CURRICULUM

Pre-Diploma in

Automobile Engineering

(Apprenticeship Programme)

Council for Technical Education & Vocational Training (CTEVT)

Curriculum Development Division

Sanothimi, Bhaktapur

Developed: 2019

First Revision: 2025(2082 B.S.)

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Introduction:

This Curriculum in Automobile Engineering is designed to produce Pre-diploma level workforce in Automobile sector. The graduates will be equipped with required knowledge, skills and attitude necessary to this level to meet the demand of the Automobile repair workshop in the country and aboard. This curriculum is based on the apprenticeship mode in which apprentices involve in the real work practice in the industry. An apprenticeship program combines on-the-job training with academic instruction for those entering the workforce. It is also called dual-training programs because of the combined occupational and in-house components; apprenticeships help individuals put their academic skills to practical use in various careers.

The program extends over 24 months. First fifteen weeks in-house classes insist in theoretical and basic practical skills will be provided in technical institutes. They learn the theoritical foundational subjects, communications and soft skills. The trainees acquire theoritical knowledge and practical in the training institutes. In every subject, topical explanations will be followed by demonstrations by instructors and in all tasks, trainees will be asked to practice by themselves through do-it-yourself/hands-on exercises so that they can internalize what they learnt in the classroom.

After completing the fifteen weeks classes in institutes, students are placed in Automotive Repairing Center or Workshop for 78 weeks (5 days a week for 8 hours a day) for real practice and they are called in training institute for 1 day a week, where they get some theoretical and practical exposure they find necessary. After the completion of 78 weeks' industrial practice, apprentice come back to the training institute for the revision and exam preparation for 4 weeks as block release.

Admitted trainees will have the three parties training agreement among apprentice, sponsor industries and training institute. The Agreement term and conditions will be implemented during the whole training period.

Rationale

The Automobile Engineering is genuine field in the engineering and technology sector. Many people in the world have been given emphasis for the broader application of automobile. This sector has been helping the world for the overall development and it has been creating wage and self-employment opportunities both in public and private sectors. Nepal is lacking huge number of trained workforce in automobile sector.

Very few Nepalese workers are working in automobile sector at present. They are not able to fulfil the needs of industries due to the lack of skills and knowledge on latest technology. This curriculum is designed as apprenticeship mode with the involvement of experts from automobile industries. Based on this curriculum, students will acquired required skills and knowledge in real work of world and fulfil the skills gap of the industries. This apprenticeship curriculum prepares graduates apt to the industry need, so that they get employed. Moreover the automobile industries

have agreed to develop the curriculum and train the students as apprentice so that they won't have the scarcity of skilled workers updated with their technologies in low cost.

Course Title:

Pre-diploma in Automobile Engineering (Apprenticeship Programme)

Aim:

The aim of this programme is to produce competent workforce equipped with automotive skills and knowledge to undertake any automobile repairing center or workshop or business company.

Objectives:

This curriculum has following objectives to:

- Produce basic level competent workforce in the field of automobile engineering who will able to:
    - Repair and maintain automobile vehicles.

- Prepare such technicians who are able to work in the automobile sector related local workshop and industrial settings of the country.
- Prepare such technical workforce who will demonstrate positive attitude and respect for the profession and socio-cultural values.
- Meet the demand of such technical workforce for the automobile industries of Nepal.
- Create self-employment opportunities.

Course Duration

This course will be completed within 24 months after the enrolment in a formal setting. The total hours for the course will be 3880 hours in the 24 months of period. The details of the course duration are as follows:

A .Institute Based Instruction:	**1280 hours (32 Weeks)**
• Pre training course:	15 weeks (600 hours)
• One day/week for 78 weeks:	13 weeks (520 hours)
• Block Release:	4 weeks (160 hours)
B. Industry Based Training (Hands on Practice):	**2600 hours (65 Weeks)**
• Automotive Engine:	23 Weeks (920 hours)
• Power Trains & Control System:	16 weeks (640 hours)
• Auto Electrical & Electronics System	16 weeks (640 hours)
• Electrical Vehicle Technology:	10 weeks (400 hours

Entry Criteria:

Individuals with following criteria will be eligible for this program:

- SEE, Grade-10 with any GPA and grade (Since 2072 SLC).

- SLC appeared (Before 2072 SLC).
- Nepali citizen above 16 years of age.
- Pass entrance examination administered by CTEVT.
- Candidates will be recruited on the merit base of entrance examination.
- Selected candidates should pass the interview conducted jointly by industry and the training institute.
- Mentally & physically fit for the occupation.

Group size:

The group size of this program will be 40.

Medium of Instruction:

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

Pattern of Attendance:

The students should have 90% attendance in theory classes and 100% in practical/industrial practice to be eligible for internal assessments and final examinations.

Instructors' Qualification

- Instructors should have Bachelor Degree in Automobile / Mechanical Engineering or equivalent Or Diploma in Automobile with a minimum of 3 years' experience.
- Assistant Instructors should have Diploma in Automobile Engineering or Pre-Diploma in Automobile Engineering with 3 years' experience.
- Practical Assistant/Teaching Aide should have Pre-diploma in Automobile Engineering
- For in-company/ industry trainers the required qualification must align with those specified in the "औद्योगिक प्रशिक्षार्थी (एप्रेन्टिसशीप) तालीम सञ्चालन कार्यविधि, २०७५"
- All instructional staff should have completed recognized instructional skills trainings (IS/ToT)
- Good communication and instructional skills.

Teacher and Student Ratio:

Overall ratio of teacher and student must be 1:40 (at the institution level).

- Teacher and student's ratio for theory class should be as per nature of classroom
- Teacher and student ratio for practical should be 1:10
- 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, Individual training packets, Procedure sheets, Performance Check lists, Textbooks).
- Non-projected Media Materials (Display, Photographs, Flip chart, Poster, Writing board.).
- Projected Media Materials (Multimedia, Overhead transparencies, Slides).
- Computer-Based Instructional Materials (Computer-based training, Interactive video.)

Teaching Learning Methodologies:

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

- Theory: Lecture, group discussion, Assignment, Group work.
- Practical: Demonstration, Observation and individual practice, guided practice, tutorial.
- Industrial Practice: Real work under the supervision of Industrial Supervisor.

Evaluation Details

- The distribution of marks 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%
3	Industrial Practice	50%	50%	60%

- There will be three internal assessments conducted by institute, followed by the Pre-Industry Examination for each subject at the end of the initial institute-based training phase. This exam serves as a mandatory for entry into the industry-based training phase. 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.
- Continuous evaluation of the students' performance is to be done by the related instructor/ trainer/industrial supervisor to ensure the proficiency over each competency under each area of a subject specified in the curriculum. Upon completion of the industry-based training phase, **Final Industrial Competency Test** shall be conducted through practical performance tests/assessments, supported by viva and/or objective test items to evaluate the corresponding theoretical knowledge across all subject areas.
- Performance evaluation of industrial practice should be done by the related In-company Trainer (Industrial Supervisor).
- Every student must pass every internal assessment to appear in the Pre-Industry Examination and the final Industrial Competency Test.

Provision for Back Paper

Apprentices may appear in back paper examinations; however, all subjects must be passed within three years from the date of enrolment. Chance examinations shall be conducted as per prevailing CTEVT rules and provisions.

Grading System:

The grading system will be as follows:

Grading	Overall marks
Distinction	80% or above
First division	75% to below 80%
Second division	65% to below 75%
Third division	to below 65%

Certificate Awarded:

The council for technical education and vocational training will award certificate of "**Pre-Diploma Certificate in Automobile Engineering (Apprenticeship)"** to those students who have successfully completed the requirements as prescribed by the curriculum. This certificate is considered equivalent to the previous qualification level, Technical School Leaving Certificate (TSLC).

Career Path:

The graduate will be eligible for the position equivalent to Non-gazetted 2nd class/level 4 (technical) in the government related organizations or as prescribed by the Public Service Commission of Nepal or the concerned authorities (Automotive Industries) of the Federal Democratic Republic of Nepal.

Course Structure

A. Institute Based Training (3.5 Months – 1 to 15 Weeks)

S.N	CODE	Subject	Teaching Scheme				Examination Scheme						Total Marks	Remarks
			Mode		Weekly Hour	Credit Hours	Theory			Practical				
			T	P			Assmt Marks	Final		Assmt Marks	Final			
								Marks	Time		Marks	Time		
1		Workshop Technology	3	5	8	6	20	80	3	60	40	4	200	
2		Engineering Drawing	1	3	4	3	25	-	-	30	20	3	75	
3		Power Trains & Control System	2	4	6	4	10	40	1.5	30	20	3	100	
4		Automotive Engine	2	4	6	4	10	40	1.5	30	20	3	100	
5		Auto Electrical & Electronics System	2	2	4	3	10	40	1.5	25	-	-	75	
6		Basic of Electric Vehicle Technology	2	1	3	3	10	40	1.5	25	-	-	75	
7		Applied Math	3	0	3	3	20	80	3	-	-	-	100	
8		Applied Communication & Professionalism	3	0	3	3	20	80	3	-	-	-	100	
9		Entrepreneurship Development	2	1	3	3	10	40	1.5	25	-	-	75	
		Sub Total	**20**	**20**	**40**	**32**	**135**	**440**		**225**	**100**		**900**	

B. Pre-Industry Examination (2 weeks)

Administered by the Controller of Examinations, CTEVT prior to the commencement of industrial practice

C. Industry-Based Training: Weeks 18 to 95 (78 weeks @ 34 hours per week ≈ 2600 hours)

S.N	CODE	Subject	Teaching Scheme				Examination Scheme						Total Marks	Remarks
			Mode		Weekly Hour	Credit Hours	Theory			Practical				
			T	P			Assmt. Marks	Final		Assmt. Marks	Final			
								Marks	Time		Marks	Time		
Total Duration: 23 Weeks														
1		Automotive Engine		14	14	7				120	80	6	200	
Total Duration: 16 Weeks														
2		Power Trains & Control System		10	10	5				90	60	5	150	
Total Duration: 16 Weeks														
3		Auto Electrical & Electronics System		10	10	5				90	60	5	150	
Total Duration: 10 Weeks														
4		Basic of Electric Vehicle Technology		6	6	3				60	40	4	100	
		Sub Total		**40**	**40**	**20**				**360**	**240**		**600**	

D. Institute-Based Training: Weeks 18 to 95 (78 weeks @ 6 hour per week)

Online and/or physically mode, with structured and integrated activities into the weekly plan

Submission of practice logbook as per provided instructions

Sharing field experiences, discussion of problems faced, resolved and unresolved issues supported by simulated practice and project work

Presentation of field report, assessment and evaluation, reflection of learning, exchange of feedback, sharing of upcoming task and activities and progress reporting

E. Block Release Session: Weeks 96 to 99 (4 weeks)

According to the structured weekly activity plan

Addressing critical queries from the apprentice

Providing supplementary instruction in remaining key theory and workshop practices

Conducting refresher training, independent and project/problem-based practice activities, including simulated workplace tests and feedback

F. Final Industrial Competency Test

Administered at accredited industry/institute-based test centers

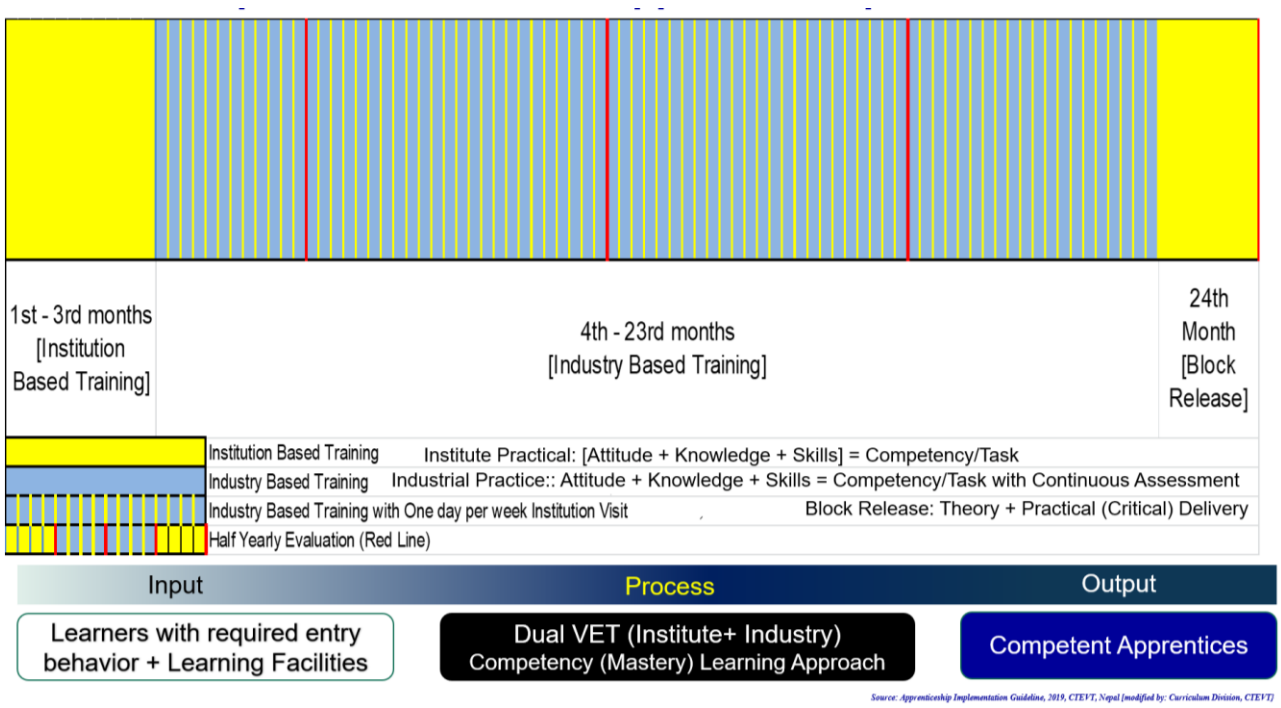
Collaborated with partner industries, employer associations, and training institutes, under the supervision of CTEVT

Credit System

S. N	Subjects	Credits-A (15 weeks Institution-Based)	Credits-C (65 weeks Industry-Based)	Credits-D (13 weeks Institution-Based)	Credits-E (4 weeks Block Release)	Maximum Credits
1.	Workshop Technology	2.57	-	-	0.69	**3**
2.	Engineering Drawing	1.29	-		0.34	**2**
3.	Power Trains & Control System	1.71	9.29	1.86	0.46	**13**
4.	Automotive Engine	1.71	13	2.6	0.46	**18**
5.	Auto Electrical & Electronics System	1.29	9.29	1.86	0.34	**13**
6.	Basic of Electric Vehicle Technology	1.29	5.57	1.11	0.34	**8**
7.	Applied Math	1.29			0.34	**2**
8.	Applied Communication & Professionalism	1.29			0.34	**2**
9.	Entrepreneurship Development	1.29		-	0.34	**2**
	Total	**13.73**	37.15	7.43	**3.66**	**63**

Notes:
T: Theory
P: Practical
Credit Hour: Represents instructor-led contact time, used for calculating evaluation weightage based on weekly hours for theory, workshop, and/or industrial practice.
Credit (Annual System): Indicates the total volume of learning completed over 3,880 hours across 97 weeks [15 (A) + {65 (C) + 13 (D)} + 4 (E)] at 40 hours per week. In this model, Credits are calculated using the formula: Credit Hours per Week × (Phase Weeks ÷ 35 Annual Weeks) across all phases, with Phase E following the same weekly planning structure as Phase A, and Phase D following that of Phase C.

