procedure to create chart/graph. 	0.5	
13.	Filter data	<ul style="list-style-type: none"> ▪ Differentiate between filtering and sorting. ▪ Explain the purpose of filtering. ▪ Interpret filtered data. 	0.5	
14.	Sort data	<ul style="list-style-type: none"> ▪ Explain the purpose of sorting. ▪ Interpret sorted data. 	0.5	
15.	Setup page in spreadsheet	<ul style="list-style-type: none"> ▪ Explain different features and attributes of "page setup" box. ▪ Explain how to setup margins, orientation, size and columns. ▪ Explain the procedure to setup page. 	0	
	Sub total		4	

Module 4: Create Presentation using Presentation Package

S.N.	Task Statements	Related Technical Knowledge	Time (hrs.)	
			T	P
16.	Prepare master slide	<ul style="list-style-type: none"> ▪ Interpret presentation package interface including tools/menu. ▪ Differentiate among slides, master slide, outline, notes page, handout master, and notes master and slide sorter. ▪ Explain the purpose of preparing master slide. 	1	

S.N.	Task Statements	Related Technical Knowledge	Time (hrs.)	
			T	P
		<ul style="list-style-type: none"> ▪ Enlist the procedure to prepare master slide including formatting and editing. 		
17.	Prepare slides	<ul style="list-style-type: none"> ▪ Explain the procedures to insert text, pictures/objects/ sound and charts/graphs. 	1	
18.	Animate the content of slide.	<ul style="list-style-type: none"> ▪ Define animation. ▪ Explain the procedure to apply animation to the content of slide. ▪ Differentiate between transition and animation. 	1	
19.	Perform on-screen presentation	<ul style="list-style-type: none"> ▪ Explain the procedure to perform on-screen presentation. ▪ State the precautions to be taken while connecting computer with Multimedia projector for presentation. 	1	
	Sub total		4	

Module 5: Manage e-mail/internets.

S.N.	Task Statements	Related Technical Knowledge	Time (hrs.)	
			T	P
20.	Browse information through internet	<ul style="list-style-type: none"> ▪ Differentiate among web server, web browser, web site, domain name system (DNS), WWW, search engine and internet service provider. ▪ State the precaution to be taken while browsing through internet. ▪ List the steps for information browsing through internet. 	1	
21.	Send mail through internet.	<ul style="list-style-type: none"> ▪ Explain the concept of e-mail. ▪ Differentiate web based e-mail and POP e-mail. ▪ Explain the procedure to send mail through internet. 	1	
	Sub total		2	

Project works

22.	Following projects are to be prepared and submitted (e-copy) using different packages. <ul style="list-style-type: none">• Create a bio-data in word processing giving educational and personal details.• 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.• Design a presentation with not less than 10 slides on trade specific topic.• Create a database in database package with not less than 20 entries. Query and then generate the report.		36
	Sub total		36
	Total	16	36
	Grand total		52

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

Engineering Drawing

Total Class: 156 hrs.
Weekly Class: 3 hrs.

Course Description:

This course deals with geometrical construction, orthographic projections and basic techniques of freehand sketch as well as sectional view, pictorial projections and development of surfaces drawing. The course provides skills and knowledge to undertake drafting and designing sketch of automobile machinery parts, electrical circuits related to automobile repairing work.

- 1. Introduce engineering drawing** **3 hrs.**
 - 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

- 2. Handle engineering drawing instruments** **8 hrs.**
 - 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

- 3. Construct Geometric Drawing** **12 hrs.**
 - 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

- 4. Draw orthographic view** **20 hrs.**
 - 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

- 5. Apply dimension** **6 hrs.**
 - 5.1. Dimension in drawing
 - 5.2. Apply tolerances
 - 5.3. Apply surface roughness

- | | |
|--|----------------|
| <p>6. Draw pictorial projection
 6.1. Draw oblique projection
 6.2. Draw isometric projection</p> | 18 hrs. |
| <p>7. Draw section views
 7.1. Draw full section views
 7.2. Draw half section views
 7.3. Draw part section views</p> | 8 hrs. |
| <p>8. Machine drawing
 8.1. Detail workshop drawing of machine parts
 8.2. Assembly drawing
 8.3. Exploded drawing of simple machine</p> | 15 hrs. |
| <p>9. Auto electrical/electronic drawing
 9.1. Symbols of auto electrical.
 9.2. Parking/head light circuit
 9.3. Turn light/hazard light circuit
 9.4. Brake/reverse light circuit
 9.5. Ignition circuit
 9.6. Starting circuit
 9.7. Charging circuit (alternator/dynamo)
 9.8. Various indicators and meter circuits.
 9.9. Complete auto electrical system</p> | 15 hrs. |
| <p>10. Surface development
 10.1. Development of prismatic (square base, circular, hexagonal) object
 10.2. Development of pyramidal (square base, circular, hexagonal) object
 10.3. Development of truncated prismatic (square base, circular, hexagonal) object
 10.4. Development of truncated pyramidal (square base, circular, hexagonal) object</p> | 16 hrs. |
| <p>11. Machine elements drawing
 11.1. Screw, thread, nut and bolt
 11.2. Gear
 11.3. Keys, splines, cutter and pin
 11.4. Bearing, coupling, journal
 11.5. Spring
 11.6. Connecting rod
 11.7. Pistons
 11.8. Eccentric shaft/cam shaft
 11.9. Rivets
 11.10. Welding and material symbols</p> | 10 hrs. |
| <p>12. Automotive parts drawing
 12.1. Simple sketch of
 12.1.1. Four stroke diesel/petrol engine.
 12.1.2. Two stroke engine</p> | 25 hrs. |

References:

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, Samuel Yaslov, Delmar Publishers
5. Machine Drawing, N Sidhewar, P. Kannaiah, V.V.S. sastry, TaTa McGraw
6. Machine Drawing, P.S. Gill, Katsan Publishing House, Ludiana
7. A Text book of Engineering Drawing, R.B. Gupta, Satya Prakasan, Technical India
8. Mechanical Draughtsmanship, G.L. Tamta, Dhanpat Rai & Sons, Delhi
9. Geometrical and Machine Drawing, N.D. Bhatt, Cheroter book stalls, India
10. Engineering Drawing, D.N. Ghose, Dhanpat Rai & Sons, Delhi
11. Automotive Technology, W. Chrouse, MC Graw Hill Publication

Applied Mathematics

Total: 104 hrs.

