

CURRICULUM

Pre-diploma in Mechanical Engineering

(Apprenticeship Model)



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

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Introduction

This curricular program is designed to prepare the middle-level competent Mechanical Engineering Technicians as **Assistant Sub-engineers**. The graduates will be equipped with the required knowledge, skills and attitude necessary to this level to meet the demand of the Mechanical Engineering Industry in the country and abroad. The implementation modality of this curriculum is the apprenticeship model. UNESCO-UNEVOC defines apprenticeship as a ‘unique form of vocational education, combining on-the-job learning and school-based training, for specially defined tasks and work processes. It is regulated by law and based on written employment contract with a compensatory payment, and standard social protection scheme. A formal assessment and a recognized certification come at the end of a clearly identified duration.

The program extends over 24 months. The first fifteen weeks of in-house classes that insist on theoretical and basic practical skills will be provided in the institution. It involves an instructional mode of delivery for technology-based education and training in which learning takes place in two venues: the technical school or training institute and the company or industry. Here, the term “industry” is not a single area, it is meant generally to include all the sectors of the economy in our community, which range from manufacturing firms, service shops, business establishments, and government agencies to non-government organizations (NGOs). There will have a tripartite training agreement between apprentices, sponsoring industries and training institutions for implementing this curricular program.

Rationale

The rationale behind designing this curricular program is to acquire competencies by an apprentice through his/her engagement in hands-on practices (the real world of work experiences) as he/she gets an opportunity to get exposed to mechanical engineering-based industries where they can learn about modern-day tools, machines and processes which gives them the insight and attitudes to combine creativity, knowledge and tools to complete the difficult task of shaping an idea into reality.

This curricular program will be implemented and operated as based on the *Apprenticeship Training Operation Working Procedures, 2075 B.S.*

Curriculum Title

The title of this curricular program is Pre-diploma in Mechanical Engineering (Apprenticeship Model).

Program Aim

The program aims to prepare middle-level competent Mechanical Engineering Technicians as Assistant Sub-engineers who can serve at related government offices, maintenance workshops, industries or firms in Nepal and abroad.

Program Objectives

The objectives of the program are to produce a mid-level workforce, who will be able to:

1. Prepare industry ready through institute-based education and industry-based training.
2. Perform basic mechanical works carried out in Mechanical workshops.
3. Interpret engineering drawings and computerized drawings.
4. Perform sheet metal fabrications.
5. Operate lathe, milling and welding machines and their accessories.
6. Repair and maintain basic types of Mechanical, Hydraulic and Pneumatic devices.

7. Perform simple calculations related to mechanical works.
8. Prepare a business plan for establishing small mechanical work-related production and service industries.
9. Create self-employment opportunities by linking skills, knowledge and attitudes to related mechanical works.

Duration

This course will be completed within 24 months after the enrollment in a formal setting. The detailing of course duration is depicted below.

A. Institute Based Training Phase: 1280 Hours

- Pre-Training Phase: 15 weeks (600 Hours)
- One day/week for 78 weeks (78 days/13 weeks): 13 weeks (520 Hours)
- Block Release Phase: 4 weeks (160 Hours)

B. Industry Based Training (Hands on Practice) Phase: 2600 Hours

- 65 Academic Weeks (78-13): 65 Weeks (2600 Hours)
- Mechanical fitting 21 weeks (840 Hours)
- Welding and Workshop Practice 22 weeks (880 Hours)
- Maintenance Practice 22 weeks (880 Hours)

Entry Criteria

Individuals with following criteria will be eligible for this program:

- SLC/SEE appeared.
- Above 16 years of age.
- Pass entrance examination administered by CTEVT/as decided by the Office of the Controller of Examination, CTEVT.
- Mentally and Physically fit for the occupation.
- Pass the interview conducted jointly by industry and the training institute.

Candidates will be recruited on the merit base of entrance examination.

Group Size

The group size of this program will be 40 (forty) in a batch.

Medium of Instruction

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

Pattern of Attendance

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

Qualification of Instructional Staff

- Instructors should have Bachelor Degree in Mechanical in Engineering
- Assistant Instructors should have Diploma in Mechanical Engineering
- Practical Assistant/Teaching Aide should have Pre-diploma in Mechanical Engineering with 3 years' experience

- Good communication and instructional skills
- Experience in the related field

Teacher and Apprentice Ratio

- Overall ratio of teacher and student must be 1:10 (at the institution level)
- Teacher and apprentice ratio for theory class should be as per nature of classroom
- Teacher and apprentice ratio for practical should be 1:10
- Minimum 75% of the teachers must be full time

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 etc.).
- Non-projected Media Materials (Display, Photographs, Flip chart, Poster, Writing board etc.).
- Projected Media Materials (Multimedia, etc.).
- Computer-Based Instructional Materials (Computer-based training, Interactive video etc.)
- Web-Based Instructional Materials (Online learning)
- Radio/Television/Telephone
- Education-focused social media platforms

Teaching Learning Methodologies

The methods of teachings for this curricular program will be a combination of several approaches such as.

- Theory: Illustrated lecture Discussion, Seminar, Interaction, Assignment and Group work.
- Practical: Demonstration, Observation, Guided practice, Self-practice and Project work.
- Industrial practice: Work place-based learning at the building construction companies or industries under the supervision of industrial supervisor.

Approaches of learning

There will be inductive, deductive and learner-centered approaches of learning.