Conceptual Framework of Apprenticeship Model



Source: Apprenticeship Implementation Guideline, 2019, CTEVT, Nepal [modified by: Curriculum Division, CTEVT]

Workshop Technology

Total Class: 120 hrs
Theory: 45 hrs
Practical: 75 hrs

Course description:

This subject deals with theory and practical on basic hand tools, measuring instrument, power tools required in mechanical workshop practice. This subject aims at imparting general knowledge and skills to the student making them competent and potential in the field of applied mechanical fitting and machining works.

Course Objectives:

After completion of this course, apprentices will be able to:

1. Work on safe working environment following safety regulation
2. File out plain surface and curved surfaces.
3. Perform marking using general and precision measuring tool
4. Measure & mark the given object.
5. Cut metals using different metal cutting tools
6. Drill holes and other operations on drilling machines.
7. Cut internal and external threads manually using taps and dies
8. Perform simple welding operation.
9. Perform machine operations

Course content

Section A: Institute Based Training (15 Academic Weeks) 120 hours

S.N.	Objectives	Related Contents/Tasks	Time (Hrs)		
			Th.	Pr.	Total
1.	Apply safety regulation	• Hazards, accidents and safety management principles • Safety rules of mechanical workshops • Electrical safety rules • Use of Personal Protective Equipment, • Apply safety of work on height and confined space, • Apply safety code and posters • Apply first aid on: electric shock, simple cut and injuries • Fix safety notices/signs • Follow safety precautions/instructions • Maintain first aid box • Fire hazards and fighting equipment • Use fire extinguisher	5	2	7
2	Maintain Housekeeping	• Plan housekeeping program,	4	2	6

		• Keep aisles and exits clear of items, • Replace/repair worn, ripped or damage flooring • Keep hazardous materials away from the floor and machine areas, • Maintain housekeeping materials, • Carryout day-to-day clean up, • Manage waste material disposal, • Report to supervisor if any issues arise.			
3	Perform Measuring and Marking	• Measuring and marking tools and their safety • Take measurement with steel rule, and measuring tape • Take measurement with vernier caliper • Take measurement with micrometer • Take measurement with simple and bevel protractor, • Take measurement with dial gauge • Take measurement with feeler gauge and bore gauge • Check radius with radius gauge, • Check thread profile with pitch gauge, • Check flatness using straight edge • Mark lines with marking scriber, • Mark height with height gauge, • Punch dot on marked point with center punch,	8	6	14
4	Perform Bench work operations	• Follow Bench work safety, • Basic bench work tools such as: Files, Hammer, Chisels, Punches, Pliers and cutters, Wrench and spanners, Vices, C-clamps, V-Block with clamps, Hacksaw, Taps and dies. • Interpret Mechanical Drawing in bench work operations • Measure & mark the given object as per drawing • Use of different techniques of holding work piece on bench vice	8	30	38

		• Use of file to file plane surface, external radius, angular surface • Check the flatness of plain surface • Make square hole with square file • Make chamfer and fillet on the work piece's edge • Use of different files on round and inner surfaces • Use of Saw for cutting metal by hand • Use of grinding machine on metal surfaces to clean the rust and burrs. • Use of center punch for drilling • Use of Drill for drilling • Use of chisel on flat surface chipping • Use of taps and dies to cut threads • Perform sheet metal work using hand shear, rivets, folding and seaming process, soldering			
5	Perform Drilling Operation	• Use of center punch for drilling • Use of Drill for drilling • Use of chisel on flat surface chipping • Use of taps and dies to cut threads • Perform sheet metal work using hand shear, rivets, folding and seaming process, soldering • Use of drill bit for different hole size • Replace drill bit and chuck • Apply different speed for different drilling operations • Placing and holding the drilling objects • Use of center punch to mark the drilling position. • Drilling, counter boring. Reaming operation • Cleaning of drilled hole	4	5	9
6	Perform Welding Operation	• Use of welding safety equipment's • Prepare AC arc welding machine, tools & equipment's.	5	10	15

		• Use of appropriate welding position • Use of appropriate welding electrode. • Use of appropriate welding current. • Apply Striking and maintain the arc • Weld Straight bead in flat position • Weld Fillet Lap joint in flat position • Weld Fillet Tee joint in flat position • Weld on cast iron parts • Grind–off welding surfaces			
7	Perform Gas Welding	• Prepare Acetylene gas and safety equipment • Set up ration of Oxygen gas and Acetylene gas • Set up Welding Nozzles • Run fusion lines without filler rod • Run fusion lines with filler rod • Weld Butt joint in flat position • Cut straight line in MS plate manually • TIG and MIG welding basic	6	10	16
8	Perform Machining Operation	• Perform selection of tools, speed, depth of cut and feed and setting on lathe machine. • Perform job fixing and centering on three and four jaw chuck of lathe machine. • Perform straight and step turning, facing, boring and knurling. • Use of bearing puller	5	10	15
		Total	45	75	120

References:

- Khurmi, R. S., & Gupta, J. K. (2019). *A textbook of workshop technology: Manufacturing processes* (24th ed.). S. Chand Publishing.
- S. K. and A.K. Hajra Chaudhary, Workshop Technology (Vol. I and II)
- Henp Fort Trade School, Shop Theory (Vol. 1)
- CIMI, Madras, Fitter trade Practical
- ILO learning element, Mechanical engineering

- Heinrich Gerling, all about MACHINE TOOLS
- Elementary Metal Course Training Section I, BBF.
- John, K. C. (2010). *Workshop practice manual*. PHI Learning.

Engineering Drawing

Total: 60 hrs
Theory: 15 hrs
Practical: 45 hrs

Course Description:
This Engineering Drawing subject provides essential skill and knowledge to communicate ideas and information in graphical language. This subject mainly focuses on orthographic representation, Oblique/Isometric views, and various types of lines, Dimensions, symbolic, sectional views, Assembly, and detailed drawing.

Course Objectives:
After completion of this course, apprentices will be able to:

1. Define engineering drawing
2. Describe element of the engineering drawing
3. Handle drawing instruments.
4. Draw geometric constructions.
5. Interpret a drawing with text, dimensioning, tolerance and related information.
6. Draw projections.
7. Draw orthographic projections.
8. Draw isometric view in scale
9. Draw sectional views of the given three-dimensional solid.
10. Interpret Assembly and Detailed Drawing.

Section A: Institute Based Training (15 Academic Weeks) 60 hours

S.N.	Objectives	Related Contents/Tasks	Time (hrs)		
			Th.	Pr.	Total
1.	Define engineering drawing	• Definition • Types of drawing • Classification of engineering drawing • Application of engineering drawing	2		2
2	Handle drawing instruments	• Introduction • Types, uses and sizes • Handling techniques • Precautions • Exercises and assignments	2	2	4
3	Describe and draw elements of the engineering drawing	• Introduction • Lines	1	2	3

		• Symbols (Basic Electrical, Basic Electronics, Basic Plumbing, Basic Mechanical, Basic Hydraulic and Pneumatic, Traffic sign and symbols) • Title block • Annotation (texts) • Scale • Exercises and assessment			
4	Acquaint to dimension the drawing.	• Introduction of dimensioning • Elements and rules of dimensioning • Direction of dimensioning • Dimensioning angles • Dimensioning arcs • Dimensioning through and blind holes • Exercises and assignments	2	1	3
5	Draw geometric construction	• Introduction • Layout of the drawing paper • Procedure of drafting title block • Conventional lines and their usages • Procedure for Bisect/trisect a line • Procedure for Bisect/trisect an angle • Procedure of drawing perpendicular and parallel line • Procedure of drawing tangents(circle to circle, line to circle, arc between two line) • Procedure for constructing circle, polygons (inscribed/circumscribed) • Procedure of Construct ellipse (four center method/rhombus method) • Procedure of Construct oval • Exercises and assignments	2	8	10
6	Interpret and draw Orthographic Projection	• Introduction • Types of projection • Projection of point and line • Basic concept of true line and shape	2	10	12

		• Draw Orthographic projection (first angle and third angle) of different solid and combined solid which includes cube, solid and hollow cylinder, Pyramid, cone • Exercises and assignments			
7	Interpret pictorial projection and draw isometric drawing	• Introduction to isometric projection and oblique projection • Rules for presenting the lines in isometric and oblique projection. • Methods of constructing isometric and oblique drawings. • Isometric drawing of rectangular object, circular object and combination of rectangular and circular object. • Oblique drawing of rectangular plane, circular plane and combined plane of rectangle and circle. • Exercises and assignments	2	10	12
8	Draw sectional views	• Introduction • Cutting plane line • Types of sectional views • Method of sectional views • Full sectional drawing • Half sectional drawing • Exercises and assignments	1	5	6
9	Interpret Assembly and Detailed Drawing	• Introduction • Types of fits and their uses • Exercise in identifying parts in Assembly drawing of different automobile parts. • Exercise in detailing assembly drawing. • Exercises and assignments	1	7	8
			15	**45**	**60**

References:

- Luintel, M.C (2021).*Engineering drawing for diploma in Engineering : I and II*, Heritage publishers and distributors
- Bhatta, N. D. (2018). *Engineering drawing: Plane and solid geometry* (Revised ed.). Dreamtech Press.
- Caribbean Examinations Council. (2012). *Geometrical and mechanical engineering drawing*. Oxford University Press.
- Dhawan, R. K. (2020). *Fundamentals of engineering drawing for polytechnics* (3rd ed.). S. Chand Publishing.
- Dhawan, R. K. (2019). *A textbook of machine drawing (First angle projection)* (2nd ed.). S. Chand Publishing.
- Gill, P. S. (2017). *Engineering drawing (Geometrical drawing)* (3rd ed.). SK Kataria & Sons.

Power Transmission and Control system

Total Class: 90 hrs
Theory: 30 hrs
Practical: 60 hrs

Course description:
This subject deals with basic principle of automobile system and their importance, function, types, trouble shooting and safety precautions related to control and suspension system and power trains in the automobile.

Course Objectives:
After completion of this course, apprentices will be able to:

1. Identify components of power transmission and control system of automobile
2. Understand the operation of transmission system and control system
3. Service, Repair and Troubleshooting of power transmission system
4. Service, Repair and Troubleshooting of Steering system
5. Service, Repair and Troubleshooting of Brake system
6. Service, Repair and Troubleshooting of Suspension system

Course content
Section A: Institute Based Training (15 Academic Weeks) 90 hours

S.N.	Objectives	Related Contents/Tasks	Time (Hrs)		
			Th.	Pr.	Total
1.	Dismantle and Assemble the Clutch System	• Introduction • Types of Clutch: Mechanical, Hydraulic, Pneumatic, • Technical Specification • Special Service tools and their usage • Removal of Clutch component from vehicle • Identification of Clutch system components • Layout of Clutch system • Operation of Clutch system • Inspection of Clutch components • Tightening torques • Installation of clutch components • Important adjustment and setting • General maintenance of clutch systems • Diagnosis and Trouble shooting of clutch	2	6	8
2	Dismantle and Assemble the Gear box	• Introduction:	2	6	8

		• Types of Gear box: Sliding mesh, Constant mesh, Synchromesh • Technical Specification • Special Service tools and their usage • Dismantle gear box • Cleaning of component • Identification of gear box components • Inspection of gear box components • Tightening torques • Important adjustment and setting: Drive shaft end play, counter shaft end play, main shaft end play • Assembly of gear box • Regular maintenance of gearbox • Diagnosis and Trouble shooting of gear box			
3	Dismantle and Assemble the Automatic gear box	• Introduction: Torque Converter, Epicyclic gear train, Continuous variable transmission, • Technical Specification • Special Service tools and their usage • Operation of Automatic gear box • Dismantle automatic gear box • Cleaning of component • Identification of Automatic gear box components • Inspection of components • Tightening torques • Important adjustment and setting • Assemble the gear box • Regular maintenance of gearbox • Diagnosis and Trouble shooting of gear box	3	6	9
4	Dismantle and Assemble Transfer Case	• Introduction • Special Service tools and their usages • Operation of transfer case • Dismantling of transfer case	1	2	3

		• Identification of components • Inspection of components • End play adjustment of shafts • Assemble transfer case • Regular maintenance of transfer case • Diagnosis and Trouble shooting of transfer case			
5	Dismantle and Assemble the Differential	• Introduction • Types: Limited slip, Conventional • Technical Specification • Special Service tools and their usages • Dismantling of differential • Cleaning of components • Identification of Components • Operation of differential • Inspection of components • Important adjustment and setting: Tail pinion depth, tail pinion bearing pre loading, backlash between sun gear and star gear, backlash between tail pinion and ring gear, Thrust pad adjustment • Assemble the differential • Regular maintenance of differential • Diagnosis and Trouble shooting of differential	1	4	5
6	Dismantle and Assemble the Transaxle	• Introduction • Technical Specification • Special Service tools and their usages • Dismantling of Transaxle • Cleaning of components • Identification of Components • Operation of Transaxle • Inspection of components • Important adjustment and setting • Assemble the transaxle • Regular maintenance of Transaxle	1	6	7