Class/week: 2 hrs.

Description:

This subject consists of basic mathematical calculation of work, energy and power, force, speed, velocity and related to automobile engineering students to develop mathematical background helpful for auto mechanical engineering works.

Areas and topics	Time (hrs.)
1. SI units/conversion factors	3 hrs.
1.1. Basic units	
1.2. Derived SI units and relationship	
1.3. Decimal, multiples and parts of units	
1.4. Example and exercises	
2. Other system of units (FPS system, CGS system, Metric system)	3 hrs.
2.1. Conversion and comparative table of previous technical units and SI units	
2.2. Example and exercises	
3. Fractions	3 hrs.
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	
4. Square root	2 hrs.
4.1. Square number	
4.2. Splitting up	
4.3. Procedure	
4.4. Example and exercises	
5. Percentage	2 hrs.
5.1. Conversion of the percentage into actual number	
5.2. Conversion of the real number into percentage	
5.3. Example and exercises	
6. Conversion of length measurement	2 hrs.
6.1. Metric system	
6.2. SI system	
6.3. Examples and exercises	
7. Circumferences	3 hrs.
7.1. Definition of circumference	
7.2. Circumference	
7.3. Sector	
7.4. Polygons	
7.5. Examples and exercises	

8. Pythagoras' Theorem	3 hrs.
8.1. Terms used in Pythagoras' theorem	
8.2. Pythagoras formula	
8.3. Summary	
8.4. Examples and exercises	
9. Unitary method	3 hrs.
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	
10. Trigonometric functions	2 hrs.
10.1. Dependency	
10.2. Side ratio	
10.3. Relationships	
10.4. Examples and exercises	
11. Area of regular quadrilaterals	2 hrs.
11.1. Square	
11.2. Rhombus	
11.3. Rectangle	
11.4. Parallelogram	
11.5. Examples and exercises	
12. Area of other shapes	3 hrs.
12.1. Triangle	
12.2. Trapezium	
12.3. Circle	
12.4. Sector	
12.5. Circular ring	
12.6. Examples and exercises	
13. Volume of prismatic bodies	3 hrs.
13.1. Concept of cube, prism and cylinder	
13.2. Cube	
13.3. Prism	
13.4. Cylinder	
13.5. Examples and exercises	
14. Taper and inclination	3 hrs.
14.1. Concept of taper and taper ratio	
14.2. Taper ratio	
14.3. Ratio of inclination	
14.4. Setting angles	
14.5. Taper length	
14.6. Examples and exercises	
15. Mass	3 hrs.
15.1. Concept of mass and density	
15.2. Mass	
15.3. Density	

15.4. Examples and exercises	
16. Weight and force	3 hrs.
16.1. Concept of weight and force	
16.2. Weight	
16.3. Force	
16.4. Examples and exercises	
17. Thermal expansion	2 hrs.
17.1. Introduction of thermal expansion	
17.2. Coefficient of linear expansion	
17.3. Change in length	
17.4. Final length	
17.5. Examples and exercises	
18. Heating and fuel consumption	2 hrs.
18.1. Heat input or specific calorific capacity	
18.2. Fuel consumption or amount of heat require for work done	
18.3. Examples and exercises	
19. Pressure and gases	5 hrs.
19.1. Concept of pressure	
19.2. Air pressure	
19.3. Absolute pressure	
19.4. Gauge pressure	
19.5. Examples & exercises	
20. Uniform speeds	6 hrs.
20.1. Laws of motion	
20.2. Velocity in straight line, circular path	
20.3. Acceleration	
20.4. Examples & exercises	
21. Average speed	4 hrs.
21.1. Stroke speed	
21.2. Piston speed	
21.3. Examples & exercises	
22. Work, power and efficiency	6 hrs.
22.1. Work	
22.2. Power	
22.3. Efficiency	
22.4. Examples & exercises	
23. Effects of force calculation	6 hrs.
23.1. Representation	
23.2. Line of application	
23.3. Equi-directional force	
23.4. Opposite forces	
23.5. Force at an angle	
23.6. Resolution of forces	
23.7. Supports reaction	
23.8. Equilibrium	
23.9. Examples & exercises	

24. Pulley and belt calculation	10 hrs.
24.1. Simple pulley and belt drive calculation	
24.2. Multiple pulley and belt drive calculation	
24.3. Gear wheel dimension calculation	
25. Simple gear drive calculation	6 hrs.
25.1. Dependency of pitch diameter and revolution	
25.2. Transmission ratio	
25.3. Distance between axis	
25.4. Examples & exercises	
26. Multiple gear drive calculation	6 hrs.
26.1. Components of transmission	
26.2. Total transmission	
26.3. Examples & exercises	
27. Engine capacity calculation	8 hrs.
27.1. Clearance volume	
27.2. Swept volume	
27.3. Engine capacity	
27.4. Piston displacement	
27.5. Examples & exercises	

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 TechnischeZusammenarbeit (GTZ), Wiley Estern Limited, New Delhi, India

Automotive Technology I

Total Class: 104 hrs.

Weekly Class: 2 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 control and suspension system and power trains in the automobile.