Examinations and Marking Scheme

- The subject teacher will internally assess learning achievements of apprentices in each subject during the instructions, followed by a final examination at the end of curricular program.
- Continuous assessment will be adopted for institute based practical components.
- The marking weightage of industrial practice will be limited to practical only for the all subjects that they are offered in industrial practice. Moreover, proportions of internal assessment and final examinations are as follows:

S.N.	Nature	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, those to be administered by the institute, and one final examination in each subject at the end of the program. Moreover, modes of internal assessment and final examinations include both theory and practical or as per the nature of instruction as mentioned in the curriculum structure.
- Continuous assessment will be adopted for institute based practical components.
- Each student must pass every internal assessment to appear the final examinations.
- Continuous evaluation of the students' performance is to be done by the related In-company Trainer/ Industrial Supervisor/Internal Guide to ensure the proficiency over each competency under each area of a subject specified in the curriculum.
- Performance evaluation of industrial practice should be done by the related In-company Trainer/Industrial Supervisor/Internal Guide. In addition, on the basis of continuous assessments (at the interval of three months' plan and program) an aggregate mark of each subject will be calculated for determining internal assessment marks of industrial practice.
- Logbook, an official document is used to record information on learning experienced by the learners attained during industrial practice or training. Both of the In-company Trainer/Industrial Supervisor/ Internal Guide and the apprentice are required to sign in the logbook as a skill or a task is confirmed and performed. In addition, the maintained logbook will be baselines for both formative and summative aspects of evaluation.

Provision of Back Paper

There will be the provision of back paper, but the apprentice must pass all the subjects within three years from the enrollment date; however, there should be a provision of chance exam for the apprentices as per CTEVT rules.

Marking System

The marking system will be as follows:

Grading	Overall marks
Distinction:	80% and above
First division:	75% to below 80%
Second division:	65 % to below 75%
Pass division:	Pass marks to below 65%

Disciplinary and Ethical Requirements

- Intoxication, insubordination or rudeness to peers will result in immediate suspension followed by review by the disciplinary review committee of the institute.
- Dishonesty in academic or practice activities will result in immediate suspension followed by administrative review, with possible expulsion.
- Illicit drug use, bearing arms at the institute, threats or assaults to peers, faculty or staff will result in immediate suspension, followed by administrative review with possible expulsion.

Certificate Requirements

The Council for Technical Education and Vocational Training will award certificate of “Pre-diploma in Mechanical Engineering (Apprenticeship Model)” to those apprentices who successfully complete the requirements as prescribed by the curriculum.

Career Path

The graduate will be eligible to work in the position of Assistant Sub-engineer (Mechanical) in the government related organizations or as prescribed by the Public Service Commission or the concerned authorities of Federal Democratic Republic of Nepal.

General Attitudes Required

An apprentice should demonstrate the following general attitudes for effective and active learning.

Acceptance, Affectionate, Ambitious, Aspiring, Candid, Caring, Change, Cheerful, Considerate, Cooperative, Courageous, Decisive, Determined, Devoted, Embraces, Endurance, Enthusiastic, Expansive, Faith, Flexible, Gloomy, Motivated, Perseverance, Thoughtful, Forgiving, Freedom, Friendly, Focused, Frugal, Generous, Goodwill, Grateful, Hardworking, Honest, Humble, Interested, Involved, Not jealous, Kind, Mature, Open minded, Tolerant, Optimistic, Positive, Practical, Punctual, Realistic, Reliable, Distant, Responsibility, Responsive, Responsible, Self-confident, Self-directed, Self-disciplined, Self-esteem, Self-giving, Self-reliant, Selfless, Sensitive, Serious, Sincere, Social independence, Sympathetic, Accepts others points of view, Thoughtful towards others, Trusting, Unpretentiousness, Unselfish, Willingness, Work-oriented.

Curriculum Structure of Pre-Diploma in Mechanical Engineering (Apprenticeship Model)

S. N	Subjects	Nature	Hours/			Total Hours		
			T	P	Total	T	P	Total
A.	Institute Based Training (3.5 Months/90 Working Days or 1 to 15 Weeks) for 15 Academic Weeks @40 Hours/Week							
1	Applied Communication and Professionalism	T+P			5	37	38	75
2	Mechanical Fitter	P			6	-	90	90
3	Workshop Practice	P			10	-	150	150
4	Engineering Drawing and CAD	T+P			4	15	45	60
5	Maintenance Practice	P			4	-	60	60
6	Basic Electrical and Electronics	T+P			2	11	19	30
7	Workshop Technology	T+P			6	78	12	90
8	Applied Math	T+P			3	41	4	45
	Total of A				40	182	418	600
B.	Institute Based Training @ 1 Day Per Week for 78 Weeks (16 to 93 Weeks)/78 Days/13 Academic Weeks @ 40 Hours/Week							
1	Engineering Drawing and CAD	P			5		65	65
2	Mechanical Fitter	T+P			9	13	104	117
3	Workshop Practice	T+P			9	13	104	117
4	Applied Math	T			2	26	-	26
5	Maintenance Practice	T+P			9	13	104	117
6	Entrepreneurship Development	T+P			6	30	48	78
	Total of B					95	425	520
C.	Industrial Practices @ 5 Days Per Week for 78 Weeks (16 to 93 Weeks)/ (78 -13 Weeks)/ 65 Academic Weeks @ 40 Hours/Week							
	Mechanical Fitter	P		21 weeks			840	840
	Maintenance Practice	P		22 weeks			880	880
	Workshop Practice	P		22 weeks			880	880
	Total of C			(65 weeks)			2600	2600
D.	Block Release for 4 Academic Weeks (94 to 97 Weeks) @40 Hours/Week	T+P		(4 weeks)		80	80	160
	Grand Total (A+B+C+D)			(97 weeks)		357	3523	3880
E.	Exam Preparation and Final Exam (98 to 104 Weeks)/7 Weeks							

Important: Industrial practices (C) phase of learning/training can be extended to 40 Hours X 78 Weeks (5 Working Days/Week) = 3120 Hours on the request of sponsoring industry at the time of Tripartite Agreement if the age of an apprentice is above 18 years.