		• Diagnosis and Trouble shooting of Transaxle			
7	Dismantle and Assemble the Drive line	• Introduction • Types: Semi floating, 3-quarter floating, fully floating • Technical Specification • Special Service tools and their usages • Dismantling of Drive line • Cleaning of components • Identification of Components • Operation of Drive line • Inspection of components • Important adjustment and setting: Hub bearing adjustment • Assemble the Drive line • Regular maintenance of Drive line • Diagnosis and Trouble shooting of Drive line	1	4	5
8	Dismantle and Assemble the Propeller shaft	• Introduction • Technical Specification • Special Service tools and their usages • Operation of Propeller shaft • Removal of Propeller shaft, universal joints and bearing • Cleaning of components • Identification of Components • Inspection of components • Assemble the Propeller shaft • Regular maintenance of Propeller shaft • Diagnosis and Trouble shooting of Propeller shaft	2	3	5
9	Dismantle and Assembly of Steering System	• Introduction • Basic principle Types: Mechanical: Rack and pinion ,Worm and roller, Recirculating ball and nut ✓ Power steering hydraulic: Rack and pinion, Worm and	4	5	9

		roller, Recirculating ball and nut ✓ Electric Power assisted steering • Technical Specification • Special Service tools and their usages • Operation of Steering System • Removal of Steering system components from vehicle • Dismantling of components • Cleaning of components • Identification of Components • Inspection of components • Adjustment: free play, axial play, wheel centering / steering calibration , toe in, toe out, king pin inclination, Thrust alignment • Assemble the Steering system • Regular maintenance of Steering system • Diagnosis and Trouble shooting of Steering system			
10	Dismantle and Assemble the Suspension System	• Introduction • Types: Rigid type, Independent type, Air suspension • Technical Specification • Special Service tools and their usages • Operation of Suspension System • Removal of Suspension System components from vehicle • Dismantling of components • Cleaning of components • Identification of Components • Inspection of components • Adjustment: Camber and caster, • Assembly of Suspension system • Regular maintenance of Suspension system • Diagnosis and Trouble shooting of Suspension system	4	5	9

11	Dismantle and Assemble various types of Braking System	• Introduction • Types: Mechanical brake, Hydraulic brake, Air brake system, Anti-lock braking system, Electric Brake • Technical Specification • Special Service tools and their usages • Operation of Braking Systems • Removal of Braking System components from vehicle • Dismantling of components • Cleaning of components • Identification of Components • Inspection of components • Brake system electrical circuit analysis. • Continuity voltage resistance and short circuit check in braking system • Important setting and adjustment of braking system • Assembly of Braking system • Air Bleeding • Regular maintenance of Braking system • Diagnosis and Trouble shooting of Braking system	6	7	13
12	Removal and installation of Wheel and Tyres	• Introduction • Types: Radial and cross ply tyre, Tube and Tubeless tyre, Spoke wheel, steel wheel and alloy wheel • Technical Specification • Special Service tools and their usages • Removal and installation of wheel • Removal and installation of tyre • Repair the Flat Tyres • Tyre Rotation • Wheel Balancing • Maintain Tyre pressure • Regular maintenance of Wheel and Tyre	3	6	9

		• Trouble shooting of Wheel and Tyre			
		Total	30	60	90

Section C: Industry Based Training **(640 hours)**

S.N.	Objectives	Related Contents/Tasks	Time (Hrs)		
			Th.	Pr.	Total
1.	Dismantle and Assemble of Clutch System	• Dos and Don'ts • Technical Specification • Special Service tools and their usage • Removal of Clutch component from vehicle • Identification of Clutch system components • Layout of Clutch system • Operation of Clutch system • Inspection of Clutch components • Tightening torques • Installation of clutch components • Important adjustment and setting • General maintenance of Clutch systems • Diagnosis and Trouble shooting for clutch			
2	Dismantle and Assemble of Gear box	• Dos and Don'ts • Technical Specification • Special Service tools and their usage • Removal of Gear box from vehicle • Dismantle gear box • Cleaning of component • Identification of gear box components • Inspection of gear box components • Tightening torques • Important adjustment and setting: Drive shaft end play, counter shaft end play, main shaft end play • Assembly of gear box			

		• Regular maintenance of gearbox • Diagnosis and Trouble shooting for gear box •			
3	Dismantle and Assemble of Automatic gear box	• Dos and Don'ts • Technical Specification • Special Service tools and their usage • Operation of Automatic gear box • Dismantle automatic gear box • Cleaning of component • Identification of Automatic gear box components • Inspection of components • Tightening torques • Important adjustment and setting • Assemble the gear box • Regular maintenance of gearbox • Diagnosis and Trouble shooting for gear box			
4	Dismantle and Assemble of Transfer Case	• Dos and Don'ts • Special Service tools and their usages • Operation of transfer case • Dismantling of transfer case • Identification of components • Inspection of components • End play adjustment of shafts • Assemble transfer case • Regular maintenance of transfer case • Diagnosis and Trouble shooting for transfer case			
5	Dismantle and Assemble of Differential	• Dos and Don'ts • Technical Specification • Special Service tools and their usages • Dismantling of differential • Cleaning of components • Identification of Components • Operation of differential • Inspection of components			

		• Important adjustment and setting: Tail pinion depth, tail pinion bearing pre loading, backlash between sun gear and star gear, backlash between tail pinion and ring gear, Thrust pad adjustment • Assembly of differential • Regular maintenance of differential • Diagnosis and Trouble shooting for differential			
6	Dismantle and Assemble of Transaxle	• Dos and don'ts • Technical Specification • Special Service tools and their usages • Dismantling of Transaxle • Cleaning of components • Identification of Components • Operation of Transaxle • Inspection of components • Important adjustment and setting • Assembly of transaxle • Regular maintenance of Transaxle • Diagnosis and Trouble shooting for Transaxle			
7	Dismantle and Assemble of Drive line	• Dos and Don'ts • Technical Specification • Special Service tools and their usages • Dismantling of Drive line • Cleaning of components • Identification of Components • Operation of Drive line • Inspection of components • Important adjustment and setting: Hub bearing adjustment • Assembly of Drive line • Regular maintenance of Drive line • Diagnosis and Trouble shooting for Drive line			

8	Dismantle and Assemble of Propeller shaft	• Dos' and Don'ts • Technical Specification • Special Service tools and their usages • Operation of Propeller shaft • Removal of Propeller shaft, universal joints and bearing • Cleaning of components • Identification of Components • Inspection of components • Assembly of Propeller shaft • Regular maintenance of Propeller shaft • Diagnosis and Trouble shooting for Propeller shaft			
9	Dismantle and Assemble of Steering System	• Do's and Don'ts • Technical Specification • Special Service tools and their usages • Operation of Steering System • Removal of Steering system components from vehicle • Dismantling of components • Cleaning of components • Identification of Components • Inspection of components • Adjustment: free play, axial play, wheel centering / steering calibration , toe in, toe out, king pin inclination, Thrust alignment • Assembly of Steering system • Regular maintenance of Steering system • Diagnosis and Trouble shooting for Steering system			
10	Dismantle and Assemble of Suspension System	• Do's and don'ts • Technical Specification • Special Service tools and their usages • Operation of Suspension System • Removal of Suspension System components from vehicle • Dismantling of components • Cleaning of components			

		• Identification of Components • Inspection of components • Adjustment: Camber and caster, • Assembly of Suspension system • Regular maintenance of Suspension system • Diagnosis and Trouble shooting for Suspension system			
11	Dismantle and Assemble of Braking System	• Do's and don'ts • Technical Specification • Special Service tools and their usages • Operation of Braking Systems • Removal of Braking System components from vehicle • Dismantling of components • Cleaning of components • Identification of Components • Inspection of components • Brake system electrical circuit analysis. • Continuity voltage resistance and short circuit check in braking system • Important setting and adjustment of braking system • Assembly of Braking system • Air Bleeding • Regular maintenance of Braking system • Diagnosis and Trouble shooting for Braking system			
12	Removal and installation of Wheel and Tyres	• Do's and Don'ts • Technical Specification • Special Service tools and their usages • Removal and installation of wheel • Removal and installation of tyre • Mending of Flat Tyres • Tyre Rotation • Wheel Balancing • Maintain Tyre pressure			

		• Regular maintenance of Wheel and Tyre • Trouble shooting of Wheel and Tyre			
		Total		640hrs	640hrs

References:

- Rajamani, R. (2011). *Vehicle dynamics and control* (2nd ed.). Springer.
- Gillespie, T. D. (1992). *Fundamentals of vehicle dynamics*. Society of Automotive Engineers.
- Reimpell, J., & Stoll, H. (2001). *The automotive chassis: Engineering principles* (2nd ed.). Butterworth-Heinemann.
- Babu A.K, & Singh A. P (2014), Automobile Engineering, S Chand and Co.
- Gilles, T. (2011). *Automotive Service: Inspection, Maintenance, Repair* (4th ed.).

Automotive Engine

Total Class: 90 hrs
Theory: 30 hrs
Practical: 60 hrs

Course description:
This subject deals with basic principle of automobile engine and their importance, function, types, Engine components, repair the engine and troubleshoot engine problem

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Course Objectives:
After completion of this course, apprentices will be able to:

1. Identify of engine components
2. Explain operation of engine
3. Overhaul and repair the engine
4. Troubleshoot engine

Course content
Section A: Institute Based Training (15 Academic Weeks) 90 hours

S.N.	Objectives	Related Contents/Tasks	Time (Hrs)		
			Th.	Pr.	Total
1	Dismantle automotive engine	• Safety rules of Automobile workshops • Use of Personal Protective Equipment • Engine Specification • Special Service Tools • Workshop Manual • Tightening torque and Angle torque • Various types of automobile: 2 wheeler, 3 wheeler, passenger, commercial, special application vehicles • Dismantling of cylinder head • Dismantling of cylinder block • Identification of various engine components • Demonstrate function of various engine components • Demonstrate operating principle of engine : Two stroke and four stroke, SI and CI engine • Clean engine components • Inspect engine components • Operation of Lubrication system	8	16	24

		• Operation of Cooling system			
2	Measure Engine Component	• Measure engine components • Measurement of ovality and taperness • Cylinder bore • Crankshaft main journal and big end journal • Pistons ring butt clearance • Piston ring groove clearance • Main bearings parent bores with bearings • Big end bearing parent bores with bearings • Cam shaft journals • Cam bushes in cylinder block • Measure surface of cylinder block and cylinder head • Crank shaft end play • Connecting rod end play • Piston Projection/Protrusion	2	12	14
3	Assemble cylinder block	• Install Crank shaft • Install Piston • Install Flywheel • Install balancer • Install Oil Pump • Install Oil Pan • Install Cam shaft • Test and alignment	3	3	6
4	Assemble Cylinder head	• Install valves • Install overhead cam shaft • Install fuel Injector/spark plug • Install Intake and exhaust manifold • Install glow plugs	1	2	3
5	Assemble Engine Component (Cylinder head and Block)	• Tighten cylinder head bolts • Install fuel injection pump • Install timing gears • Set valve timing/ timing belt • Set fuel injection pump timing • Adjust valve clearance	4	5	9
6	Familiarize Engine system	• Demonstrate operation of ✓ Air Induction system ✓ Exhaust System: Exhaust Gas Recirculation, Turbocharger, Intercooler ✓ Fuel Supply System	3	3	6

		✓ Evaporative emission control system ✓ Blow by system ✓ Vacuum system ✓ Exhaust gas recirculation system			
7	Test of Engine Condition	• Perform Cylinder compression pressure test • Perform oil pressure test • Emission test	2	3	5
8	Service, Repair and testing of After treatment system	• Introduction to After treatment system (ATS) • Layout of ATS • Function and operation of ATS components: ECU, Temperature sensor, Injector, Differential Pressure sensor, Particulate Matter sensor, Oxygen sensor, Catalytic converter, Diesel Particulate Filter, Diesel Oxidation Catalyst, Selective catalytic Reduction (SCR), Lean Nox Trap (LNT) • Circuit diagram of ATS • Do's and Don't • Regeneration • Troubleshooting of ATS using Multi-meter and Diagnostic scanner	4	6	10
9	Maintenance of Engine	• Periodic maintenance • Daily Maintenance •	1	4	5
10	Troubleshooting of Engine	• Engine Management system (Diesel) • Multipoint fuel injection system • After treatment system	2	6	8
		Total	30	60	90

Section C: Industry Based Training (920 hours)

S.N.	Objectives	Related Contents/Tasks	Time (Hrs)		
			Th.	Pr.	Total
1.	**Perform Servicing and Repair of Cooling System**				
1.1	Check/ Replace Seal/Hoses pipes	• Determine the location/ points of leaks. • Drain cooling system. • Clean gasket mating surfaces.			

		• Install new gasket. • Use sealing compound if necessary. • Inspect hose and clamp. • Replace hoses and clamp if needed. • Tighten attaching bolts. • Refill cooling system to proper level with coolant. • Test pressure system for leaks. • Operate engine until it reaches normal operating temperature. • Recheck coolant level.			
1.2	Change Radiator, radiator fan and Motor	• Consult service manual noting safety procedures. • Drain coolant from engine. • Remove upper and lower radiator hoses. • Remove mounting bolts. • Remove radiator. • Locate leaks by pressure testing. • Check radiator by pressure testing. • Inspect radiator cap and reservoir tank. • Replace radiator. • Replace upper and lower radiator hoses. • Refill radiator with coolant. • Test pressure system for leaks. • Operate engine until it reaches normal operating temperature. • Recheck coolant level.			
1.3	Check Thermostat valve	• Drain cooling water. • Remove thermostat housing and thermostat. • Clean gasket surfaces. • Check thermostat valve for operation. • Install thermostat and housing using new gasket. • Refill cooling system to proper level with coolant. • Test pressure system for leaks. • Operate engine until it reaches normal operating temperature.			

		• Recheck coolant level.			
1.4	Check / change water pump	• Consult service manual noting safety procedures. • Drain cooling system. • Disconnect lower radiator hose and pump. • Remove fan pulley and fan hub. • Remove pump by pass hose if equipped. • Remove water pump. • Clean block surface of all old gaskets. • Disassemble pump according to manufacturer's recommended procedures. • Clean all parts and gasket mating surfaces. • Check water pump kit, impeller, shaft and bearings for wear. • Reassemble pump using new parts according to manufacturer's recommended procedures and specifications. • Install water pump using new gasket. • Refill cooling system to proper level with coolant. • Test pressure system for leaks. • Operate engine until it reaches normal operating temperature. • Recheck coolant level.			
1.5	Check/change Coolant temp. sensor	• Check the ECTS by monitoring live data form the scanner while engine running. • Remove the ECTS from the installed Position. • Check ECTS by measuring change in Resistance while Temperature change. • Install / Change ECTS and connect connector.			
1.6	Check / change Oil filter/ Cooler	• Consult service manual noting safety procedures. • Clean external surface of cooler and surrounding engine area.			