Theory

A. Control and suspension system

1. **Automobile** **2 hrs.**
 - 1.1. Definition
 - 1.2. History
 - 1.3. Types

2. **Chassis and frame** **2 hrs.**
 - 2.1. Introduction and unction
 - 2.2. Types
 - The ladder frame
 - The cruciform frame
 - The perimeter frame
 - The sub frame
 - 2.3. The integral body/frame construction
 - 2.4. Common defects in frame; methods of alignments of frame and methods for their repairing and straightening

3. **Axle** **5 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** **12 hrs.**
 - 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
 - 4.3. Shock absorber and it's types
 - a. Constructional features
 - b. Trouble shooting.

- 4.4. Types of suspension
- 4.5. Types of independent suspension system
 - 4.5.1. Parallelogram type
 - 4.5.2. Strut and link type/ McPherson strut
 - 4.5.3. Wishbone type
 - 4.5.4. Torsional spring type
 - 4.5.5. Coil spring on upper control arm
- 4.6. Types of rear suspension
 - 4.6.1. Leaf spring type
 - 4.6.2. Coil spring type
 - 4.6.3. Torsion bar
- 4.7. Air Suspension

5. Steering system.

15 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, purpose and importance 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. Purpose and construction of tyre.
- 5.18. Tread pattern of tyre.
- 5.19. Types of tyre
 - 5.19.1. Inner tube with tyre
 - 5.19.2. Tubeless tyre
- 5.20. Types of tyre according to the ply
 - 5.20.1. Bias or cross ply tyre
 - 5.20.2. Radial ply tyre
- 5.21. Specification of tyre or tyre size and marking
- 5.22. Importance of inflating tyres to the correct pressure.
- 5.23. Purpose and methods of tyre rotation.
- 5.24. Trouble shooting on wheel and tyre.

6. Braking System

16 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
 - 6.14.1. Floating caliper disc brake
 - 6.14.2. Sliding caliper disc brake
 - 6.14.3. Fixed caliper disc brake
- 6.15. Comparison or difference between various types of brake
- 6.16. Various parts of air brake
 - 6.16.1. Air compressor
 - 6.16.2. Drying and distribution unit (system protection valve, governor, unloader, purge tank)
 - 6.16.3. Quick release valve
 - 6.16.4. Auto load sensing valve
 - 6.16.5. Relay
 - 6.16.6. Pressure switches and gauges
 - 6.16.7. Unloaded valve
 - 6.16.8. Reservoir (air tank)
 - 6.16.9. Brake chamber
 - 6.16.10. 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
 - 6.20.3. ECU

B. Power Train

7. Transmission

7.1. Transmission System

2 hrs.

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

8. Clutch

10 hrs.

- 8.1. Necessity for a clutch in a vehicle
- 8.2. Types of clutch used in vehicle
- 8.3. Function of the clutch
- 8.4. Various types of clutch actuation system
- 8.5. Function of mechanically operated clutch
- 8.6. Function of hydraulically operated clutch
- 8.7. Introduction of fluid clutch, torque converter and its function
- 8.8. Trouble shooting of clutch

9. Gearbox	14 hrs.
9.1. 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	
• Automated manual Transmission and its working principle	
• Double clutch transmission and its working principle	
• Trouble shooting of gearbox	
10. Gear shifting mechanism	2 hrs.
10.1. Various types of gear shift mechanism	
10.2. Working principle of gear shift mechanism	
10.3. Trouble shooting of gear shifting	
11. Propeller shaft, Universal Joint and Slip Joint	4 hrs.
11.1. Function of the propeller shaft	
11.2. Various components used in the power transmission	
11.3. Purpose of centre bearing.	
11.4. Trouble shooting related to propeller shaft	
11.5. Purpose and function of a universal joint	
11.6. Various types of universal joint and its constructional features	
11.7. Purpose and function of a slip joint	
11.8. Introduction of hotchkiss drive	
11.9. Introduction of torque tube drive	
11.10. Trouble shooting	
12. Rear Axle Assembly	5 hrs.
12.1. Various types of axle housings	
12.2. Various types of rear axles	
12.3. Merits and demerits of each types of the rear axle	
12.4. Trouble shooting related to rear axle	
13. Final drive	9 hrs.
13.1. Introduction to transaxle	
13.2. Purpose, function and types of differential	
13.3. Constructional features of differential	
13.4. Limited slip differential	
13.5. Differential adjustments	
13.6. Trouble shooting	
14. Four wheel drive and Transfer case	6 hrs.
14.1. Difference between two wheel drive and four wheel drive	
14.2. Purpose and function of transfer case	
14.3. Trouble shooting on four wheel drive	

Practical

A. Control and suspension system

Total Class: 312 hrs.

Practical: 6hrs/week

Course Description:

The subject aims at imparting knowledge and skills to the student making them competent and potential in the field of repair and maintenance of suspension, brake, and steering system of automobile. The course is offered as hands on skills on repair and maintenance of automobile vehicles.

1. Suspension System

1. Identify various units of vehicles.
2. Identify the defects in frame and body.
3. Overhaul front axle hub.
4. Overhaul Front Suspension.
5. Overhaul Leaf /coil /torsion springs.
6. Replace shock absorber and bushes.
7. Service/replace Steering Linkages.

2. Steering System

I. Mechanical system

1. Identify different types of steering gear box
 - Worm and roller type
 - Recirculating ball
 - Rack and Pinion
2. Demonstrate the function of steering gear box
3. Dismantle different types of gear box
 - Worm and roller type
 - Recirculating ball
 - Rack and Pinion
4. Perform adjustment on steering system
 - Worm Shaft preloading
 - Backlash between sector shaft and rack piston
5. Troubleshoot mechanical steering system
6. Check /Rectify Wheel alignment & steering geometry.
7. Rectify Wheels, Tires and Steering Troubles.