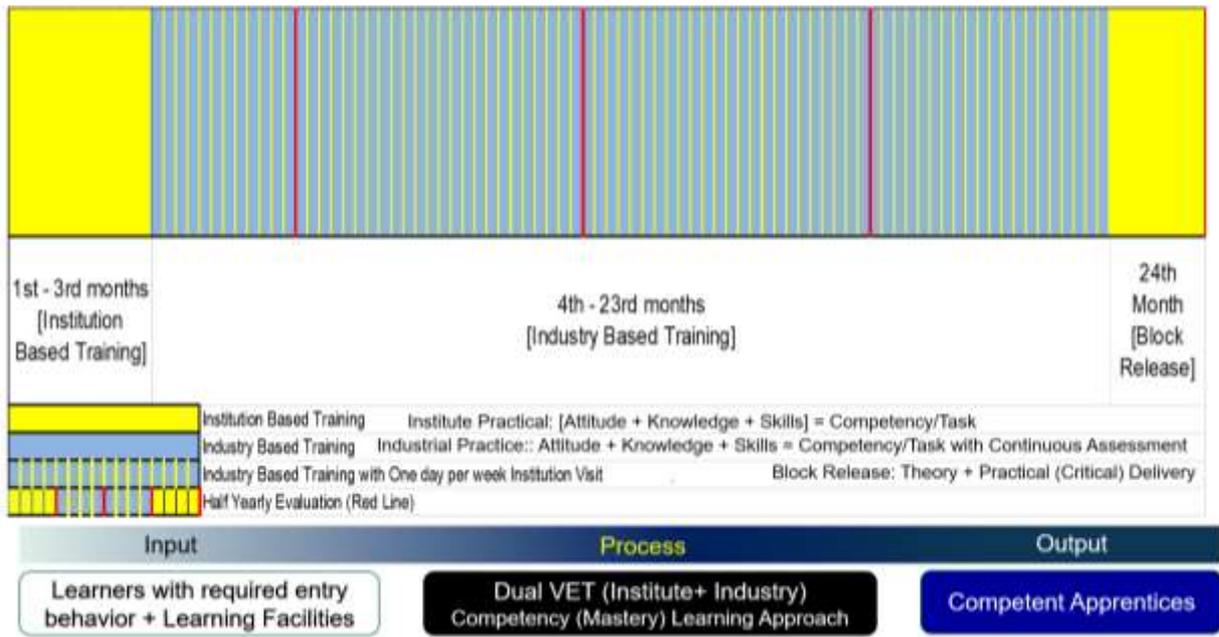
Pre-Diploma in Mechanical Engineering (Apprenticeship Model)

Evaluation Scheme

S. N.	Subjects	Nature	Total Hours			Full Marks		
			T	P	Total	T	P	Total
A+B	Institute Based Training (15 Weeks Plus 13 Weeks) for 28 Academic Weeks @40 Hours/Week							
1.	Applied Communication and Professionalism	T+P	37	38	75	25	25	50
2.	Mechanical Fitter	T+P	13	194	207	-	100	100
3.	Workshop Practice	T+P	13	254	267	-	150	150
4.	Engineering Drawing and CAD	T+P	15	110	125	-	50	50
5.	Maintenance Practice	T+P	13	164	177	-	100	100
6.	Basic Electrical and Electronics	T+P	11	19	30	-	25	25
7.	Workshop Technology	T+P	78	12	90	100	-	100
8.	Applied Math	T+P	67	4	71	75	-	75
9.	Entrepreneurship Development	T+P	30	48	78	20	30	50
	Total (A+B)		277	843	1120	220	480	700
C.	Industry Practice (93 Weeks Minus 28 Weeks) for 65 Academic Weeks @40 Hours/Week							
1.	Mechanical Fitter	P		840	840		420	420
2.	Maintenance Practice	P		880	880		440	440
3.	Workshop Practice	P		880	880		440	440
	Total (C)			2600	2600		1300	1300
D.	Block Release for 4 Academic Weeks @ 40 Hours/Week							
	Grand Total (A+B+C+D)		357	3523	3880	220	1780	2000

Important: An academic week indicates six working days per week.

Conceptual Framework of Apprenticeship Model



Applied Communication and Professionalism

Total: 75 hours
Theory: 37 hours
Practical: 38 hours

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 of 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.

Section A: Institute Based Training (15 Academic Weeks)

Units	Topics	Contents	Time (Hrs.)
1	Communicative functions/ Conversation skills		8 Hrs.
		1.1 Everyday functions: 1.1.1 Greetings, 1.1.2 Welcoming, 1.1.3 Introductions, 1.1.4 Thanking, 1.1.5 Excuses/apologizing/forgiving	2
		1.2 Everyday Activities: 1.2.1 Asking about activity 1.2.2 Asking about trouble/problems/conditions 1.2.3 Asking about health status 1.2.4 Telling not to interrupt/disturb	2
		1.3 Requests and offers 1.3.1 Making requests 1.3.2 Offers: Offering, Accepting, Declining 1.3.3 Excuses: Asking to be excused, Excusing 1.3.4 Permission: Asking for permission, Giving permission	2
		1.4 Expressing 1.4.1 Likes/dislikes 1.4.2 Hopes/wishes 1.4.3 Advice/suggestions/recommendations	2