		• Drain oil form oil cooler if necessary. • Disconnect lube oil inlet and outlet lines and cap ends of lines. • Remove oil filter cooler. • Install new cooler. • Reconnect oil lines using new gaskets or seals. • Add oil to crankcase if necessary. • Operate engine and check for oil leaks. • Stop engine and check oil level and correct as necessary			
1.7	Replace Coolant	• Prepare the vehicle • Consult service manual noting safety procedures. • Clean external surface of cooler and surrounding engine area. • Lift the vehicle if necessary • Place drain pan under radiator • Remove radiator cap • Open radiator drain plug and drain old coolant • Remove engine block drain plug (if applicable) • Close drain plugs after draining • Flush with distilled water or radiator flush (optional) • Run engine with heater on (for flushing) • Drain flush water and close drain plugs • Refill with new coolant (correct mix or pre-mixed) • Start engine with radiator cap off • Bleed air from cooling system • Top off coolant as needed • Replace radiator cap • Check coolant reservoir level • Check for leaks after short drive • Dispose of old coolant properly			
2. Service and Repair of Fuel System					

2.1	Identify and locate Fuel System Components	• Identify and locate following Fuel System Components • In Diesel Engines – Fuel feed pump, fuel filter, Inline /distributor type Fuel pump, Injectors, In CRDI Engines – Fuel Pump, High pressure pump, injector, common rail, rail pressure sensor, fuel pressure control valves, • In Petrol Engines- in tank fuel pump, Fuel lines, Petrol filter, fuel pressure relief valve, Injectors.			
2.2	Replace Injectors	• Locate and gain access to the injector(s). • Clean the area around the fuel injector(s). • Clean the fuel or oil leakage lines as required per manufacturer's procedure. • Remove any electrical connections if used. • Remove the fuel line at the injector nozzle at the injection pump using the special equipment as required by manufacturer. • Cap the fuel lines and injection pump openings. • Loosen the fuel line clamp and remove the fuel line as per manufacturer's procedure. • Remove the injector(s) as per manufacturer's procedure and specifications and mark the injector for replacement. • Plug the cylinder block injector nozzle opening if more injectors are removed. • Clean the injector nozzle opening in the cylinder block. • Apply a copper-based, anti-seize compound to the nozzle threads. • Remove the protective plug from the cylinder block.			

		• Install injector nozzle(s) into the original positions as per manufacturer's specifications. • Remove the protective caps from the fuel lines, injector pump and injector nozzles. • Install fuel lines, nozzle/fuel line clamps. • Reattach electrical connections. • Reconnect the fuel or oil leakage lines. • Bleed the fuel system. • Reinstall any parts removed to gain access to the nozzle. • Start the engine, check for leakage and correct as necessary			
2.3	Replace Fuel Tank	• Disconnect the negative terminal of the battery. • Drain the fuel system as necessary per manufacturer's procedure. • Raise the back of the vehicle and safety support on jack stands or hoist. • Disconnect fuel lines and electrical connections. • Disconnect fuel filler tube. • Support the fuel tank. • Remove the fuel tank attachment hardware and tank. • Remove and clean components from old fuel tank. • Clean the components with correct O-ring on the new fuel tank per manufacturer's procedure. • Install fuel tank and attachment hardware. • Reconnect fuel lines and electrical connections. • Reconnect fuel filler tube. • Fill fuel tank and check for leaks. • Pressurize the fuel system and check for leaks per manufacturer's procedures. • Lower the vehicle off the jack stands or hoist.			

		• Reconnect the terminal of battery			
2.4	Replace Fuel Feed Pump	• Locate and gain access to fuel pump. • Disconnect and plug fuel lines. • Remove fuel pump fastening hardware and remove pump. • Clean fuel pumps mounting area of old gasket material and foreign matter. • Install replacement fuel pump and mounting hardware. • Reconnect fuel lines. • Reinstall any components that were removed to gain access to the fuel pump. • Start engine and check for leaks.			
2.5	Replace Fuel Pump (Electrical type- in tank)	• Disconnect the negative terminal of the battery. • Depressurize the fuel system. • Drain as much fuel out of the fuel tank by pumping out through the filler neck. • Raise the back of the vehicle and support on jack stands. • Disconnect the fuel supply, return and vent lines from the frame of the vehicle. • Disconnect the wiring harness from the fuel pump. • Support the fuel tank, loosen and remove the mounting straps. • Remove the fuel tank. • Disconnect the fuel lines and wiring harness from the pump flange. • Clean the outside of the mounting flange and retaining ring. • Remove the fuel pump lock ring per manufacturer's procedures. • Remove the fuel pump. • Clean the pump mounting surfaces. • Install the sealant, new fuel pump and lock ring.			

		• Reconnect the fuel lines and wiring harness to the pump flange. • Install the fuel tank. • Support the fuel tank, replace and tighten the mounting straps. • Reconnect the wiring harness to the fuel pump. • Reconnect the fuel supply, return and vent lines to the vehicle frame. • Lower the vehicle off the jack stands. • Reconnect the negative terminal of the battery terminal. • Pressurize the fuel system and check fittings for leakage. • Start the engine and check for leaks.			
2.6	Set Diesel fuel injection pump timing (Distributor type)	• Disconnect the negative terminal. • Remove components as necessary to gain access to the injection pump. • Remove the injection pump distributor head plug bolt and sealing washer or equivalent as per manufacturer's procedure and specifications. • Install static timing gauge with dial indicator, so that indicator pointer is in contact with the injection pump plunger as per manufacturer's procedure. • Remove the timing mark cover from transmission housing. • Align timing mark with no. 1 piston at TDC of compression stroke with mark on the rear engine cover plate. • Rotate the crankshaft pulley slowly, counterclockwise until the dial indicator stops moving as per manufacturer's procedure and specifications. • Set the dial gauge with zero position.			

		• Turn the crankshaft clockwise until crankshaft-timing mark aligns with indicator pin. • Check the dial indicator reading as per manufacturer's specifications. • Loosen the pump mounting bolts and rotate the pump toward the engine to advance the timing and away from the engine to retard the timing until the reading is within the manufacturer's specifications. • Tighten the pump mounting bolts if the reading is within specifications. • Repeat Performance steps 6 to 11 to make sure that the timing is adjusted correctly. • Remove the dial indicator and adopter. • Install the injection pump distributor head plug or equivalent as per manufacturer's procedure and specifications. • Connect the negative terminal of the battery. • Run the engine, check and adjust the idle RPM, if necessary. • Check for fuel leaks.			
2.7	Bleed fuel system (Fuel line air Remove- Diesel Engine)	• Determine whether the fuel injection system is mechanical or electrical according to manufacturer's specifications. Use scanner in Electronic Fuel injection system. • Loosen connection at fuel filter outlet, and pump hand primer until fuel flows from connections. • Tighten connection at fuel filter outlet. • Loosen fuel pump outlet line and pump hand primer until fuel flows from connection			

		• Loosen fuel line connections at fuel injectors and crank engine until fuel appears. • Retighten the connection. • Start the engine and operate for period of time necessary to purge remaining air from lines as per manufacturer's procedure.			
2.8	Replace fuel unit	• Disconnect the negative terminal. • Depressurize the system per manufacturer's procedures. • Locate fuel level sending unit. • Remove fuel tank if necessary to gain access to the sending unit. • Clean sending unit area to prevent dirt from entering the fuel tank. • Siphon fuel as necessary to lower the fuel level below the sending unit opening. • Remove the sending unit fuel lines, electrical connections and attachment hardware. • Remove the sending unit. • Clean the sending unit mounting surface. Do not get dirt into the fuel tank. • Install replacement sending unit, gaskets or seals per manufacturer's procedures. • Reattach fuel lines and electrical connections. • Pressurize the fuel system and check for leaks per manufacturer's procedures. • Reinstall any components that were removed to gain access to the fuel-sending unit. • Reconnect the negative battery terminal. • Check out put voltage and/or gauge while filling the tank.			
2.9	Check Fuel Pump Pressure	• Check Fuel Pump Pressure using pressure gauge with standard procedure recommended by manufacturer			
3. Perform Servicing and Repair of Lubricating System					

3.1	Identify and locate Lubricating system Components	• Identify and locate Lubricating system Components – Engine oil, filter, oil cooler, oil galleries, oil pump, oil pressure sensor and warning lamp			
3.2	Replace Engine Oil and Filter	• Place a clean tray under the drain plug. • Unscrew the drain plug. • Remove the drain plug. • Drain the engine oil in a jar or tray. • Remove oil filter. • Replace oil filter. • Plug the drain plug when oil stops dropping. • Tighten the drain plug as per specified torque according to the service manual. (Don't over tight) • Refill the specified grade of engine oil to the required level. • Wait 5 to 10 minutes for checking oil level. • Lift the dipstick and wipe it. • Check the oil level. • Refill the oil if the level is low. • Cap the filler cap. • Keep the jar or tray in proper place.			
3.3	Replace Oil Cooler	• Consult service manual noting safety procedures. • Clean external surface of cooler and surrounding engine area. • Drain oil form oil cooler if necessary. • Disconnect lube oil inlet and outlet lines and cap ends of lines. • Remove cooler. • Install new cooler. • Reconnect oil lines using new gaskets or seals. • Add oil to crankcase if necessary.			

		• Operate engine and check for oil leaks. • Stop engine and check oil level and correct as necessary.			
3.4	Replace Oil Pump	• Park vehicle on level ground • Disconnect battery • Lift vehicle and secure with jack stands • Drain engine oil • Locate the oil pump in the engine. • Disconnect all parts to gain access to remove oil pump. • Remove oil pump assembly. • Remove oil filter. • Clean oil strainer. • Disassemble the oil pump according to manufacturer's procedures. • Inspect the worn parts to be replaced. • Examine to determine reason for failure before replacing with new pump. • Get replaced parts or new pump. • Reassemble the oil pump as per service manual's procedures and specifications. • Install the oil strainer and oil pump to the engine. • Connect the oil supply pipes. • Connect all the parts that were removed to gain access to the oil pump. • Reconnect battery • Start engine and check for oil pressure • Inspect for leaks • Test drive and recheck oil level			
3.5	Test oil pressure	• Park vehicle on level ground • Turn off engine and let it cool • Open hood and locate oil pressure sensor • Disconnect battery (for safety) • Remove oil pressure sensor			

		• Install mechanical oil pressure gauge in sensor port • Reconnect battery • Start the engine • Let engine warm to operating temperature • Read oil pressure on gauge at idle • Increase RPM and observe pressure change • Compare readings with manufacturer specs • Turn off engine • Remove test gauge • Reinstall oil pressure sensor • Reconnect any electrical connectors • Reconnect battery (if disconnected) • Check for oil leaks • Close hood and test drive (if needed)			

4. Perform Engine					
4.1	Dismantle Engine	• Remove all electrical and accessories attached to the engine. • Remove Engine Cover • Remove Camshaft Cover • Remove Inlet Manifold • Remove Exhaust Manifold • Remove Timing belt • Remove Cylinder Head and Gasket • Remove Camshaft / Gear • Remove valves from cylinder head. • Remove Oil Pan • Remove Oil Pump • Remove Engine Mounting • Remove Rear timing belt cover • Remove connecting Rods/Pistons			

		• Remove Crankshaft • Remove Crankshaft Bearing • Clean all components.			
4.2	Identify Engine Components	• Cylinder Head • Oil Filler Cap • Engine Cover • Camshaft Cover • Camshaft Cover Gasket • Camshaft Cover Bolt • Hydraulic lash Adjuster • Tappet, pushrod, rocker arm • Valve Key/cullet • Valve Spring Cap • Valve Spring • Valve Stem Seal • CVT (continuous variable timing) assembly • EGR Vacuum Hose • EGR Valve with Gasket • EGR Valve Adaptor with Gasket • Cylinder Head gasket • Front Camshaft Cap • Valve Guide • spark Plug/glow plug • Freeze/expansion Plug • Oil Duct Cap • Intake Valve • Exhaust Valve • Cylinder Head Gasket • Engine Coolant Temperature Sensor • Heat Take off Pipe • Camshaft • Camshaft seal • Thermostat valve • Cam shaft position sensor • PCV (positive crankcase ventilation) • **Cylinder Block** • Piston Rings Set • Piston • Piston Pin • Connecting Rod			

		• Connecting Rod Bearing Set • Oil Level Gauge Stick • Sleeve • Clutch Housing Sleeve • Cylinder Block • Bypass Valve • Oil Filter • Oil Pump • Knock Sensor • Crank shaft position sensor • Fly Wheel • Torque converter • Crank Shaft Bearings Set • Crank Shaft • Transmitter Disc • Crankshaft Bearing Cap • Oil Pan • Thrust Washer • Oil Pan Drain Plug • Oil Pump assembly • Pressure Relief Valve • Oil Pressure Switch • Sleeve/liner • Oil Suction Pipe Bracket • Oil Suction Pipe • Exhaust and Inlet manifold • Oxygen Sensor • Heat Shield • Exhaust Manifold • Exhaust Manifold Gasket • Intake Manifold • Throttle body • Intake Air Tube • Breathe Hose • Air cleaner Assembly • Air cleaner Element • Resonator • Air Inter Hose • Timing Belt • Water Pump • Timing Belt Rear Cover • Camshaft Position Sensor • Auto Tensioner • Camshaft Gear • Idler pulley			

		• Crankshaft Gear • Timing Belt • Timing Belt Front Upper Cover • Timing Belt Front Lower Cover • Crankshaft Pulley • Crankshaft Position Sensor			
4.3	Inspect Engine Components	• Measure Engine Components : Ovality and taperness of bore, piston, crankshaft, • Inspect engine components • Check connecting rod side clearance • Check the connecting rod bearing cap oil clearance • Check fit between piston and piston pin • Check side clearance between piston and connecting rod • Check the piston-to-cylinder clearance by calculating the difference between the cylinders bore inner diameter and the piston outer diameter. • Inspect the piston ring side clearance. • Inspect the piston ring end gap. • Assemble the piston rings.			
4.4	Check/ Change Turbocharger	• Change the turbocharger as per manufactures standard procedure			
4.5	Check and change EGR Valve	• Change EGR Valve as per manufactures standard procedure			
4.6	Inspect/ Change Glow Plug	• Remove nuts and glow plug connector • Check the continuity of glow plug • Inspect glow plug relay continuity • Inspect relay operation • Inspect glow plug resistor • Install glow plug			
4.7	Check/ change Spark Plug	• Disconnect negative terminal of battery • Remove high tension cord			

		• remove spark plug • Check electrode wear • Check and clean carbon deposits • Adjust the plug gap as per specification. • Check insulator damage • Change spark plug if found faulty • Reverse the process of removal			
4.8	Assemble Engine	• Install Crankshaft Bearing • Install crankshaft • Install Main Bearing Caps • Install Pistons and Connecting rods • Install Rear Timing Belt Cover • Install Oil Pump • Install Oil pan • Install valve assembly • Install Cylinder Head and gasket • Install Exhaust Manifold • Install Inlet Manifold • Install Camshaft and Gear • Install Timing Belt and cover • Install Camshaft Cover • Install all electrical and accessories			
4.9	Set Valve timing	• Set crankshaft and piston assembly as per manufacturer's specifications and procedures. • Reassemble oil pump using new components from overhaul kit as required. • Install camshaft, pushrod, tappet, oil pump, distributor, fuel pump or FI pump. • Install head gasket and cylinder head assembly. • Install timing gear or sprockets of crankshaft and camshaft. • Rotate the camshaft to make intake valve of no. 1 cylinder must be in compression stroke. • Rotate the crankshaft in order to that no. 1 piston is in TDC position.			