II. Power Steering System

1. Identify the components of power steering system
2. Demonstrate the function of power steering system components

3. Draw a layout diagram of power steering system
4. Demonstrate working principal of power steering system
5. Dismantle power steering gear box/pump
6. Inspect various components of steering gear box/pump
7. Assemble of steering gear box/ pump
8. Perform steering Adjustment
 - Worm shaft preloading
 - Sector shaft backlash adjustment
9. Perform bleeding service on power steering system
10. Troubleshoot power steering system

3. Brake System

I. Hydraulic Brake System

1. Familiarize with safety precaution.
2. Locate/identify different component of brake system.
3. Demonstrate the function of hydraulic brake system components
4. Draw a layout diagram of braking system
5. Dismantle flowing braking system components
 - Master Cylinder
 - Wheel Cylinder
 - Vacuum Assisted brake booster
 - Brake Caliper
6. Inspect hydraulic braking system components
7. Demonstrate operating principle of braking system
8. Assemble braking system components
9. Remove/refit brake shoes/caliper disc and brake pad
10. Adjust shoe to drum clearance
11. Bleed brake system
12. Adjust parking brake
13. Adjust brake pedal free play
14. Troubleshooting of brake system

II. Anti-Lock Braking System (ABS)

1. Identify components of Anti-lock braking system (ABS)
2. Demonstrate the function of ABS Components
3. Draw a layout diagram of Anti-lock Braking system
4. Demonstrate the operation of ABS
5. Draw antilock braking system circuit diagram
6. Remove Anti-Lock Braking System components from the vehicle
7. List out specification of Anti-Lock Braking system
8. Inspect ABS Components
9. Install ABS system components on vehicle

10. Check voltage, continuity short circuit in the system
11. Check resistance of ABS components
12. Perform workshop test using diagnostic tool
 - Multimeter
 - Diagnostic tool

III. Pneumatic Brake System

1. Familiarize with Workshop Safety
2. Draw a layout diagram of 'S' cam full air brake system
3. Identify different air brake system components
4. Demonstrate the function of following air brake system components
 - Air compressor,
 - Dry and Distribution Unit, (system protection valve, air dryer, unloader, safety valve)
 - Service Air Tanks
 - Dual Brake Valve
 - Air Brake chamber Front
 - Spring Brake Actuator Rear
 - Slack Adjusters
 - Graduated Hand Brake Valve
 - Quick Release Valve
 - Automatic Load Sensing Valve
 - Engine Exhaust Brake Solenoid Valve
 - Mechanical Stop Light Switch
 - Isolator Switch Exhaust Brake
5. Demonstrate the function of following electrical Indicators/Gauges in Air Brake system
 - Low Air Pressure indicator
 - Hand Brake Indicator (Red) and Beeper
 - Air Pressure Gauges
 - Engine Exhaust Brake Indicator
6. Identify port on air braking system
7. Dismantle and demonstrate working principle of air brake components
 - Air compressor,
 - Dry and distribution unit
 - Dual brake valve,
 - Air brake chamber front
 - Spring brake actuators rear
 - Slack adjusters, hand brake valve
 - Brake shoes and S cam shaft
 - Air Compressor,
 - dry and distribution unit,
 - dual brake valve,
 - air brake chamber front
 - spring brake actuators rear,

- slack adjusters
 - hand brake valve
 - Quick release valve and automatic load sensing valve
8. Inspect of air brake components.
 9. Assemble following air brake components
 - Air Compressor
 - dry and distribution unit
 - air brake chamber front
 - spring brake actuators rear
 - slack adjusters
 - hand brake valve
 - brake shoes and S cam shaft
 10. Follow standard brake adjustment procedure
 11. Perform brake system routine check and service
 12. Perform brake system diagnosis

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

B. Power Train

Total Class: 312 hrs.
Practical: 6 hrs. /week

Course Description:

The subject aims at imparting knowledge and skills to the student making them competent and potential in the field of repair and maintenance of clutch, gearbox, axle and final drive unit of power train system of automobile. The course is offered as hands on skills on repair and maintenance of automobile vehicles.

1. Clutch

1. Familiarize with workshop safety
2. Identify various clutch components
3. Demonstrate clutch operation
4. Demonstrate the function of clutch and their components
5. Handle Special service tools
6. Perform dismantling, operating Principle, Inspection & Assembly of:
 - Clutch Master Cylinder
 - Clutch Slave Cylinder
 - Clutch Booster
7. Adjust clutch pedal free play
8. Perform dismantling, inspection & assembly of pressure plate
9. Inspect clutch wears
10. Perform clutch adjustment services
11. Familiarize with Do's and Don'ts on clutch
12. Trouble shoot on clutch

2. Gear Box

1. Familiarize with workshop safety
2. Handle special tools
3. Disassemble/detach gear box from vehicle
4. Perform disassembly of :
 - Drive shaft
 - Main shaft
 - Counter shaft
 - Rear cover
 - Front cover
 - Top cover
5. Identify various gear box components
6. Demonstrate the function of gear box components
7. Demonstrate the operation of gear box
8. Inspect gear box components
9. Familiarize with technical specification based on model, type, gear ratio, tightening torques, lubrication and maintenance)
10. Determine the selection of spacer
11. Determine the selection of shims for
 - Counter shaft (front cover bottom)
 - Main shaft (front cover upper)
12. Perform assembly of :
 - Drive shaft
 - Main shaft
 - Counter shaft
 - Rear cover
 - Front cover
 - Top cover
13. Assemble gear box
14. Trouble shoot on gear box

3. Rear Axle and final drive unit

1. Familiarize with workshop safety
2. Identify various components rear Axle
3. Demonstrate the function of rear axle components
4. Handle special service tools
5. Remove hub from rear axle tube
6. Dismantle hub
7. Inspect the components
8. Install hub on rear axle tube
9. Check and adjust hub bearing play

10. Remove, inspect and refit propeller shaft.
11. Overhaul universal and slip joints.
12. Remove/detach crown wheel, differential and tail pinion assembly from carrier housing
13. Dismantle of differential
14. Identify differential components
15. Demonstrate operation of differential
16. Demonstrate the function of differential component
17. Inspect the differential components
18. Assemble tail pinion.
 - Check and adjust frictional movement of tail pinion bearings
 - Check tail pinion depth
19. Assemble differential
 - Check and adjust differential bevel gears back lash
 - Check and adjust back lash between tail pinion and crown wheel
 - Adjust gap between crown and thrust pad
20. Trouble shoot on differential
21. Overhaul Transfer case/transaxle.