Units	Topics	Contents	Time (Hrs.)
		1.4.4 Prohibitions	
2	Comprehension and Writing skills		10 Hrs.
		2.1 Comprehension passages	2
		2.2 Technical Terms	1
		2.3 Writing Paragraphs	1
		2.4 Writing letters	2
		2.4.1 Resume/bio-data	
		2.4.2 Applications letters	
		2.4.3 Business letters	
		2.5 Writing work reports	2
		2.6 Writing Instructions	1
		2.7 Writing dialogues	1
३	नेपाली संचार		८ घन्टा
		३.१ प्राविधिक शब्दहरु	१ घन्टा
		३.२ बोध अभिव्यक्ति	१ घन्टा
		३.३ अनुच्छेद लेखन	१ घन्टा
		३.४ पत्रलेखन:	१ घन्टा
		क. व्यापारिक पत्र	१ घन्टा
		ख. निवेदनपत्र	१ घन्टा
		ग. व्यक्तिगत विवरण (बायोडेटा) लेखन	१ घन्टा
4	Motivation, Attitudes, Decision-Making & Creativity		5 Hrs.
		4.1 Motivation:	2
		4.1.1 Self-motivation	
		4.1.2 Features of self-motivation	
		<ul style="list-style-type: none"> • Honesty, • Enthusiasm, • Dedication • Productiveness 	
		4.2 Attitudes:	1
		4.2.1 Positive and Negative attitudes	
		4.2.2 Factors affecting attitudes	
		4.2.3 Positive attitude and advantages	
		4.2.4 Negative attitude & disadvantages	
		4.3 Decision-Making to solve problem:	1
		4.3.1 Decision-making and problem-solving;	
		4.3.2 Steps of problem-solving;	
		4.3.3 Steps of decision-making process.	
		4.4 Creativity	1
		4.4.1 Meaning	
		4.4.2 Purpose	
		4.4.3 Technique to improve creative thinking skills.	
5	Stress and Time Management		3 Hrs.
		5.1 Stress Management	2
		5.1.1 Definition of stress	
		5.1.2 Causes and consequences of stress	

Units	Topics	Contents	Time (Hrs.)
		5.1.3 Stress management techniques	
		5.2 Time Management 5.2.1 Meaning 5.2.2 Time wasters 5.2.3 Effective time management strategy	1
6	Team works and Leadership		3 Hrs.
		6.1 Team Work 6.1.1 Definition 6.1.2 Purpose 6.1.3 Characteristic of champion team 6.1.4 Interpersonal relationship	1.5
		6.2 Leadership Skills 6.2.1 Leadership Power 6.2.2 Leadership Styles 6.2.3 Public Speaking and Presentation	1.5
Total Theory			37 Hrs.

Practical

Units	Task	Hours
1	1.1 Compose a dialogue introducing a new friend in the class. 1.2 Compose a dialogue ting new friend in the class. 1.3 Make a request to the teacher for checking your practical work. 1.4 Compose a dialogue offering drinks to the (supposed) guests.	8
2	2.1 Prepare your own resume/bio-data. 2.2 Write a job application. 2.3 Write a letter to the Business Company or industry for the delivery of goods. 2.4 Write a report of a complete task you performed.	8
३	३.१. नेपाली निवेदन लेख्नुहोस् । ३.२. आफुनो अभ्यास कार्यलाई आवश्यक पर्ने सामान अर्डर गरी सम्बन्धितउद्योगलाई एक पत्र लेख्नुहोस् । ३.३. आफुनो व्यक्तिगतविवरण तयार पार्नुहोस्। ३.४. वर्तमान सन्दर्भमा सूचनाप्रविधिको आवश्यकताविषयमा २५० शब्दमा एक निबन्ध लेख्नुहोस् । ३.५. आफूले एक दिन गरेको अभ्यासका आधारमा कार्य प्रतिवेदन लेख्नुहोस् । ३.६. बैंक भौचरको नमूना तयार पार्नुहोस् ।	६
4	4.1 Demonstrate and show the self-motivate people's behaviors in classroom. 4.2 Demonstrate and show the positive and negative attitudes peoples behave in classroom. 4.3 Take decision using decision-making process on given problems by class teacher. 4.4 Perform the creativity skill on classroom on the given situation.	8
5	5.1 Apply the stress management techniques in classroom. 5.2 Apply the time management techniques in classroom.	4
6	6.1 Perform the team building practices and team work activities in classroom. 6.2 Perform public speaking, applying presentation skills on given topic in classroom.	4
Total practical		38 Hrs.

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Mechanical Fitter

Total: 207 hrs
Theory: 13 hrs
Practical: 194 hrs

Course Description:

This course intends to build skill and knowledge required to sizes metal parts to close tolerances and fit and assemble them using hand tools to fabricate production machines, or repair of machine or other metal products. Select materials and appropriate tools and equipment to carry out the job. Hold and clamp the work in appropriate work holding devices cuts and shape by process of sawing, chipping, filing, drilling holes, thread cutting, and grinding. Measures objects while working using ruler, calipers, protractors, gauges and correct filling with Back Square. Mechanical fitters also use precision measuring instruments to check parts for accuracy and fit.

Mechanical fitters usually work in workshops or production areas that can be noisy, hot and dusty. They may spend most of their day standing and often need to bend, crouch or climb. Workers must be aware of safety regulations and wear personal protective equipment.

Course Objectives:

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

1. Work in a safe working environment accordance with safety regulation.
2. Keep working places neat and clean.
3. File out plain surface and curved surfaces.
4. Perform marking using general and precision measuring tool
5. Cut metals using different metal cutting tools and machines.
6. Drill holes and other operations on drilling machines.
7. Cut and chip out the plain surface using different shape of metal chisels.
8. Cut internal and external threads manually using taps and dies.
9. Perform grinding operations for cutting, surfacing, grooving, beveling and cleaning.