		• Align the marks of crank/camshaft timing gear and fuel injection pump timing gear as per manufacturer's specifications and procedures. • Install timing belt or chain and set timing. • Install timing cover bracket and pulley. • Remount the engine to the chassis. • Replace all parts previously removed to gain access to overhaul engine. • Make all adjustments during reassembly as per manufacturer' specifications. • Reconnect throttle linkage. • Reconnect hoses and electrical connectors. • Reconnect the fuel line. • Refill engine oil. • Reconnect the negative battery terminal. • Adjust valve/tappet clearance per manufacturer's specifications and procedures. • Start the engine and warm it up to normal operating temperatures. • Tune up engine to manufacturer's specifications following manufacturer's procedures.			
4.10	Adjust tappet clearance	• Collect required tools and materials. • Consult service manual for specifications and safety precautions. • Clean components as necessary. • Run engine to normal operating temperature. • Shut down engine. • Remove rocker arm cover or tappet cover. • Determine the intake and exhaust valve clearly because			

		the clearance is usually different for both. • Turn the engine pulley until the first cylinder is at top dead center (TDC) of its compression stroke. • Check the valve clearance when the piston is at TDC of compression stroke. • Adjust the valve clearance with a feeler gauge. • Loosen the lock nut and turn adjusting screw to and fro until the correct valve clearance according to the specifications is obtained. • Tighten the lock nut and the adjusting screw must not turn while tightening. • Rotate the engine in its firing order. • Repeat above steps for each cylinder to adjust both intake and exhaust valves. • Install new gasket and tappet cover. • Check again after running in.			
4.11	Test Cylinder compression pressure	• Inspect Cylinder compression pressure in dry and wet conditions • Emission test			
5 Perform Vehicle Servicing					
5.1	Use personnel protective equipment	• Perform Safety related functions • Maintain safe working environment • Uses personnel protective equipment and safety equipment • Use tools, equipment and documentation • Uses hoisting and lifting equipment			
5.2	Perform general Check Up	• Inspect exterior condition of Vehicle for Scratch, dent, crack, corrosion etc. • Inspect all exterior and interior lights			

		• Inspect Wiper, wiper blade and Washer • Inspect Brake, Clutch and accelerator pedal for smooth operation. • Inspect level and leakages of Engine oil, coolant, brake oil and steering oil. • Inspect all bolt tightening condition from underbody. • Inspect vehicle management system using Scanner.			
5.3	Perform Vehicle washing	• Park the vehicle in service bay. • Apply hand brake or choke the wheel. • Clean the interior of the vehicle, use vacuum cleaner for cleaning interior floor • Lift the hydraulic ramp as required height. • Adjust the pressure of water spray nozzle in water pump or hosepipe. • Wash the vehicle thoroughly by using spray nozzle. • Clean/ wash the floor mats and mattress. • Wipe up the body of the vehicle with soft cloth and liquid soap or detergent. • Wash/Remove dry soil or mud under the chassis. • Wipe the wet water with soft cloth. • Wax the dashboard interior.			
5.4	Lubricate Chassis	• Park vehicle on level surface • Engage parking brake • Raise vehicle with jack and secure with jack stands • Identify all lubrication points (Remote gear shifting linkage, kingpins, tie rod ends/ball joints, drag links ends, steering knuckle joints, front spring pins, rear spring pins, propeller shaft U-joints, propeller shaft sliding yoke, parking brake intermediate			

		shaft bushes, brake double levers, brake shaft bushes, clutch pedal bushing. etc.) • Clean grease fittings with a rag • Attach grease gun to each fitting • Pump grease until fresh grease appears or resistance increases • Wipe off excess grease • Inspect grease boots for damage or leaks • Lower vehicle and remove jack stands • Test drive to distribute grease (optional) • Recheck fittings for leaks or missed points			
5.5	Inspect maintain Tyre Pressure	• Check the air pressure of the tyre. • Inflate tyre if the pressure is low. • Deflate tyre if the tyre is over inflation. • Maintain the pressure according to specification. • Read the air pressure gauge on the dashboard. • Adjust air valve if required.			
5.6	Adjust Clutch Pedal Free Play	• Determine the types of clutch to be adjusted. • Collect all the required tools and materials. • Check the fluid in clutch cylinder reservoir. • Top up if the level is low. • Bleed the air if required. • Check the clutch pedal free play. • Adjust the clutch cylinder push rod if the pedal free play is not specified. • Adjust the slave cylinder push rod if applicable. • In case of cable type clutch, Adjust free play by turning adjusting nut as specified in the service manual • Check the clutch plate, clutch cylinder and other components if the adjustment not works.			

5.7	Change Air Filter	• Remove air cleaner element as per manufacturer's procedure. • Strike dry element bottom side down on floor or hard surface. • Blow out dirt with approved blowgun, blowing from inside out. • Inspect filter by holding shop light inside filter and verifying that light is visible through the filter element. • Reinstall air cleaner element into the air cleaner assembly.			
5.8	Clean AC Filter	• Identify and locate AC filter. • Remove glove box. • Open grommets of AC filter box. • Remove AC filter element from housing. • Clean or replace the filter as necessary. • Connect all the parts in reverse order. • Operate AC for proper functioning			
5.9	Change Engine oil and oil filter	• Place a clean tray under the drain plug. • Unscrew the drain plug. • Remove the drain plug. • Drain the engine oil in a jar or tray. • Remove oil filter. • Replace oil filter. • Plug the drain plug when oil stops dropping. • Tighten the drain plug as per specified torque according to the service manual. (Don't over tight) • Refill the specified grade of engine oil to the required level. • Wait 5 to 10 minutes for checking oil level. • Lift the dipstick and wipe it. • Check the oil level. • Refill the oil if the level is low. • Cap the filler cap. • Keep the jar or tray in proper place.			

5.10	Change Coolant	• Collect required tools and materials. • Check the coolant level in the radiator/reservoir. • Inspect the coolant properties. • Drain the radiator if required. • Prepare the specified quantity of coolant/water according to service manual provided. • Add coolant if the level is low. • Check the leakage from radiator. • Check the radiator cap.			
		Total		920hrs	920hrs

Auto Electrical and Electronics System

Total Class: 60 hrs
Theory: 30 hrs
Practical: 30 hrs

Course description:

This subject deals with basic electrical and electronics parameter and their importance, function, working principle, types 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.

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Course Objectives:

After completion of this course, apprentices will be able to:

1. Measure electrical parameters used in automobile
2. Service, repair and test charging and starting system
3. Service, repair and test Engine management system of Diesel and Petrol Engine
4. Maintenance of Electrical System of Automobile

Course content

Section A: Institute Based Training (15 Academic Weeks) 60 hours

S.N.	Objectives	Related Contents/Tasks	Time (Hrs)		
			Th.	Pr.	Total
1.	Measure electrical Parameter	• Concept of current, voltage and resistance • Direct and alternating currents • Ohm's Law • Measuring instruments:- ✓ Ammeter ✓ Voltmeter ✓ Ohmmeter • Simple electric circuit ✓ Series circuit ✓ Parallel circuit ✓ Open circuit ✓ Short circuit ✓ Combined Circuit • Insulators and conductors • Basic electronic components diode, switch, transistor, resistor, capacitor, inductor, fuse, relay, rectifier • Electrical symbols and color code used in automobile. • Electrical Circuit diagram	4	3	7

		• Component locations, connector view and Harness layout • Relation between cable sizes and current carryings capacity of cables			
2	Maintenance of Battery	• Introduction • Construction of battery • Chemical reaction during discharging and charging • General maintenance of battery • Methods of battery charging • Testing methods of charged battery: Specific gravity test, High rate discharge test, Voltage test, Load test	2	2	4
3	Service, Repair and testing of Charging system	• Function of charging system • Charging circuits and Operation • Dismantle and assemble the alternator • Alternator regulator • Output testing of Charging system • Trouble shooting of Charging system	2	3	5
4	Service, Repair and testing of Starting system	• Function of Starting system and Components • Starting circuits and Operation • Dismantle and assemble the Starter Motor • Operational test of Starting system • Trouble shooting of Starting system	2	2	4
5	Service, Repair and testing of Ignition system	• Function of Ignition system and Components • Ignition advanced mechanism • Ignition circuits and Operation : Battery point ignition system (Ignition circuits Primary and Secondary),Electronic ignition system (Hall and Induction), Distributor less Ignition System	4	4	8

		• Testing of Spark Plug • Trouble shooting of Ignition system			
6	Service, Repair and testing of Engine Management System for diesel engine	• Introduction to electronic diesel control system (EDC) and Common Rail Direct Injection system (CRDI) • Fuel System layout of EDC and CRDI system • Function and operation of EDC and CRDI system components: Sensors, Electronic control unit (ECU) Actuators • Circuit diagram of EDC and CRDI system • Do's and Don't • Troubleshooting of EDC and CRDI system using Multi-meter and Diagnostic scanner	4	4	8
7	Service, Repair and testing of Engine Management System for Petrol engine	• Introduction to multi point fuel injection system (MPFI) and Gasoline Direct Injection (GDI) • Fuel system layout of MPFI and GDI • Function and operation of MPFI and GDI components: Sensors, Electronic control unit (ECU),Actuators • Circuit Diagram MPFI and GDI • Do's and Don't • Troubleshooting of MPFI and GDI system using Multi-meter and Diagnostic Scanner	4	4	8
8	Service, Repair and testing of Electrical Systems	• Function, Operation and circuit diagram of the exterior and interior lighting system • Function, Operation and circuit diagram of Indicators and Gauges used in instrument cluster	8	8	16

		• Function, Operation and circuit diagram of: Horn System, Windscreen wipers , washers and defogger system, Power window System, Power door lock and mirror, Center locking system, Immobilizer and push button start system, Heating ventilation and Air Conditioning System, Airbag System, • Trouble shooting of electrical Systems using multi-meter and Diagnostic tools			
		Total	30	30	60

Section C: Industry Based Training (640 hours)

S.N.	Tasks Statements	Related Contents/Tasks	Time (Hrs)		
			Th.	Pr.	Total
1.	**Repair Charging System**	**Components**			
1.1	Identify and Locate Charging System Components	• Identify and Locate Charging System Components			
1.2	Replace Battery and Charge Battery Service Alternator	• Disconnect both battery terminals, always do negative terminal first for safety practice. • Remove bracket, mounting clamp or cover to gain access to the battery. • Clean battery external and top cover. • Lift the battery from chassis/body. • Dispose the old battery properly. • Check the electrolyte level of new battery. • Add sulphuric acid or distilled water as per manufacturer's instructions and procedures. • Plug the vent plugs properly. • Replace the new battery. • Clamp or secure the battery in battery tray or case. • Connect the battery terminals, always connect positive terminal first. • Use petroleum jelly or Vaseline or white grease to the terminal post. • Start the vehicle and check the battery performance.			
1.3	Service Alternator	• Consult service manual.			

		• Remove battery ground terminal. • Disconnect connector/wires to alternator • Remove alternator. • Clean exterior of alternator. • Remove through bolts. • Examine the position of stator output leads relative to alternator fixing lugs and lift stator from drive end bracket. • Clamp rotor and unscrew shaft nut. • Remove pulley and fan. • Unscrew bearing retainer plate fixing screw and remove bearing and retainer. • Remove suppression capacitor fixing screw and remove capacitor. • Unscrew rectifier-fixing screw and remove baffle plate. • Remove slip ring end bearing. • Remove slip ring end bracket assembly and separate stator and rectifier by desoldering the stator connecting lead between field connector plates to brush box terminal. • Disconnect regulator leads, unscrew and remove regulator. • Remove brush box by unscrewing the screw from slip ring end bracket and lift off brush box assembly. • Clean all parts carefully. • Check parts for wearness and replace if necessary. • Reassemble the alternator components as reversal of the dismantling procedure. • Install the alternator. • Reconnect wires to alternator and regulator. • Reconnect battery terminal. • Test the alternator performance. • Test on bench with proper power supply			
2. **Repair Starting System**					
2.1	Identify and Locate Starting System Components	• Identify and Locate Starting System Components			

2.2	Inspect and Change Fuse and Relays	• Disconnect battery negative terminal. • Note down carefully the positions in which the various components are fitted in order to ensure the correct replacement on reassembly. • Consult the service manual or wiring diagram to locate the relay or switch that you want to replace. • Remove cover or other components to gain access to the relay or switch • Remove the faulty relay or switch. • Check the relay or switch for continuity, voltage or resistance as per service manual. • Trace out the fault or defective relay or switch. • Replace new relay or switch with correct rating or specifications. • Connect battery terminal. • Check the operation of the relay/switch.			
2.3	Service Starter Motor	• Consult service manual. • Remove battery negative terminal. • Remove wires to starter motor. • Remove starter bolts and starter motor. • Clean exterior of starter motor. • Remove cover over brushes. • Remove the solenoid from the starter. • Remove all brushes from retainers. • Remove commutator end plate. • Remove through bolts. • Remove drive end of housing. • Remove retaining ring and old drive. • Remove armature. • Inspect commutator and retainers for damage. • Remove bushing with appropriate puller or driver. • Inspect housing and shaft for wear. • Install new bearing and shaft. • Lubricate the bushings and starter drive shaft with specified lubricant. • Install new drive, retaining ring and brushes. • Pull back the brush springs with hook and insert brushes into their holders.			