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

Automotive Technology II

Total Class: 104 hrs.
Weekly Class: 2 hrs.

Course description:

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

Theory

A. Automobile engine

1. Engine

10 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. Working principle of spark ignition engine and compression ignition engine
- 1.6. Types of engine based on construction
- 1.7. Function and types of combustion chamber.

2. Valve and valve mechanism

4 hrs.

- 2.1. Functions
- 2.2. Construction
- 2.3. Operating mechanism.
 - Side valve mechanism
 - Overhead valve mechanism
- 2.4. Importance of valve timing.
- 2.5. Valve timing diagram & valve overlap
- 2.6. Variable valve timing (VVT)
- 2.7. Hydraulic latch adjuster (HLA)
- 2.8. Trouble shooting.

3. Piston and piston rings.

4 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

4 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. Balance Shaft Module/balancer
- 4.8. 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. **2 hrs.**

- 6.1. Purpose 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
 - 7.3.4. Single overhead (SOHC) and double overhead camshaft (DOHC)
- 7.4. Trouble shooting.

8. Cooling system **5 hrs.**

- 8.1. Operation of the cooling system
- 8.2. Types of cooling system.
 - 8.2.1. Direct air cooling system
 - 8.2.2. Indirect or liquid (coolant) cooling system
 - o Thermo siphon system
 - o Pump circulation system
 - 8.2.3. Pressure sealed cooling system
 - 8.2.4. Evaporative cooling or steam cooling system
- 8.3. Components of cooling system.
 - 8.3.1. Radiator (tube and fins 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 and wax - element type)
 - 8.3.5. Thermo time switch
- 8.4. Function of radiator cap.
- 8.5. Water jacket
- 8.6. Coolant
- 8.7. Trouble shooting

9. Lubricating system

5 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 grades of oil
 - 9.4.1. API
 - 9.4.2. SAE
- 9.5. Viscosity index (VI)
- 9.6. Reasons for using 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 and wet sump)
 - 9.8.2. Oil pump (gear pump, rotor pump, plunger pump, vane type pump, variable pressure oil 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 intake and exhaust system

4 hrs.

- 10.1. Function of air cleaner
- 10.2. Types of air cleaner
 - 10.2.1. Dry type air cleaner
 - 10.2.2. Oil bath type air cleaner
 - 10.2.3. Thermostatically controlled air cleaner
- 10.3. Function and construction of exhaust manifold, exhaust pipe, and muffler.
- 10.4. Turbo charger & supercharger.
 - 10.4.1. Waste gate turbocharger (WGT)
 - 10.4.2. Variable geometry turbocharger (VGT)
 - 10.4.3. Concept of turbo lag, volumetric efficiency, intercooler

11. Petrol fuel system

5 hrs.

- 1.1. Purpose and function of petrol fuel system
- 1.2. Main parts of the petrol fuel system
 - 11.2.1. Fuel tank
 - 11.2.2. Fuel pipe line of filter
 - 11.2.3. Fuel pump (mechanical, and electrical fuel pump)
- 1.3. Purpose, function and working principle of carburetor
- 1.4. Trouble shooting.

12. Diesel fuel system

8 hrs.

- 12.1. Purpose and function
- 12.2. Main parts of the diesel fuel feed system
 - 12.2.1. Fuel tank
 - 12.2.2. Fuel lines
 - 12.2.3. Pre - filter
 - 12.2.4. Fuel feed pump or transfer pump
 - 12.2.5. Fuel filter
 - 12.2.6. Injection pump
 - 12.2.7. Injectors
 - 12.2.8. Water separator
- 12.3. Function and types of diesel fuel filter
- 12.4. Function and construction of fuel feed/transfer pump
- 12.5. Function and types of injection pump.
- 12.6. Function and types of governor of injection pumps
- 12.7. Hydraulic advance mechanism of delivery in distributor pump
- 12.8. Function and types of fuel injector.
- 12.9. Trouble shooting.

B. Auto electrical and electronics system

1. Automobile electrical/electronics

5 hrs.

- 7.1. Simple electric circuit
 - 1.1.1. Series circuit
 - 1.1.2. Parallel circuit
 - 1.1.3. Open circuit
 - 1.1.4. Short circuit
- 7.2. Direct and indirect currents
- 7.3. Measuring instruments:-
 - 1.3.1. Ammeter
 - 1.3.2. Voltmeter
 - 1.3.3. Ohmmeter
- 7.4. Ohm's law
- 7.5. Types of resistance
 - 1.5.1. Series circuit resistance
 - 1.5.2. Parallel circuit resistance
 - 1.5.3. Series - parallel circuit resistance
- 7.6. Insulators and conductors

- 7.7. Electrical symbols used in automobile.
7.8. Relation between cable sizes and current carrying capacity of cables.

2. Automobile Battery

3 hrs.