Section A: Institute Based Training (15 Academic Weeks)

S.N.	Tasks Statements	Related Technical Knowledge	Time (Hrs)		
			Th.	Pr.	Total
1.	Apply safety regulation	<ul style="list-style-type: none">• Apply Safety rules of mechanical workshops• Apply Electrical safety rules• Use Personal Protective Equipment,• Apply safety of work on height,• Apply safety of work on confined space,• Apply safety code and posters		4	4
2	Maintain Housekeeping	<ul style="list-style-type: none">• Plan housekeeping program,• Keep aisles and exits clear of items,• Replace/repair worn, ripped or damage flooring,		4	4

S.N.	Tasks Statements	Related Technical Knowledge	Time (Hrs)		
			Th.	Pr.	Total
		<ul style="list-style-type: none"> • 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 Filing plain/curve surface	<ul style="list-style-type: none"> • Follow filing safety, • Follow techniques of holding work piece on bench vice, • File plain surface with flat file, • File external radius with flat file, • File angular surface with flat file, • Check the flatness of plain surface, • File square hole with square file • Make chamfer on the workpiece's edge. 		34	34
4	Perform Measuring and Marking	<ul style="list-style-type: none"> • Follow measuring and marking safety, • Take measurement with steel ruler, and measuring tape, • Take measurement with Vernier caliper, • Take measurement with bevel protractor, • Check radius with radius gauge, • Check thread profile with pitch gauge, • Mark lines with marking scriber, • Mark height with height gauge, • Punch dot on marked point with center punch, 		6	6
5	Perform metal cutting	<ul style="list-style-type: none"> • Follow metal cutting safety, • Follow techniques of holding work piece on vice for sawing, 		6	6

S.N.	Tasks Statements	Related Technical Knowledge	Time (Hrs)		
			Th.	Pr.	Total
		<ul style="list-style-type: none"> • Saw metal workpiece with hand hacksaw, • Saw metal workpiece with power hacksaw, • Cut metal workpiece with cut off grind machine. • Cut metal workpiece with angle grinder, • Saw metal workpiece with hand shearing machine, 			
6	Perform drilling operation	<ul style="list-style-type: none"> • Follow drilling safety, • Follow techniques of clamping work piece on machine table, • Align a hole to center of workpiece, • Drill pilot hole, • Drill through hole with twist drill bit, • Drill blind hole with twist drill bit, • Make a counter sunk a hole • Sharpen the drill bit cutting edge. 		12	12
7	Perform chiseling and chipping	<ul style="list-style-type: none"> • Follow chiseling and chipping safety, • Follow techniques of clamping work piece, • Trim excess surfaces of workpiece with flat chisel • Sharpen the chisels 		6	6
8	Perform internal and external thread cutting	<ul style="list-style-type: none"> • Follow thread cutting safety, • Follow techniques of clamping work piece, • Cut internal thread using series of taps (first tap, plug tap and bottom tap), manually, • Cut external thread using die and stock, manually, • Maintain the taps and dies. 		6	6
9	Perform Grinding	<ul style="list-style-type: none"> • Follow grinding safety, • Follow techniques of clamping and holding work piece, • Select grinding wheel for hard and soft metal. 		12	12

S.N.	Tasks Statements	Related Technical Knowledge	Time (Hrs)		
			Th.	Pr.	Total
		<ul style="list-style-type: none"> Grind excess material with bench grinder, Grind plain surface with angle grinder, 			
				90	90

Section B: Institute Based Training One Day Per Week (78 Days/13 Academic Weeks)

S.N.	Tasks Statements	Related Technical Knowledge	Time (Hrs)		
			Th.	Pr.	Total
2	Perform Filling plain/curve surface	<ul style="list-style-type: none"> Follow filling safety, Follow techniques of holding work piece on bench vice, File triangular hole and corner with triangular file, Check right angle with back square File angular surface and check angles, File drilled groove with round file, File curve surface with half round file, 	2	38	40
3	Perform Measuring and Marking	<ul style="list-style-type: none"> Follow measuring and marking safety, Check angels with angle gauge, Check gaps with filler gauge, Check thread profile with pitch gauge, Measure flatness, roundness and run out with dial gauge, 	2	6	8
4	Perform metal cutting	<ul style="list-style-type: none"> Follow metal cutting safety, Follow techniques of holding work piece on vice for cutting, Cut thin sheet, wire and round rod with flat chisel and hammer, Cut metal workpiece with oxyacetylene gas cutting. 	2	18	20
5	Perform drilling operation	<ul style="list-style-type: none"> Follow drilling safety, Follow techniques of clamping work piece on machine table, Drill a counter bore, Perform reaming a hole Perform honing a hole Make hole enlargement with boring head, 	2	12	14

S.N.	Tasks Statements	Related Technical Knowledge	Time (Hrs)		
			Th.	Pr.	Total
		<ul style="list-style-type: none"> • Make spot facing. 			
6	Perform chiseling and chipping	<ul style="list-style-type: none"> • Follow chiseling and chipping safety, • Follow techniques of clamping work piece, • Cut grooves and slits using cross-cut chisel, • Clean keyways and cotter with side cut chisel, • Cut oil groove on bush bearing with round nose chisel, • Cut a groove on plain surface with diamond point chisel, • Sharpen the chisels 	2	6	8
7	Perform internal and external thread cutting	<ul style="list-style-type: none"> • Follow thread cutting safety, • Follow techniques of clamping work piece, • Cut internal thread using series of taps (first tap, plug tap and bottom tap) on machine, • Cut external thread using die and stock on machine, • Maintain the machine taps and dies. 	1	8	9
8	Perform Grinding	<ul style="list-style-type: none"> • Follow grinding safety, • Follow techniques of clamping and holding work piece, • Select grinding wheel for hard and soft metal. • Grind cutting tools with tool grinding machine, 	2	16	18
			13	104	117

References Books:

1. Raghuwanshi B. S. , A Course in Workshop Technology-Vol 1 and 2 , Dhanpat Rai & Company(P) Limited, 2003.
2. Hajra Choudhury S. K., Elements of Workshop Technology-Vol 1 and 2, Media Promoters & Publishers, 1971
3. Singh Sethi Balbir, Fitter trade practical, Computech Publications Ltd.,2015

Workshop Practice

Total: 267 hrs.
Theory: 13 hrs.
Practical: 254 hrs.

Course Description:

This course provides essential skill and knowledge to perform lathe, milling and Welding works. The first part of the course focuses on performing set up, operate, turning /boring /facing /parting /threads cutting so on, in lathe machine workshop. Plane, steps, angular surface, grooves, key ways and gear milling operation on milling machine and plane surfaces on shaper machine. The second part focused on impart the knowledge and skills required to perform SMAW, OAW, GTAW and GMAW. This course is mainly focused on position of welding, welding joint, set of machine & selection of electrode and shielding gas, set of gas welding plant & selection of filler rod.