		• Slide in end plate. • Cover brushes. • Install the new solenoid on the starter motor. • Reassemble the starter motor. • Install starter motor. • Tighten starter bolts. • Reconnect wires to starter motor. • Reconnect battery negative terminal. • Check operation with battery. • Test on bench with proper power supply.			
2.4	Replace Ignition Switch	• Disconnect the negative battery terminal. • Determine the wiring circuit as per manufacturer. • Disconnect the electrical connectors after marking them with tape for identification when reinstalling. • Remove components as necessary to gain access to the ignition switch as per manufacturer's procedure and specifications. • Clean wiring harness connectors. • Test the ignition switch as manufacturer's procedures. • Replace new ignition switch. • Connect switch wires to their original location. • Replace all components that were removed to gain access to ignition switch. • Connect battery negative terminal. • Start the engine and check the switch operation.			
3. **Repair Ignition System**					
3.1	Identify and Locate Ignition System Components Check / Replace Ignition Coil	• Identify and Locate Ignition System Components			
3.2	Check / Replace High Tension cables	• Troubleshoot High tension cables			
3.3	Check / Replace Ignition Coil	• Manufacturer's service manual for specifications and procedures. • Disconnect terminals and high tension cord from ignition coil.			

		• Test primary and secondary coil resistance. • Replace if needed. • Test the function of ignition coil as per manufacturer's specifications.			
4. **Repair Gasoline EMS**					
4.1	Identify and locate Gasoline EMS Components , harness and Control module	• Identify and locate Gasoline EMS Components, harness and Control module • Sensors • Manifold absolute pressure sensor (MAPS) • Air temperature sensor • Barometric pressure sensor • Throttle position sensor • Crank shaft position sensor/rpm sensor • Camshaft position sensor • Water temperature sensor • Oxygen sensor • Knock sensor • Accelerator pedal position sensor • Brake switch • Clutch switch • Actuators • Idle speed control valve • Ignition coil • Purge control valve • Fuel injector • Fuel pump • ECU Relay • Fuel cut of solenoid valve • Check engine light • Malfunction indicator light (MIL) • Positive crankcase ventilation (PCV) valve • ECU and wiring harness			
4.2	Clean Throttle Body	• Turn Ignition Switch off and disconnect battery terminals • Remove air filter, Resonator and intake hoses. • Disconnect Throttle position sensor connector and Accelerator cable. • Remove mounting bolts and remove throttle body from Engine. • Inspect operation and carbon deposits.			

		• Clean throttle body (and Idle speed control actuator if installed) with carbon cleaner. Note: In case of electronic throttle control use Scanner to clean and reset referring to shop manuals. • Replace / Re Install throttle body in reverse order of dismount. • Connect battery terminals. • Verify proper operation. • Start the engine and by connecting the scanner, check the voltage output of Throttle position sensor at idle and wide open throttle. (Specification refer to shop manuals.) • Locate the Diagnostic link connector (DLC). • Connect MPFI diagnostic tester as per manufacturer's procedures and instructions. • Diagnose the various sensors using scanner and multimeter. • Read / Clear Diagnostic Troubleshooting code (DTC's), Analyze Live/ Current Data, perform actuation test. • Replace new sensors if found defective but they are not recommended to be repaired.			
4.3	Troubleshoot Gasoline Engine EMS using Scanner	• Locate the Diagnostic link connector (DLC). • Connect MPFI diagnostic tester as per manufacturer's procedures and instructions. • Diagnose the various sensors using scanner and multimeter. • Read / Clear Diagnostic Troubleshooting code (DTC's), Analyze Live/ Current Data, perform actuation test. • Replace new sensors if found defective but they are not recommended to be repaired.			
4.4	Perform emission test using smoke analyzer	• Perform emission test using smoke analyzer			
5. **Repair Diesel EMS System**					

5.1	Identify and locate Diesel EMS Components , harness and Control module	**Sensors** • Mass airflow sensor • Air temperature sensor • Barometric pressure sensor • Crank shaft position sensor/rpm sensor • Camshaft position sensor • Water temperature sensor • Oxygen sensor • Knock sensor • Rail pressure sensor • Fuel temperature sensor • Boost pressure sensor • Accelerator pedal position sensor • Brake switch • Clutch switch • Water in fuel sensor **Actuators** • Fuel injector • Fuel pump • ECU Relay • EGR valve • Air control valve • Fuel cut of solenoid valve • Check engine light • Malfunction indicator light (MIL) • High pressure pump • Common rail • Inlet metering valve (IMV) • Positive crankcase ventilation (PCV) valve **ECU and wiring harness**			
5.2	Troubleshoot Diesel EMS using Scanner and Multimeter	• Locate the Diagnostic link connector (DLC). • Connect MPFI diagnostic tester as per manufacturer's procedures and instructions. • Diagnose the various sensors using scanner and multimeter. • Read / Clear Diagnostic Troubleshooting code (DTC's), Analyze Live/ Current Data, perform actuation test. • Replace new sensors if found defective but they are not recommended to be repaired.			

5.3	Perform emission test using smoke analyzer	• Perform emission test using smoke analyzer			
6. Repair Body Electrical System					
6.1	Diagnose and Repair Power Window and Door Mirror system	• Identify and locate Power window and door mirror system components • Troubleshoot Power Window System			
6.2	Repair Wiper, washer and Defogger system	• Identify and locate Wiper , washer and Defogger System components • Troubleshoot Wiper, washer and defogger System • Windshield wiper and water spray pump • Check/ Change wiper fuse • Check/ repair wiper motor • Check/ repair wiper control switch • Check/ repair wiring or ground and power supply • Check/ replace water spray motor • Check/ repair washer hose or nozzle			
6.3	Repair Lighting Systems	• Identify and locate lighting system components • Troubleshoot Lighting system • Disconnect the negative battery terminal. • Determine the wiring circuit as per manufacturer. • Locate the blown/fused bulbs/lamps of the lightening system. • Disconnect the electrical connectors after marking them with tape for identification when reinstalling. • Remove components as necessary to gain access to the blown bulbs/lamps/fuses as per manufacturer's procedure. • Clean bulb holder and wiring harness. • Remove the bulb/lights/lenses assembly. • Check short circuit, loose connection or poor ground in the wiring. • Replace new bulbs/lights as specified watt. • Replace bulb cover, lenses assembly. • Replace components that were removed to gain access the bulbs/ lights. • Connect battery negative terminal.			

		• Switch on the switches to check the bulbs. • Adjust Headlight Beam • Adjust air pressure of all tyres as per the manufacturers' recommendation • Move vehicle up and down by hand to settle its attitude • Move it over a flat surface • Set vertical beam alignment by means of the screw provided in head light • Set the head light in such a way that the main beam axis falls on a spot not above the height of head light and not below a height equal to a fifth (1/5) of the head light height. • Set horizontal beam alignment by using screw provided in head light			
6.4	Test Immobilizer and Push botton start (Smart Key) system	• Identify and locate immobilizer and push button start system components. • Test immobilizer and push button start system			
6.5	Change Relays and fuses in electrical system	• Disconnect battery negative terminal. • Note down carefully the positions in which the various components are fitted in order to ensure the correct replacement on reassembly. • Consult the service manual or wiring diagram to locate the relay or switch that you want to replace. • Remove cover or other components to gain access to the relay or switch • Remove the faulty relay or switch. • Check the relay or switch for continuity, voltage or resistance as per service manual. • Trace out the fault or defective relay or switch. • Replace new relay or switch with correct rating or specifications. • Connect battery terminal. • Check the operation of the relay/switch.			
6.6	Repair Power door lock and Central door lock System	• Repair Power door lock and Central door lock System			
7. **Repair Heating Ventilation and Air Condition System**					
7.1	Identify and Locate HVAC Components	• Identify and Locate HVAC Components.			
7.2	**Change AC filter.**	• Identify and locate AC filter.			

		• Remove glove box. • Open grommets of AC filter box. • Remove AC filter element from housing. • Clean or replace the filter as necessary. • Connect all the parts in reverse order. • Operate AC for proper functioning.			
7.3	AC Gas Leakage Check	• Visual inspection of High pressure and low pressure pipe. • Inspect for condenser and compressor breakage. • Check for vacuum gauge reading in– ve value and mark it. (While connecting High pressure & low pressure line to machine) • Check for gauge reading stable for some a while of holding time. • Interpret the result, unstable gauge reading indicate system leakage. • Repair & replace faulty components. • Inspect for fittings, their setting faces for damage, replace if necessary. • Verify repair.			
7.4	Check / Change Compressor	• Select & use necessary tools. • Disconnect the negative cable from battery. • Recover the refrigerant with recovery machine. • Loosen the drive belt. • Remove bolts and disconnect suction & discharge line from compressor. • Disconnect compressor clutch connector & mounting bolts and the compressor. • Check pully bearing play, replace if it is noisy or excessive play/drag. • Check operation of magnetic clutch by connecting battery power to appropriate terminals. • Check for electric control valve if the compressor is clutch less type (Optional). • Install in the reverse order of removal.			

		• Adjust drive belt, change the refrigerant system. • Verify the repair.			
7.5	Check / change Condenser	• Visually inspect condenser fins for dogging, damage, bond & leakage. • Recover the refrigerant with recycling matching before removing condenser. • Remove nuts & then disconnect discharge and liquid line from the condenser.(remove FR bumper if needed) • Remove the condenser mounting bolts and then condenser. • Check radiator for jam and damage (compressed air can be blower from one side and inspect it comes out from another side). • Installation is reverse process. • Verify repair.			
7.6	Check / Change Blower Fan	• Disconnect the negative battery terminal. • Remove crash pad (dash board). • Remove blower by loosen mounting bolts and screws (remove cross bar if needed in some cars). • Disconnect the blower motor after loosening the mounting screw. • Supply battery voltage to check for blower motor rotation. • Check for vary in blower motor speed according to input given from blower motor speed control knob. • Also check for blower resistor. • Installation of blower motor and blower unit in reverse order. • Verify repair by functional test.			
7.7	Check / Change Heater Core	• Select & use necessary tools. • Disconnect the negative battery terminal. • Recover the refrigerant, drain engine coolant. • Disconnect the inlet & outlet bushes from the heater unit, (outside of dash panel).			

		• Remove crash pad (dash board). • Remove blower unit from heater unit. • Remove evaporator core. • Visual inspect evaporator for crack & then air leakage. • Install the heater core in reverse order of removal. • Verify repair.			
7.8	Check/ Service Air flow Control System	• Recover refrigerant and Evacuate Air Conditioning system • Access and inspect for faulty components such as blower motor, cabin filter, knob vent, bend door etc. • Remove, repair and replace faulty components such as cFontrol units, connector, blend door, connector, blower motor and resistors. • Clean Air flow system witFh deordinizer. • Complete repair by verifying system function and performance.			
7.9	Diagnose and Repair Heating System	• Verify operating conditions • Remove and replace faulty components			
7.10	Check/ change Refrigerant line	• Discharge refrigerant from refrigeration system • Open suction and discharge hose from compressor, discharge hose and liquid tube from condenser and tube from expansion valve to evaporator. • Check and inspect hose and tubes for damages, seal seating position and condition of fasteners. • Evacuate air in refrigeration system and charge refrigerant. • Tighten the bolt and nuts with specified torque.			
7.11	Diagnose and Repair refrigerant system	• Verify problem and visual inspection • Perform leak test. • Verify operation condition of electronically controlled system			

		• Interpret Pressure gauge readings, DTC's, live data to determine conditions of system and components. • Recover refrigerant and evacuate air conditioning system. • System components are inspected for wear, damage and leaks. • Remove and replace faulty components. • Recharge system.			
8. **Restrain System (Airbag System)**					
8.1	Diagnoses restraint systems	• Identify type of restraint systems • Identify restraint system components • Inspect restraint system components • Inspect restraint system monitoring and warning system • Identify restraint system dtcs • Perform tests using scanner and multimeter as per manufacturer's guideline • Record, interpret and analyze results of tests and inspection			
		Total		640hrs	640hrs

References:

- Hollembeak, B. (2011). *Automotive electricity and electronics: Classroom manual* (5th ed.). Delmar Cengage Learning.
- Erjavec, J., & Thompson, R. (2010). *Automotive technology: A systems approach* (5th ed.). Delmar Cengage Learning.
- Halderman, J. D. (2013). *Automotive electrical and engine performance* (6th ed.). Pearson Education.
- Gott, P. G**.** (1996). *Automotive air-conditioning refrigerant service guide* (2nd ed.). SAE International.

Basic of Electric Vehicle Technology

Total Class: 45 hrs
Theory: 30 hrs
Practical: 15 hrs

Course description:

This subject deals with basic introduction to electrical vehicle technology and safety precautions to be followed while operating and maintaining electric vehicle and basic techniques of repair and maintenance of electric vehicle.