- 2.1. Introduce the battery
2.2. Cell and plates
2.3. Electrolyte.
2.4. Construction of battery
- Plats
 - Cell elements
 - Cell covers
 - Cell connector
- 2.5. Chemical action during discharging and charging
2.6. General maintenance of battery
2.7. Methods of battery charging
- Slow charge method
 - Quick charge method
 - Trickle charge method
- 2.8. Testing methods of charged battery
- Specific gravity test
 - High rate discharge test
 - Voltage test

3. Ignition system

5 hrs.

- 7.1. Define the ignition system
7.2. Function of ignition system.
7.3. Components of ignition system.
- Ignition coil
 - Condenser
 - Distributor
 - Spark plug
- 7.4. Operating principle of ignition system.
7.5. Ignition circuits
- Primary
 - Secondary
- 7.6. Spark advance mechanism.
- Vacuum
 - Centrifugal
- 7.7. Setting ignition timing and checking dwell angle (cam angle)
7.8. Overview of spark plug.
7.9. Electronic ignition system.
- Hall
 - Induction
- 7.10. 30.10 Identify the causes and their remedies ignition system.

4. Charging system

6 hrs.

- 4.1. Function of charging system
- 4.2. Charging circuits
- 4.3. Basic principle of generator
- 4.4. Main parts of simple generator
 - Armature
 - Pole shoes
 - Commutator
 - Carbon brushes
 - Field circuit
 - Body or housing
 - Auxiliary units
 - Cutout relay
 - Voltage regulator
 - Current regulator
- 4.5. Introduction to alternator
- 4.6. Basic principle of alternator
- 4.7. Basic construction of alternator
 - Rotor assembly
 - Stator assembly
 - Diodes
- 4.8. Types of alternator regulator
- 4.9. Disadvantages of generator
- 4.10. Advantages alternator
- 4.11. Identify the causes of their remedies the charging system.

5. Starting system

5 hrs.

- 7.1. Introduction to starting system
- 7.2. Function of starter motor
- 7.3. Starter motor circuits
 - The four - pole two winding type
 - The four - pole four winding type
 - Six - pole six - winding type
 - Series - shunt would type
- 7.4. Starter motor drives
- 7.5. Types of starter motor drives
 - Bendix drive
 - Over running clutch drive
 - Reduction gear starter motor
- 7.6. Starter motor controls and circuits.
- 7.7. Construction of the solenoid switch
- 7.8. Function of the solenoid switch
- 7.9. Trouble shooting of starting system

6. Lighting and auxiliary equipment

4 hrs.

6.1. 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

6.2. Purpose and operation of the exterior light

6.3. 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

6.4. Major components of car operated by electricity

- Horn
- Windscreen wipers and washers
- Heater and demisters
- Power window
- Center locking
- Immobilizer

6.5. Following ancillaries

- Cigarette lighter
- Clock
- Radio / cassette player
- Fog light

6.6. Purpose and function of fuses

6.7. Trouble shooting.

7. Emission Control System

3 hrs.

7.1. Overview of emission control system.

7.2. Components/devices used to control pollution.

7.3. Trouble shooting.

C. Engine management system (EMS)

1. Electronic diesel control system

6 hrs.

- 1.1. Introduction to electronic diesel control system (EDC)
- 1.2. Advantage of electronic diesel control system
- 1.3. Block diagram of electronic diesel control system
- 1.4. Fuel System layout of EDC
- 1.5. Function and operation of EDC system components
 - Sensors
 - Electronic control unit (ECU)
 - Actuators
- 1.6. Circuit diagram of electronic diesel control system
- 1.7. Troubleshooting of EDC system

2. Direct injection common rail System (DICOR)

6 hrs.

- 2.1. Introduction to direct injection common rail system (DICOR)
- 2.2. Advantage of direct injection common rail system
- 2.3. Block diagram of direct injection common rail system
- 2.4. Fuel system layout of DICOR system
- 2.5. Function and operation of DICOR system components
 - Sensors
 - Electronic control unit (ECU)
 - Actuators
- 2.6. Circuit diagram of direct injection common rail system
- 2.7. Troubleshooting of direct injection common rail system

3. Multi point fuel injection system (MPFI)

6 hrs.

- 3.1. Introduction to multi point fuel injection system
- 3.2. Advantage of multi point fuel injection system
- 3.3. Block Diagram of multi point fuel injection system
- 3.4. Fuel system layout of multi point fuel injection system
- 3.5. Function and operation of multi point fuel injection system components
 - Sensors
 - Electronic control unit (ECU)
 - Actuators
- 3.6. Circuit Diagram of multi point fuel injection system
- 3.7. Troubleshooting of multi point fuel injection system

Practical

A. Automobile Engine

Total Class: 312 hrs.
Practical: 6 hrs. /week

Course Description:

The subject aims at imparting knowledge and skills to the student making them competent and potential in the field of repair and maintenance of petrol and diesel engine. The course is offered as hands on skills on repair and maintenance of automobile engines.

1. Familiarize with workshop safety
2. Handle special tools
3. Demonstrate operating principle of engine
4. Overhaul/dismantle of various engine
 - Disassembly of Head
 - Disassembly of Block
5. Identify various engine components
6. Demonstrate function of engine components
7. Demonstrate operating principle, repair and maintenance of following systems in engine
 - Air induction system
 - Exhaust system
 - Cooling system
 - Lubricating system
 - Fuel system
 - Charging system
 - Starting system
8. Practice reading on Vernier Caliper, Cylinder bore gauge, inside micrometer, outside micrometer
9. Measure engine components
 - Measurement of ovality and taperness
 - Cylinder bore
 - Crankshaft main journal and big end journal
 - Pistons
 - Main bearings parent bores with bearings
 - Big end bearing parent bores with bearings
 - Cam shaft journals
 - Cam bushes in cylinder block
10. Familiarize with technical specifications (Components specification and torque value)
11. Inspect various engine components

12. Assemble the overhauled engine
 - Assembly of engine block
 - Assembly of engine head
13. Set valve timing
 - Gear drive
 - Chain drive
 - Belt drive
14. Tighten cylinder head bolt with specified torque in sequence
15. Set fuel injection pump timing
16. Adjust valve clearance
 - Calculate of shim size to get specified valve clearance in overhead camshaft
17. Perform cylinder compression/pressure test
18. Perform emission test using smoke analyzer
19. Troubleshoot of engine

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

B. Auto Electrical and Electronics System

Total Class: 312 hrs.
Practical: 6 hrs. /week

Course Description:

The subject aims at imparting knowledge and skills to the student making them competent and potential in the field of repair, maintenance and troubleshoot of auto electrical and electronics system. The course is offered as hands on skills on repair and maintenance of automobile electrical and electronics system.