Course Objectives:

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

1. Set up lathe machine.
2. Measure & mark the dimensions.
3. Perform machine operations.
4. Perform threads cutting.
5. Perform off-hand grinding.
6. Perform milling machine operation
7. Perform shaper machine operation
8. Setting up of SMAW, OAW, GTAW and GMAW plant.
9. Perform arc striking and maintaining of arc.
10. Perform surface weld in flat position.
11. Perform Butt, Corner, Lap, Edge joint & Tee joint in flat position.
12. Perform pipe & plate welding in flat position.
13. Select & Handle welding tools/equipment.
14. Select Arc welding current and electrode.
15. Prepare and set up welding material.
16. Use and follow safety precaution.
17. Select and set up gas pressure & flame.
18. Identify and use of tungsten electrode.
19. Identify and use of shielding gas.
20. Set the shielding gas flow rate.

Section A: Institute Based Training (15 Academic Weeks)					
Part I: Machine Work					
S.N.	Tasks Statements	Related Technical Knowledge	Time (Hrs)		
			Th.	Pr.	Total
Unit 1: Set up Lathe machine					
1.1	Clamp a work piece	<ul style="list-style-type: none"> • Lathe machine safety • Types of work holding devices • Align work piece in 3 jaw and 4 jaw chuck • Align work piece in center to center • Align work piece in faceplate 		2.5	2.5
1.2	Set turning tool on tool post	<ul style="list-style-type: none"> • Identify lathe cutting tools • Identify tool post • Setting of tool tips • Tighten of tool bit 		2.5	2.5
1.3	Set machine control	<ul style="list-style-type: none"> • Select RPM • Ready coolant device • Set gearbox in neutral position • Set carriage in middle of the bed • Ensure carriage is disconnected with feed shaft 		2.5	2.5
Unit 2: Perform Lathe machine operation					
2.1	Perform facing	<ul style="list-style-type: none"> • Follow facing procedure • Follow facing safety precaution 		8.5	8.5
2.2	Perform plain turning	<ul style="list-style-type: none"> • Follow turning procedure • Follow turning safety precaution 		8.5	8.5
2.3	Perform chamfering	<ul style="list-style-type: none"> • Follow chamfering and de-burring procedure • Follow chamfering safety precaution • Apply coolant 		2.5	2.5
2.4	Perform Center drilling	<ul style="list-style-type: none"> • Follow center drilling procedure • Follow center drilling safety precaution • Apply coolant 		4.5	4.5
2.5	Perform drilling	<ul style="list-style-type: none"> • Follow drilling procedure 		4.5	4.5

		<ul style="list-style-type: none"> • Follow drilling safety precaution • Apply coolant 			
2.6	Perform Step Turning	<ul style="list-style-type: none"> • Follow step turning procedure • Follow step turning safety precaution • Apply coolant 		10	10
2.7	Perform external grooving	<ul style="list-style-type: none"> • Follow external grooving procedure • Follow external grooving safety precaution • Follow undercut procedure • Apply coolant 		4.5	4.5
2.8	Perform boring	<ul style="list-style-type: none"> • Follow boring procedure • Follow boring safety precaution • Apply coolant 		4.5	4.5
2.9	Perform internal grooving	<ul style="list-style-type: none"> • Follow internal grooving procedure • Follow internal grooving safety precaution • Follow undercut procedure • Apply coolant 		4.5	4.5
2.10	Perform external and internal taper turning	<ul style="list-style-type: none"> • Identify Taper turning methods • Set taper turning features • Follow Taper turning procedure • Follow Taper turning safety precaution • Apply coolant 		10.5	10.5
2.11	Perform knurling operation	<ul style="list-style-type: none"> • Identify knurling pattern • Identify knurling tool • Set knurling tool • Follow knurling procedure • Follow knurling safety precaution • Apply oil/kerosene 		3.5	3.5
2.12	Perform parting off operation	<ul style="list-style-type: none"> • Identify parting-off tool • Set parting tool • Follow parting-off procedure • Follow Parting-off safety precaution 		1.5	1.5

		<ul style="list-style-type: none"> • Apply coolant 			
Unit 3: Perform Threads Cutting					
3.1	Perform threads cutting	<ul style="list-style-type: none"> • Identify thread profile • Set threading tool • Set RPM and Feed • Cut groove/ Undercut • Follow Thread cutting procedure • Follow Thread cutting safety precaution • Apply coolant 		9.5	9.5
Unit 4: Perform grinding					
4.1	Grind lathe cutting tools	<ul style="list-style-type: none"> • Identify lathe cutting tools • Ensure Tool angles • Follow Tool grinding procedure • Follow Tool grinding safety precaution • Apply Coolant 		5.5	5.5
		Total		90	90

Part-II: Welding Works					
S.N.	Task Statements	Related Technical Knowledge	Time (Hrs)		
			T	P	Total
1. Perform Flat Position Welding					
1.1	Perform Arc striking	<ul style="list-style-type: none"> • Introduction • Safety • Welding symbols • Set up arc welding MC. • Operate and control of arc welding machines. • Identify arc welding accessories. • Electrode • Set ampere • Arc Length • Striking Method • Exercises 		2	2
1.2	Perform Straight bead weld	<ul style="list-style-type: none"> • Introduction • Electrode • Set ampere • Procedure • Angle of electrode <ul style="list-style-type: none"> • Welding technique • Deposition rate 		3.5	3.5