Course Objectives:

After completion of this course, apprentices will be able to:

1. Familiarize Electric Vehicle Technology
2. Safety Precaution in EV Technology
3. Service, Repair and maintenance of High voltage system
4. Familiarize EV transmission and Drive Train
5. Diagnose EV Concern Using Vehicle Scanner
6. Troubleshooting of Electric vehicle

Course content

Section A: Institute Based Training (15 Academic Weeks) 45 hours

S.N.	Objectives	Related Contents/Tasks	Time (Hrs)		
			Th.	Pr.	Total
1	Introduction to Electric Vehicles	• History & Evolution of EVs • Comparison: EV vs. Internal Combustion Engine (ICE) Vehicles • Types of EVs (Battery Electric Vehicle , Plug in Hybrid Electric Vehicle, Hybrid Electric Vehicle, Fuel Cell Electric Vehicle) • Identify types of Vehicles	3	1	4
2	Apply Basic Workshop Safety	• Electrical Safety in EVs: Hazard Involved in Working with High Voltage (HV) System, • Safety Precautions, Electric Isolation, de energize HV system • Personal Protective Equipment (PPE) • Workshop Tools & Handling • Fire Safety & First Aid • Warning Stickers	3	1	4
3	De energize and re activate high voltage system	• Identify and locate the safety plug or high voltage disconnect connector • Remove auxiliary battery	2	1	3

		• Removal of high voltage disconnect Switch/Plug • Measure capacitor voltage • Installation of high voltage disconnect Switch/Plug • Electrical Circuit Diagram of safety plug or high voltage disconnect System.			
4	Replace High voltage control unit/ Inverter	• Layout of BEV • High-Voltage vs. Low-Voltage Systems • Main Components of BEV ✓ HVB (High Voltage Battery) ✓ Inverter/ EPCU(Electric Power Control Unit) ✓ DC to DC converter ✓ Motor/Motor controller Unit (MCU) ✓ Reducer ✓ OBC (On Board Charger) ✓ VCU(Vehicle Control Unit) ✓ High voltage cables and Bus bar, Wiring & Connectors in ✓ EVs • Circuit diagram of High voltage control unit / inverter • Removal of inverter • Install inverter • Test and verify if vehicle comes to ready mode • Removal of VCU • Install VCU • Test and verify if vehicle comes to ready mode	3	1	4
5	Removal and Installation of High Voltage Battery (HVB)	• Function • Types of HVB ✓ Lithiumion :Nickle manganese cobalt battery (NMC) , Lithium iron phosphate (LFP), Lithium manganese oxide (LMO) ✓ Solid state battries ✓ Nickel metal hydride battery ✓ Nickel Cadmium • Various terminologies of HVB ✓ Energy density	3	1	4

		✓ Cycle Life and Calendar life ✓ Efficiency • HVB construction details ✓ Cell and its types ✓ Module ✓ Cell Monitoring Unit (CMU), Battery Management System (BMS) ✓ Cell Balancing ✓ Battery cooling and heating • Identification and locate the HVB • Remove peripheral parts to access and remove battery • Remove the Battery from Vehicle • Installation of HVB to the Vehicle • Insulation breakdown test using Vehicle scanner and mega ohm tester/Insulaton Tester			
6	Repair High voltage Distribution System	• Identify and locate component • Removal of HVB junction box • Related Components inspection • Circuit Diagram of high voltage distribution system	2	1	3
7	Repair charging port and Replace OBC	• Types of charging ✓ AC Charging ✓ DC Charging • On Board Charging (OBC) • Charge control unit (EVCU) • Types of charging socket : Combined Charging system (CCS), Chademo, GBT • Battery management System (BMS) • Related circuit diagram • Removal of charging port • Install Charging port • Circuit diagram of charging system • Inspection of fuse, fusible link, circuit breaker switches and relays. • Removal of OBC • Installation of OBC • Test and verify if charging system works	3	2	5

8	Replace EV Motors	• Types and application of Motors Used in EVs (BLDC, PMSM, Induction) • Operation of Motor and Controllers • Removal and Installation of Motor • Regenerative Braking system	2	1	3
9	Familiarize EV Transmission & Drivetrain	• Single-Speed vs. Multi-Speed Transmission • Gear Reduction Mechanism in EVs • Drive with in-wheel Motor • Drive with Electric Motor in Central Drivetrain ✓ Front axle drive ✓ Rear axle drive ✓ Front motor and Four wheel drive ✓ Rear motor and four wheel drive ✓ Front and rear motor four wheel drive	3	1	4
10	Diagnose EV Concern Using Scanner	• Control units & Sensors in EVs • CAN Bus Communication • Diagnostic Tools & Scanners • Connection of Vehicle scanner to the vehicle • Read/clear fault code / DTC • Monitor live data • Vehicle software Introduction	2	2	4
11	Detect insulation breakdown	• Perform insulation breakdown test using scanner • Test Insulation breakdown of HV Cables using Mega ohm tester/ Insulation Tester	2	1	3
12	Service EV cooling system	• Cooling Systems for Batteries & Motors • Heat Dissipation Techniques • Air vs. Liquid Cooling • Removal and Installation of Electric Water pump • Removal and Installation of three way valve • Removal and Installation of Chiller • Drain EV coolant	2	2	4

		• Fill EV coolant • Perform air bleeding • Coolant specification			
		Total	30	15	45

Section C: Industry Based Training (400 hours)

S.N.	Objectives	Related Contents/Tasks	Time (Hrs)		
			Th.	Pr.	Total
1	Apply Basic Workshop Safety	• Electrical Safety in EVs: Hazard Involved in Working with High Voltage System, • Safety Precautions, Electric Isolation, de energize HV system • Personal Protective Equipment (PPE) • Workshop Tools & Handling • Fire Safety & First Aid • Warning Stickers			
2	Replace High voltage control unit/ Inverter/DC to DC converter/Power Distribution Unit (PDU)	• Block diagram of High voltage control unit / inverter/ DC to DC converter/Power Distribution Unit (PDU) • Removal of inverter • Install inverter • Test and verify if vehicle comes to ready mode			
3	Replace Vehicle control unit	• Block diagram of VCU • Removal of VCU • Install VCU • Test and verify if vehicle comes to ready mode			
4	Repair High voltage Distribution System	• Identify and locate component • Removal of HVB junction box • Related fuse inspection • Circuit Diagram of high voltage junction box			

5	Replace charging port	• Related block diagram • Removal of charging port • Install Charging port • Test and verify if charging system works			
6	Replace OBC	• Block diagram of charging system • Inspection of fuse, fusible link, circuit breaker switches and relays. • Removal of OBC • Installation of OBC			
7	Diagnose EV Concern Using Vehicle Scanner	• Connection of Vehicle scanner to the vehicle • Read/clear fault code / DTC • Monitor live data • Vehicle software management			
8	De energize and re activate high voltage system	• Identify and locate the safety plug or high voltage disconnect connector • Remove auxiliary battery • Removal of high voltage disconnect • Measure capacitor voltage • Installation of high voltage disconnect • Electrical Circuit Diagram of safety plug or high voltage disconnect System.			
9	High voltage Battery Pack Removal and Installation	• Identification and locate the HVB • Insulation breakdown test using Scanner and Mega ohm tester • Remove auxiliary battery/12 volt and Main Service Fuse (MSF) • Remove peripheral parts to access and remove battery • Remove the Battery from Vehicle • Installation of HVB to the Vehicle • Insulation breakdown test using Scanner and Mega ohm tester			
10	Detect insulation breakdown	• Perform insulation breakdown test using scanner			

		• Test Insulation breakdown of HV Cables using Megaohm tester			
11	Service EV coolant system	• Removal and Installation of Electric Water pump • Removal and Installation of three way valve • Removal and Installation of Chiller • Drain EV coolant • Fill EV coolant • Perform air bleeding			
		Total		400hrs	400hrs

Reference:

- Larminie, J., & Lowry, J. (2012). *Electric vehicle technology explained* (2nd ed.). Wiley.
- Sundaram, S. N. (2024). *Electric vehicle technology: Structure, instrumentation and challenges*. Nova Science Publishers
- Scrosati, B., Garche, J., & Tillmetz, W. (Eds.). (2015). *Advances in battery technologies for electric vehicles*. Woodhead Publishing

Applied Mathematics

Total: 45 hrs
Theory: 45 hrs
Practical: 0 hrs

Course Description:
This course provides skill and knowledge to solve the numerical problems related to Pre-diploma in Automobile Engineering. This subject consists of basic mathematical calculation of work, energy, power, force, speed, velocity and other calculations related to Automobile engineering.

Course Objectives:
After completion of this course, the apprentice will be able to:

1. Calculate and convert units.
2. Enumerate mensuration parameters.
3. Determine force, work, power and velocity.
4. Calculate gear and belt drive's calculation.
5. Calculate engine capacity

Course Content
Section A: Institute Based Training (15 Academic Weeks) 45 hours
Module I: Basic Mathematics

S.N.	Objectives	Related Contents/Tasks	Time (Hrs.)		
			T	P	Total
1	Calculate SI units / conversion factors	System of units ✓ Basic Units, Derived units and SI units Conversion of units :FPS system, CGS system Example and exercises	3		3
2	Calculate Fraction and percentage	• Basic Concept of a fraction • Fraction addition, subtraction, multiplication and division • Conversion of the percentage into actual number and vice versa • Example and exercises	2		2
3	Apply Unitary method	• Concept of unitary method • Direct variance and Indirect variance • Chain rule • Estimate time, money and number of worker for any job • Examples and exercise	2		2
4	Apply Pythagoras' Theorem	• Terms used in Pythagoras' theorem • Pythagoras formula • Examples and Exercise	1		1

5	Calculate area and circumferences	Definition ✓ Area and Circumference Area calculation of: ✓ Square ✓ Rectangle ✓ Parallelogram ✓ Triangle ✓ Circle and semi-circle ✓ Cube / Prism ✓ Curved surface area and base area of Cylinder Circumference calculation of: ✓ Square ✓ Rectangle ✓ Parallelogram ✓ Triangle ✓ Circle ✓ Polygons Example and exercises	8		8
6	Calculate volume of right bodies, pointed and truncated bodies	Concept of cube, prism and cylinder ✓ Prism ✓ Cylinder ✓ Cone ✓ Engine capacity calculation ✓ Examples and Exercises	4		4
7	Calculate weight, mass and force	• Concept of weight, mass and force • Mass • Weight • Density • Force • Examples and Exercises	4		4
8	Calculate Speed and Velocity	• Distance and displacement • Speed and velocity • Acceleration • Example and Exercise	3		3
9	Calculate work, power and efficiency	• Work, Power Efficiency • Examples and Exercises	2		2

10	Calculate Simple belt drive	• Definition ✓ Driven and driving pulley ✓ Peripheral speed ✓ Transmission ratio • Calculation of ✓ Diameter of driving and driven pulley ✓ RPM of driving and driven pulley • Examples and Exercises	6		6
11	Calculate Simple gear drive	• Concept of ✓ Driven and driving ✓ Revolution per minute ✓ Distance between axes ✓ Transmission ratio • Dependency of number of teeth and revolution • Examples and Exercises	4		4
12	Calculate Engine capacity calculation	• Clearance volume • Swept volume • Engine capacity • Piston displacement • Torque calculation, IHP, BHP, FP • Examples & exercises	6		6
			45		45

References:

- G.S. Sethi, K. Kakkar, Workshop calculation and science, Tata McGraw-Hill Publishing company Limited New Delhi
- H.P. Dahal ,*United's Math in action grade-10* ,United Nepal publication
- R Awasthi, B.H. Subedi, B. B. Subedi, *UNIQUE Mathematics book-9*, Unique Educational Publishers Pvt. Ltd.
- Technical Mathematics book for metal Trade**,** GTZ
- 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 Communication and Professionalism

Total Class: 45 hrs
Theory: 45 hrs
Practical: 0 hrs

Course Description

This course is designed for the development of communication skills in Nepali and English languages, intending to enhance professional skills of apprentices at work places. The communication skills are incorporated here with the perspectives to applying in speaking and writing for to-be professional apprentices or technicians so that they can exhibit such skills while working in national and international labor market work places. This course includes speaking and writing skills, self-motivation, positive attitudes, decision making skill, creativity skill, stress and time management knowledge, team work and leadership skills.

Course Objectives:

After completion of this course, apprentices will be able to:

1. Apply speaking and writing skills of communication skills on day to day organizational activities;
2. Write different types of letters, job applications, simple reports and memos in English and Nepali medium;
3. Bring into operation the decision making & creative activities through acquiring self-motivation and positive thinking;
4. Apply time and stress management skills; and
5. Follow decision making process, team building and leadership for effective organizational functioning.

Course Content

Section A: Institute Based Training (15 Academic Weeks) 45 hours

Units	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
1	Communicative functions/ Conversation skills	• Everyday functions: o Greetings, o Welcoming, o Introductions, o Thanking, o Excuses/apologizing/forgiving • Everyday Activities: o Asking about activity o Asking about trouble/problems/conditions o Asking about health status o Telling not to interrupt/disturb • Requests and offers o Making requests o Offers: offering, accepting, declining o Excuses: asking to be excused, Excusing o Permission: asking for permission, giving permission • Expressing	6		6

		○ Likes/dislikes ○ Hopes/wishes ○ Advice/suggestions/recommendations ○ Prohibitions • Compose a dialogue introducing new friend in the class. • Compose a dialogue ting new friend in the class. • Make a request to the teacher for checking your practical work. • Compose a dialogue offering drinks to the (supposed) guests			
2	Comprehension and Writing skills	• Comprehension passages • Technical terms • Writing Paragraphs • Writing letters ○ Resume/bio-data ○ Applications letters ○ Business letters • Writing work reports • Writing Instructions • Writing dialogues • Prepare your own resume/bio-data. • Write a job application. • Write a letter to the Business Company or industry for the delivery of goods. • Write a report of a complete task you performed.	8		8
३	नेपाली संचार	१. प्राविधिक शब्दहरु २. बोधअभिव्यक्ति ३. अनुच्छेद लेखन ४. पत्रलेखनः ५. व्यापारिक पत्र ६. निवेदनपत्र ७. व्यक्तिगतविवरण (बायोडाटा) लेखन ८. निबन्ध लेखन ९. कार्य प्रतिवेदन लेखन १०. भौचर लेखन ११. नेपाली निवेदन लेख्नुहोस् । १२. आफुनो अभ्यास कार्यलाई आवश्यक पर्ने सामान अर्डर गरी सम्बन्धितउद्योगलाई एक पत्र लेख्नुहोस्।	८		८

		१३. आफुनो व्यक्तिगतविवरण तयार पार्नुहोस्। १४. वर्तमान सन्दर्भमा सूचनाप्रविधिको आवश्यकताविषयमा २५० शब्दमा एक निबन्ध लेख्नुहोस्। १५. आफूले एक दिन गरेको अभ्यासकाआधारमाकार्य प्रतिवेदन लेख्नुहोस्। १६. बैंक भौचरको नमूना तयार पार्नुहोस् ।			
4	Motivation, Attitudes, Decision Making & Creativity	• Motivation: o Self-motivation o Features of self-motivation; honesty, enthusiasm, dedication, Productiveness • Attitudes: o Positive and negative attitudes o Factors affecting attitudes o Positive attitude and advantages o Negative attitude & disadvantages • Decision making to solve problem: o Decision making and problem solving; o Steps of problem solving; o Steps of decision-making process. • Creativity o Meaning o Purpose o Technique to improve creative thinking skills. • Demonstrate and show the self-motivate people's behaviors in class room. • Demonstrate and show the positive and negative attitudes peoples behave in class room. • Take decision using decision making process on given problems by class teacher. • Perform the creativity skill on class room on the given situation.	10		10
5	Stress and Time Management	• Stress management o Definition of stress o Causes and consequences of stress o Stress management techniques • Time management o Meaning o Time wasters o Effective time management strategy • Apply the stress management techniques in class room.	5		5

		• Apply the time management techniques in class room.			
6	Team work and Leadership	• Team Work o Definition o Purpose o Characteristic of champion team o Interpersonal relationship • Leadership skills o Leadership power o Leadership Styles o Public speaking and presentation • Perform the team building practices and team work activities in class room. • Perform public speaking applying presentation skills on given topic in class room.	8		8
		Total	45		45

References:

1. GRANT TAYLOR, English conversation practice.
2. R C Poudel, A manual to Communicative English, K P Pustak Bhandar , Dillibazaar, Kathmandu.
3. लालानाथ सुवेदी, इन्जिनियरिङ्ग नेपाली
4. Surya Sinha (2017). Complete Personality Development Course (Hindi Edition).
5. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
6. Lucas, Stephen (2001). Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill.