1. Service/charge/test battery
2. Service/repair/testing of charging system
3. Service/repair/testing of starting system
4. Service/repair/testing of lighting system and auxiliary equipment
5. Service, repair and replace fuse, fusible link, circuit breaker switch and relays
6. Service/repair /testing of distributor type ignition system with C.B. point
7. Service/repair /testing of distributor-less ignition system
8. Troubleshoot engine management system(EMS)
9. Troubleshooting electrical diesel control system (EDC)
10. Service/repair and test of immobilizer control unit
11. Service/repair/replace power window winding
12. Service/repair of center locking system
13. Remove/replace/testing of Body Control Module (BCM)

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

References Books:

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

Motor Vehicle Driving

Total class: 52 hrs.

Course Description:

The subject aims at imparting knowledge and skills to the student making them familiar with vehicle driving.

Lists of Tasks

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

Note: Related safety precaution should provide while performing the task

Entrepreneurship Development

Total: 52 hrs.
Class/week: 1 hr.

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	Total
Unit 1: Introduction to Entrepreneurship			5.5	3	8.5
1	Introduce business	Introduction of business: <ul style="list-style-type: none"> • Definition of business/enterprise • Types of business • Classification of business • Overview of MSMEs(Micro, Small and Medium Enterprises) in Nepal 	1		1.0
2	<i>Define entrepreneur/entrepreneurship</i>	<i>Definition of entrepreneur:</i> <ul style="list-style-type: none"> • <i>Definition of entrepreneur</i> • <i>Definition of entrepreneurship</i> • <i>Entrepreneurship development process</i> 	1	0.5	1.5
3	<i>Describe entrepreneur's characteristics</i>	<i>Entrepreneur's characteristics:</i> <ul style="list-style-type: none"> • <i>Characteristics of entrepreneurs</i> • Nature of entrepreneurs 	0.5	0.5	1.0
4	<i>Assess entrepreneur's characteristics</i>	<i>Assessment of entrepreneur's characteristics:</i> <ul style="list-style-type: none"> • <i>List of human characteristics</i> 	0.5	0.5	1.0

		<ul style="list-style-type: none"> • <i>Assessment of entrepreneurial characteristics</i> 			
5	Compare entrepreneur with other occupations	Entrepreneur and other occupations: <ul style="list-style-type: none"> • Comparison of entrepreneur with other occupations • Types and styles of entrepreneurs 	1		1.0
6	Differentiate between entrepreneur and employee	Entrepreneur and employee: <ul style="list-style-type: none"> • Difference between entrepreneur and employee • Benefit of doing own business 	0.5	0.5	1.0
7	Assess “Self”	“Self” assessment: <ul style="list-style-type: none"> • Understanding “self” • Self-disclosure and feedback taking 	0.6	0.4	1.0
8	Entrepreneurial personality test: <ul style="list-style-type: none"> • Assess “Self” inclination to business 	Entrepreneurial personality test: <ul style="list-style-type: none"> • Concept of entrepreneurial personality test • Assessing self-entrepreneurial inclination 	0.4	0.6	1.0
Unit 2: Creativity and Assessment			4	4.5	8.5
9	Create viable business idea	Creativity: <ul style="list-style-type: none"> • Concept of creativity • Barriers to creative thinking 	1.0	1.0	2.0
10	Innovate business idea	Innovation: <ul style="list-style-type: none"> • Concept of innovation • SCAMPER Method of innovation 	0.5	0.5	1.0
11	Transfer ideas into action	Transformation of idea into action: <ul style="list-style-type: none"> • Concept of transferring idea into action • Self-assessment of creative style 	1.0	1.0	2.0
12	Assess personal entrepreneurial competencies	Personal entrepreneurial competencies: <ul style="list-style-type: none"> • Concept of entrepreneurial competencies • Assessing personal entrepreneurial competencies 	0.5	0.5	1.0
13	Assess personal risk taking attitude	Risk taking attitude: <ul style="list-style-type: none"> • Concept of risk • Personal risk taking attitude 	0.5	1.0	1.5

		<ul style="list-style-type: none"> Do and don't do while taking risk 			
14	Make decision	Decision making: <ul style="list-style-type: none"> Concept of decision making Personal decision making attitude Do and don't do while making decision 	0.5	0.5	1.0
Unit 3: Identification and Selection of Viable Business Ideas			1	3	4
15	Identify/ select potential business idea <ul style="list-style-type: none"> Analyze strength, Weakness, Opportunity and Threat (SWOT) of business idea 	Identification and selection of potential business: <ul style="list-style-type: none"> Sources of business ideas Points to be considered while selecting business idea Business selection process Potential business selection among different businesses Strength, Weakness, Opportunity and Threats (SWOT) analysis of business idea Selection of viable business idea matching to "self" 	1	3	4
Unit 4: Business Plan			13	19	31
16	Assess market and marketing	Market and marketing: <ul style="list-style-type: none"> Concept of market and marketing Marketing and selling Market forces 4 Ps of marketing Marketing strategies 	1	1	2
17	Business exercise: Explore small business management concept	Business exercise: <ul style="list-style-type: none"> Business exercise rules Concept of small business management Elements of business management <ul style="list-style-type: none"> Planning Organizing Executing Controlling 	1	1	2
18	Prepare market plan	Business plan/Market plan <ul style="list-style-type: none"> Concept of business plan Concept of market plan 	1.5	1.5	3