		<ul style="list-style-type: none"> Inspect the welded beads for surface defects 			
1.3	Grind off welding surfaces	<ul style="list-style-type: none"> Introduction Safety Grinding process Material profile 		1	1
1.4	Perform straight multi run beads Weld	<ul style="list-style-type: none"> Introduction Set ampere Angle of electrode Welding technique Deposition rate 		4.5	4.5
1.5	Perform tack weld	<ul style="list-style-type: none"> Introduction Safety Set ampere Angle of electrode Deposition rate Technique Welding Joints Defects Position 		2	2
1.6	Perform Tee joint	<ul style="list-style-type: none"> Introduction Safety Set ampere Angle of electrode Welding technique Deposition rate 		3	3
1.7	Weld corner joint	<ul style="list-style-type: none"> Introduction Safety Set ampere Angle of electrode Welding technique Deposition 		4	4
1.8	Weld edge joint	<ul style="list-style-type: none"> Introduction Prepare base metal and set up edge joint. Set Ampere Angle of electrode Welding technique Deposition rate 		3	3
1.9	Weld Lap joint	<ul style="list-style-type: none"> Introduction Safety Electrode Set ampere Angle of electrode Welding technique Deposition rate 		4	4
1.10	Weld square butt Joint	<ul style="list-style-type: none"> Introduction 		5	5

		<ul style="list-style-type: none"> • Safety • Prepare parent metal and set square butt joint. • Set ampere • Weld melt Penetration • Angle of electrode • Welding technique • Deposition rate 				
1.11	Weld V-butt joint	<ul style="list-style-type: none"> • Introduction • Safety • Electrode • Set ampere • Edge Preparation • Weld melt Penetration • Angle of electrode • Weaving • Travel speed • Deposition rate • Welding technique 		5	5	
2. Perform Horizontal, Vertical in plate & Pipe Welding in Flat Position						
2.1	Perform surface weld in horizontal position	<ul style="list-style-type: none"> • Introduction • Safety • Electrode • Set ampere • Arc length • Angle of electrode • Electrode movement • Deposition rate • Welding technique 		4.5	4.5	
2.2	Perform surface weld in vertical position	<ul style="list-style-type: none"> • Introduction and safety • Electrode • Set ampere • Arc length • Angle of electrode • Welding technique • Deposition rate 		4.5	4.5	
2.3	Perform fillet weld in horizontal position	<ul style="list-style-type: none"> • Introduction • Safety • Electrode • Set ampere • Angle of electrode • Welding technique 		2.5	2.5	
2.4	Perform fillet weld in vertical position	<ul style="list-style-type: none"> • Introduction • Weld melt Penetration • Set ampere • Angle of electrode • Welding technique 		3	3	

2.5	Weld pipe to pipe joint in flat position	<ul style="list-style-type: none"> • Introduction • Safety • Electrode • Set ampere • Angle of electrode • Clamping Devices • Deposition rate • Welding technique 		4	4
2.6	Weld pipe to plate in flat position	<ul style="list-style-type: none"> • Introduction • Safety • Fixture • Electrode • Set ampere • Arc length • Angle of electrode • Deposition rate • Welding technique 		2.5	2.5
3	Welding Defects				
3.1	Welding defects	<ul style="list-style-type: none"> • Introduction • Types, Causes and Effects • Remedies 		2	2
		Total		60	60
		Total hour Section A		60	60

Section B: Institute Based Training One Day Per Week (78 Days/13 Academic Week)

Part-I: Machining (62 hrs)					
S.N.	Tasks Statements	Related Technical Knowledge	Time (Hrs)		
			Th.	Pr.	Total
Unit 1: Perform Milling Operation					
1.1	Set up machine control	<ul style="list-style-type: none"> • Select RPM • Ready coolant device • Set gearbox in neutral position • Set saddle • Ensure Saddle is disconnected with feed shaft 	0.5	2.5	3
1.2	Set up milling vice on machine table	<ul style="list-style-type: none"> • Identify milling vice • Identify vice clamp • Align vice jaw with column • Align vice jaw with column using dial gauge • Tighten nut of clamp 	0.5	2.5	3

1.3	Mount milling cutters in Vertical and horizontal spindle	<ul style="list-style-type: none"> Identify milling cutter Select cutter holding devices Bolted the cutter holder in machine spindle Follow safety precaution 	0.5	3.5	4
1.4	Perform surface, slot, key ways and V-groove milling	<ul style="list-style-type: none"> Select Up-milling and Down milling Set Feed direction Follow milling procedure Follow milling safety precaution Apply Coolant 	0.5	20.5	21
Unit 2: Shaper Machine Operation					
2.1	Set up machine control	<ul style="list-style-type: none"> Select Stroke length Set gearbox in neutral position Set Ram in backward position Ensure stroke length manually 	0.5	0.5	1
2.2	Set up shaper vice on machine table	<ul style="list-style-type: none"> Identify Shaper vice Identify vice clamp Align vice jaw with Ram Align vice jaw with Ram using dial gauge Tighten nut of clamp 	0.5	2.5	3
2.3	Hold single point cutting tool	<ul style="list-style-type: none"> Identify shaper cutting tools Hold cutting tool on tool post Follow safety precaution of tool setting 	0.5	0.5	1
2.4	Machine horizontal surface	<ul style="list-style-type: none"> Follow Shaping procedure Follow Shaper safety precaution 		6	6
Unit 3: Conduct Project Works on Lathe					
3.1		<ul style="list-style-type: none"> Job I - Prepare a Centre Punch. Job II- Prepare a hinge set 		10	10
Unit 4: Conduct Project Works on milling					