Entrepreneurship Development

Total: 45 hrs
Theory: 30 hrs
Practical:15 hrs

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

Course Objectives:
After completion of this course, apprentices will be able to:

1. Define business and entrepreneurship;
2. Explore entrepreneurial tasks;
3. Analyze business ideas and viability;
4. Formulate business plan; and
5. Learn to manage small business.

Course Content
Section A: Institute Based Training (15 Academic Weeks) 45 hours

S. N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
Module I: Introduction to Entrepreneurship			**5.0**	**3.0**	**8.0**
1	Introduce business.	**Introduction of business:** • Definition of business/enterprise • Types of business • Classification of business • Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal	1		1
2	Define entrepreneur/entrepreneurship.	**Definition of entrepreneur:** • Definition of entrepreneur • Definition of entrepreneurship • Entrepreneurship development process	0.5	0.5	1.
3	Describe entrepreneur's characteristics.	**Entrepreneur's characteristics:** • Characteristics of entrepreneurs • Nature of entrepreneurs	0.5	0.5	1.

4	Assess entrepreneur's characteristics.	**Assessment of entrepreneur's characteristics:** • List of human characteristics • Assessment of entrepreneurial characteristics	0.5	0.5	1.
5	Compare entrepreneur with other occupations.	**Entrepreneur and otheroccupations:** • Comparison of entrepreneur with other occupations • Types and styles of entrepreneurs	1.		1.
6	Differentiate between entrepreneur and employee.	**Entrepreneur and employee:** • Difference between entrepreneur and employee • Benefit of doing own business	0.5	0.5	1.
7	Assess "Self.'	**"Self" assessment:** • Understanding "self" • Self-disclosure and feedback taking	0.5	0.5	1.
8	Entrepreneurial personality test: Assess "Self" inclination to business.	**Entrepreneurial personality test:** • Concept of entrepreneurial personality test • Assessing self-entrepreneurial inclination	0.5	0.5	1.
Module II: Creativity and Assessment			**4.5**	**3.0**	**7.5**
9	Create a viable business idea.	**Creativity:** • Concept of creativity • Barriers to creative thinking	1		1.
10	Innovate business idea.	**Innovation:** • Concept of innovation • SCAMPER Method of innovation	0.5	0.5	1.
11	Transfer ideas into action.	**Transformation of idea into action:** • Concept of transferring idea into action • Self-assessment of creative style	0.5	0.5	1.
12	Assess personal entrepreneurial tasks.	**Personal entrepreneurial tasks:** • Concept of entrepreneurial tasks • Assessing personal entrepreneurial tasks	0.5	0.5	1.

13	Assess personal risk-taking attitude.	**Risk taking attitude:** • Concept of risk • Personal risk-taking attitude • Do and don't do while taking risk	1.0	1.0	2.
14	Make decision.	**Decision-making:** • Concept of decision-making • Personal decision-making attitude • Do and don't do while making decision	1.0	0.5	1.5
Module III: Identification and Selection of Viable Business Ideas			**1.5**	**1**	**2.5**
15	Identify/ select potential business idea. • Analyze strength, Weakness, Opportunity and Threat (SWOT) of business idea.	**Identification and selection of potential business:** • 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"	1.5	1	2.5
Module IV: Business Plan			**19**	**8**	**27**
16	Assess market and marketing	**Market and marketing:** • Concept of market and marketing • Marketing and selling • Market forces • 4 Ps of marketing • Marketing strategies	1.5	0.5	2
17	**Business exercise:** Explore small business management concept.	**Business exercise:** • Business exercise rules • Concept of small business management • Elements of business management ▪ Planning ▪ Organizing ▪ Executing ▪ Controlling	2.5	0.5	3

18	Prepare market plan.	**Business plan/Market plan** • Concept of business plan • Concept of market plan • Steps of market plan	2.	1.	3.
19	Prepare production plan.	**Business plan/Production plan:** • Concept of production plan • Steps of production plan	1.5	1.	2.5
20	Prepare a business operation plan.	**Business plan/Business operation plan:** • Concept of business operation plan • Steps of business operation plan • Cost price determination	3.5	1.	4.5
21	Prepare financial plan.	**Business plan/Financial plan:** • Concept of financial plan • Steps of financial plan • Working capital estimation • Pricing strategy • Profit/loss calculation • BEP and ROI analysis • Cash flow calculation	4.5	1	5.5
22	Collect market information / prepare business plan.	**Information collection and preparing business plan:** • Introduction • Market survey ▪ 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.	1.	3.
23	Appraise business plan.	**Business plan appraisal:** • Return on investment • Breakeven analysis • Cash flow • Risk factors	0.5	1	1.5

24	Maintain basic bookkeeping.	**Basic bookkeeping:** • Concept and need of bookkeeping • Methods and types of bookkeeping • Keeping and maintaining of day book and sales records	1.	1.	2.
	Total:		**30**	**15**	**45**

Textbooks:

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

ख) प्रशिक्षार्थीहरुका लागि निर्मित पाठ्यसामग्री तथा कार्यपुस्तिका, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद् (अप्रकाशित), २०६९

Reference book:

Entrepreneur's Handbook, Technonet Asia, 1981.

Industrial Practice

Description:
The training institute will make arrangement for apprenticeship. Admitted trainees will have the three parties training agreement among trainees, sponsoring industries and training institute. The Agreement terms and conditions will be implemented during the whole training period.

The proposed apprentice students have three and half months (15 weeks) theoretical and practical classes in the training institute. At the end of this institute-based training phase, the **Pre-Industry Exam** is conducted for each subject and serves as a mandatory for continuing to the industry-based training. Subsequently, students are placed as apprentices under the supervision of In-company Trainer, whereas industrial practice & related skills will be learned. The nature of the training is practical works and the duration will be of approximately 18 months (65 weeks/2600 hours). Students will work in the related sponsoring industries for 5 days a week and one day per week to attend the training either virtually via online platforms and/or physically at the institute as per scheduled plan for review sessions, sharing field experiences, discussion of problems faced, resolved and unresolved issues for consultation, presentation and evaluation of the final field report, exchange of feedback, sharing of upcoming activities and reporting.

Students will work across all four cores areas for first 65 weeks as mentioned in the structure of this curriculum. The sponsoring industries or companies will provide industrial practice platforms to the agreed apprentices for the above-mentioned duration. Furthermore, the sponsoring industries could change industrial practice venues in different geographical locations on their volume of works and convenience.

General objectives:
The objective of the apprenticeship is to make students familiar with/gain firsthand experience of the world of work as well as to provide them an opportunity to acquire skills that are theoretically learnt in the institute.

Complete Apprenticeship plan

S. N.	Activities	Duration	Remarks
1	Orientation	Two days	Before Apprenticeship
2	Report to the site	One day	Before placement
3	Actual work at site	65 weeks	During apprenticeship
4	Evaluation by the sponsoring industries		Regular
6	Evaluation by the training Institute		At least one time in every three months
7	Final evaluation		Last month of the apprenticeship Programme by the Industries
6	Final report preparation and presentation	5 days	After completion of apprenticeship

Note:
- Students should maintain the daily diary during the apprenticeship Programme.

- Students should prepare the apprenticeship report and present in training institution in the presence of In-company Trainer.
- Evaluation of apprenticeship Programme should be done by the In-company Trainer (Industrial Supervisor).

Industrial Orientation

Course Description:

The students will be assigned to various auto-workshop/service stations on a full-time basis as a trainee or apprentice. At the end of the course, students will submit a report conforming to a standard format along with the daily diary. Industrial orientation shall consist of exposure of work to learn skills and techniques in operation, diagnosis, maintenance and repair of automobile vehicle concerns based on the nature of the interned organization.

Course Objectives:

After completing the course, the students will be able to:

- Match the technical skills learn in the institute with the needs of the employer.
- Increase self-confidence to face the real work of world.
- Develop the strong linkage between industry and institution.
- Ensure the standard of the training as per the market demand.
- Sensitize with modern and new technologies applied in the industry.

The company/industry/organizations may provide orientations focusing on following areas:

1. Profile of the Industry
2. Mission, Vision, Value and believes
3. Layout of Workshop/industry
4. Basic features of the workshop
5. The service provided by industry
6. Organization structure of the industry
7. Special technology adapted
8. Safety concerns of the workshop
9. General rule and regulations of the workshop
10. Departmental divisions and their responsibility and functions
11. General problems in the workshop
12. Make them familiar with their supervisors, departmental head and staffs.
13. Prepare a plan to utilize the interns in systematic way and daily record keeping.

Format/Content of Report:

A report needs to be submitted by student on the basis of the following minimum guidelines at the end of their industrial intern.

- A hardcopy of report with simple binding.
- The font through-out the report must be of 12 size and Times New Roman.
- Cover page including name of Institute, industry, student and report submission date.
- Approval page from the side of Industry.
- Acknowledge
- Abstract
- Table of contents
- Chapter one: Introduction
    - Background of apprenticeship program
    - Introduction to industry, goal and organizational structure with role
    - Product/ Service summary of the industry
- Chapter two: Description of the Industry
    - Industry/workshop layout
    - Department/unit with their responsibility
    - List of major tools and equipment with their functions
    - Material handling equipment with purpose.
- Chapter three: Practices on the industry
    - Basic and frequent practices
    - Special Practices
    - Special technology found on industry and vehicle
- Chapter four: Conclusion and recommendation
    - Conclusion on attachment: practices, industry management and human behavior, problems and better terms.
    - Recommendation for industry: practices, industry management and human behavior, any other personnel opinion
- References if any
- Annexes: Daily dairy, drawings, photographs and others, if any.

Curriculum Development Expert Team

SN	Name	Name of Office
1	Ram Prasad Bhatta	Sipradi Training Pvt Ltd Kathmandu
2	Dipesh Poudel	Sipradi Training Pvt Ltd Kathmandu
3	Basudev Timalsina	Laxmi Intercotinental Kathmandu
4	Rudra Khanal	Syakar Training Kathmandu
5	Laxman Palikhel	T.U IOE Thapathali Campus, Kathmandu
6	Rajan Shrama	Baluja school of Engineering Technology Kathmandu
7	Anil Bolakhe	Panauti Technical School Karve
8	Shreedhar Shrama Bhatta	Panauti Technical School Karve
9	Roshan kumar Thakur	Shankarapur polytechnical institute Kathmandu
10	Surja Krishna Shrestha	Hyundai and BMW Kathmandu
11	Tapowan Shrestha	Laxmi Intercotinental Kathmandu
12	Ram sharan Sainju	Panauti Technical School Karve
13	Dhurbraj Bhusal	Butwal Autoengineering Assosiation Butwal
14	Prem Gauchan	Butwal Autoengineering Assosiation Butwal
15	Dilip kumar Chaudhari	Korea Nepal polytechnic Institute Butwal
16	Nabin Naupane	Korea Nepal polytechnic Institute Butwal
17	Gaurav Paudel	Korea Nepal polytechnic Institute Butwal
18	Amrit Mishra	Mahakabi Devatota Technical School Butwal
19	Suraj Silwal	Mahakabi Devatota Technical School Butwal
19	Susmita Parajuli	Korea Nepal polytechnic Institute Butwal
20	Santosh Aryal	Korea Nepal polytechnic Institute Butwal
21	Millan Neupane	Korea Nepal polytechnic Institute Butwal

Annex 1: Weekly Report (Logbook)

To be filled by apprentices regularly

Week ...

Month:

S. No.	Date	Description of work	Sign of Industry Supervisor
1.			
2.			
3.			
4.			
5.			
6.			

Name of Supervisor: _____

Sign of Supervisor: _____

Date: _____

Remarks by Supervisor: _____

Name of Internal Guide: _____

Sign of Internal Guide: _____

Weekly Summary

Duration From _____ To _____

Work/Task Assigned by the Supervisor: _____

_____

_____

_____

_____

_____

Learning Outcome: _____

_____

_____

_____

_____

Remarks: _____

_____

Name of Supervisor: _____

Sign of Supervisor: _____

Annex 2: Industry Practice Monitoring Tools

Monitoring Tools (For Industry/Company Purpose)

To be filled by the industrial Supervisor (In-company Trainer)/Roving Instructor/at the time of monitoring

Kindly refer to the mark scale provided below in assessing the performance of apprentices.

	Very Poor	Poor	Fair	Good	Very Good
Mark Scale	**0**	**1**	**2**	**3**	**4**

Evaluation Criteria	Score
1. Behavior and Attitude	**32**
1.1. Grooming/ Personal Appearance	…/4
1.2. Overall Attendance	…/4
1.3. Punctuality	…/4
1.4. Compliance to company Policies	…/4
1.5. Interest in work	…/4
1.6. Reliability and Accountability	…/4
1.7. Ability to cope	…/4
1.8. Acceptance of constructive criticisms and feedback	../4
2. Knowledge	**8**
2.1. Business knowledge/ General knowledge	…/4
2.2. Work ethics/ Professionalism	…/4
3. **Skills**	**36**
3.1. Problem Solving	…/4
3.2. Interaction with the work environment (e.g. Supervisor, colleagues)	…/4
3.3. Appropriate interaction with clients/ External Parties	…/4
3.4. Oral Communication Skills	…/4
3.5. Written Communication Skills	…/4
3.6. Leadership	…/4
3.7. Team Work	…/4
3.8. Technical Skills (e.g. computer software, etc.)	…/4
3.9. Creative Thinking	.../4
4. **Performance**	**24**
4.1. Quality of work performed	…/4
4.2. Ability to prioritize multi tasks	…/4
4.3. Initiative to learn	…/4
4.4. Ability to work independently	…/4
4.5. Commitment to work	…/4
4.6. Value- added contribution	…/4
Total Marks Obtained	…/**100**
Comments (if any):	

Name of Supervisor:	
Designation:	
Tel/ Mobile No:	
Signature:	
Date:	
Comments/Feedback/ Remarks from Internal Guide	
Name of Internal Guide:	
Sign of Internal Guide:	
Date filed:	