		<ul style="list-style-type: none"> • Steps of market plan 			
19	Prepare production plan	Business plan/Production plan: <ul style="list-style-type: none"> • Concept of production plan • Steps of production plan 	1.5	1.5	3
20	Prepare business operation plan	Business plan/Business operation plan: <ul style="list-style-type: none"> • Concept of business operation plan • Steps of business operation plan • Cost price determination 	2	3	5
21	Prepare financial plan	Business plan/Financial plan: <ul style="list-style-type: none"> • Concept of financial plan • Steps of financial plan • Working capital estimation • Pricing strategy • Profit/loss calculation • BEP and ROI analysis • Cash flow calculation 	2	3	5
22	Collect market information/ prepare business plan	Information collection and preparing business plan: <ul style="list-style-type: none"> • Introduction • Market survey <ul style="list-style-type: none"> • Precaution to be taken while collecting information • Sample questions for market survey • Questions to be asked to the customers • Questions to be asked to the retailer • Questions to be asked to the stockiest/suppliers • Preparing business plan 	2	4	6
23	Appraise business plan	Business plan appraisal: <ul style="list-style-type: none"> • Return on investment • Breakeven analysis • Cash flow • Risk factors 	1	2	3
24	Maintain basic book keeping	Basic book keeping: <ul style="list-style-type: none"> • Concept and need of book keeping • Methods and types of book keeping 	1	2	3

		• Keeping and maintaining of day book and sales records			
	Total:		22	30	52

Text book:

क) प्रशिक्षकहरूका लागि निर्मित निर्देशिका तथा प्रशिक्षण सामग्री, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद्, २०६९

ख) प्रशिक्षार्थीहरूका लागि निर्मित पाठ्य सामग्री तथा कार्यपुस्तिका, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद् (अप्रकाशित), २०६९

Reference book:

Entrepreneur's Handbook, Technonet Asia, 1981.

On the Job Training (OJT)

Full Marks: 300

Practical: 12 weeks/480 hrs.

Description:

On the Job Training (OJT) is a 3 months (12 weeks/72 working days) program that aims to provide trainees an opportunity for meaningful career related experiences by working fulltime in real organizational settings where they can practice and expand their classroom based knowledge and skills before graduating. It will also help trainees gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks. The trainee will be eligible for OJT only after attending the final exam. The institute will make arrangement for OJT. The institute will inform the CTEVT at least one month prior to the OJT placement date along with plan, schedule, the name of the students and their corresponding OJT site.

Objectives:

The overall objective of the On the Job Training (OJT) is to make trainees familiar with firsthand experience of the real work of world as well as to provide them an opportunity to enhance skills.

The specific objectives of On the Job Training (OJT) are to;

- apply knowledge and skills learnt in the classroom to actual work settings or conditions and develop practical experience before graduation
- familiarize with working environment in which the work is done
- work effectively with professional colleagues and share experiences of their activities and functions
- strengthen portfolio or resume with practical experience and projects
- develop professional/work culture
- broaden professional contacts and network
- develop entrepreneurship skills on related occupation.

Activity:

In this program the trainees will be placed in the real work of world under the direct supervision of related organization's supervisors. The trainees will perform occupation related daily routine work in repair and maintenance of automobile vehicles as per the rules and regulations of the organization.

Potential OJT Placement Sites:

The nature of work in OJT is practical and potential OJT placement site should be as follows;

- Automobile Workshops
- Automobile Dealer: sales, service and spare parts center
- Repair and Maintenance workshop

Requirements for Successful Completion of On the Job Training:

For the successful completion of the OJT, the trainees should;

- submit daily attendance record approved by the concerned supervisor and minimum 72 working days attendance is required
- maintain daily diary with detail activities performed in OJT and submit it with supervisor's signature
- prepare and submit comprehensive final OJT completion report with attendance record and diary
- secured minimum 60% marks in each evaluation

Complete OJT Plan:

SN	Activities	Duration	Remarks
1	Orientation	2 days	Before OJT placement
2	Communicate to the OJT site	1 day	Before OJT placement
3	Actual work at the OJT site	12 weeks/480 hours	During OJT period
4	First-term evaluation	one week (for all sites)	After 5 to 6 weeks of OJT start date
5	Mid-term evaluation	one week (for all sites)	After 9 to 10 weeks of OJT start date
6	Report to the parental organization	1 day	After OJT placement
7	Final report preparation	5 days	After OJT completion

- First and mid-term evaluation should be conducted by the institute.
- After completion of 6 months OJT period, trainees will be provided with one week period to review all the works and prepare a comprehensive final report.
- Evaluation will be made according to the marks at the following evaluation scheme but first and mid-term evaluation record will also be considered.

Evaluation Scheme:

Evaluation and mark distribution are as follows:

S.N	Activities	Who/Responsibility	Marks
1	OJT Evaluation (should be three evaluation in three months –one evaluation in every months)	Supervisor of OJT provider	200
2	First and mid- term evaluation	The Training Institute	100
	Total		300

Note:

- Trainees must secure 60 percent marks in each evaluation to pass the course.
- If OJT placement is done in more than one institution, separate evaluation is required from all institutions.

OJT Evaluation Criteria and Marks Distribution:

- OJT implementation guideline will be prepared by the CTEVT. The detail OJT evaluation criteria and marks distribution will be incorporated in the guidelines.
- Representative of CTEVT, Regional offices and CTEVT constituted technical schools will conduct the monitoring & evaluation of OJT at any time during the OJT period.