4.1		<ul style="list-style-type: none"> • Job I – Machine a rectangular block. • Job II- Prepare a V- Block 		10	10
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Part-II: Welding (55 hrs)					
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1. Gas Welding (OAW)					
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1.1	Set up gas welding Equipment	<ul style="list-style-type: none"> • Introduction • Safety precautions • Set up gas welding equipment • Operate and control of gas welding equipment • Gas welding accessories 	2	2	4
1.2	Perform gas flame setting	<ul style="list-style-type: none"> • Introduction • Safety precautions • Types of flame • Types of Nozzle • Set gas pressure • Importance of cleaning Nozzle • Movement of torch 	1	2.5	3.5
1.3	Weld surface in flat position a) Weld straight bead on surface without using filler rod	<ul style="list-style-type: none"> • Introduction • Flame setting • Welding technique • Safety precaution 	0.5	6	6.5
1.4	Weld surface in flat position a) Weld straight bead on surface with using filler rod	<ul style="list-style-type: none"> • Introduction • Flame setting • Weld deposition • Filler wire • Welding technique • Safety precaution 	0.5	6.5	7

Unit 2. Gas Tungsten Arc Welding and Gas Metal Arc Welding (GTAW & GMAW)					
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Gas Tungsten Arc Welding (GTAW)					
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2.1	Set up welding machine and equipment	<ul style="list-style-type: none"> • Introduction • Machine/Tools/equipment • Applications • Set up GTAW machine • Safety precautions 	0.5	1.5	2
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2.2	Perform surface welding in flat position a) Weld surface without filler rod Weld surface with filler rod	<ul style="list-style-type: none"> • Introduction • Welding weave/deposition of bead • Tools/materials • Tungsten electrode/filler rod • Shielding gases • Gas flow rate • Angle of torch and filler rod • Welding Process • Tip preparation of tungsten electrode • Safety precautions 	0.5	3.5	4
2.3	Perform welding in flat position a) Weld square butt joint	<ul style="list-style-type: none"> • Introduction • Torch angle and filler rod • Tack welding 	1	3	4
2.4	Perform Tee joint, Lap Joint, Corner joint	<ul style="list-style-type: none"> • Welding process • Parent metal preparation • Welding current • Safety precaution • Introduction • Safety • Set and tack the plate to form Tee joint, Lap, Corner Joint • Set ampere • Angle of Torch and filler rod • Tack welding • Welding technique • Deposition rate • Weaving pattern 	1	12.5	13.5

Unit 3: Gas Metal Arc Welding (GMAW)

3.1	Set up welding machine and equipment	<ul style="list-style-type: none"> • Introduction • Machine/Tools/equipment • Set GMAW machine • Shielding gas • Gas flow rate • Safety precautions 	1	2	3
3.2	Weld surface in flat position a) Weld straight bead on surface	<ul style="list-style-type: none"> • Introduction • Welding weave/deposition of bead • MIG wire • Shielding gas • Gas flow rate • Welding Process • Safety precaution 	0.5	3.5	4

3.3	Weld in flat position a) Weld square butt joint Weld T joint	<ul style="list-style-type: none"> • Introduction • Welding process • Work piece setting • Welding current • Angle of welding gun • Work piece preparation • Safety rules 	1	3	4
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Unit 4: Spot Welding					
4.1	Perform Spot Welding	<ul style="list-style-type: none"> • Introduction • Welding process • Welding current • Welding time • Electrode • Safety rules • Nagged • Cooling 		3	3
		Total	13.0	104.0	117.0

References Books:

1. Jain Er. R.K. ,Production Technology Vol I & II, khannapublishers, 1976
2. Sethi G.S & Singh Balbir, Machinist Trade Theory Book , Computech Publications,2013
3. Gerling Heinrich, All About Machine Tools, New Age International Publisher,2006
4. Pramdar Dr R S, Welding Engineering And Technology, Khanna Publisher,2013

Engineering Drawing and CAD

Total: 125 hrs
Theory: 15 hrs
Practical: 110 hrs.

Course Description:

This Engineering Drawing subject provides essential skill and knowledge to communicate ideas and information from one mind to another, fully and clearly define requirements for engineered items in graphical language. This subject mainly focuses on orthographic representation Oblique/Isometric views, various types of lines, Dimensions, Tolerance, Lettered notes, sectional views, Development of sheet metal and symbols.

Computer Aided Design course intends to impart the knowledge and skills required to create two-dimensional (2D) engineering drawings and drafting using Auto CAD software. This course focuses mainly on mechanical engineering drawings. Trainees develop competencies focusing mainly on different features such as constructing geometrical outline, Transform and Modifying, Dimensioning and annotating, Sectional drawings and creating output.

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. Annotate a drawing with Text, Dimensioning, Tolerance and related information.
6. Interpret drawing projections.
7. Draw three-dimensional view in orthographic form.
8. Draw isometric view in scale
9. Draw sectional views of the given three-dimensional solid.
10. Interpret sheet metal fabrication drawing
11. Interpret metal fabrication drawings
12. Interpret pipe installation drawings.
13. Draft mechanical engineering drawings on Computer Aided Design software
14. Construct 2D engineering drawing
15. Transform and Modify engineering drawing
16. Create sectional drawings
17. Create output on PDF and print paper.

Section A: Institute Based Training (15 Academic Weeks)

S.N.	Tasks Statement	Related Technical Knowledge	Time (hrs)		
			Th.	Pr.	Total
1.	Define engineering drawing	<ul style="list-style-type: none"> • Definition • Types of drawing • Classification of engineering drawing • Application of engineering drawing 	1		1
2	Describe elements of the engineering drawing	<ul style="list-style-type: none"> • Introduction • Lines • Projection method • Geometric construction • Title block • Annotation (texts) • Scale 	1		1
3	Handle drawing instruments	<ul style="list-style-type: none"> • Introduction • Types, uses and sizes • Handling techniques • Precautions • Exercises and assignments 	1	1	2
4	Draw geometric construction	<ul style="list-style-type: none"> • Introduction • Layout of the drawing paper • Procedure of drafting title block • Conventional lines and their usages • Conventional geometric symbols used in mechanical drawing • Procedure for constructing polygons • Exercises and assignments 	2	10	12
5	Acquaint to dimension the drawing.	<ul style="list-style-type: none"> • Introduction of dimensioning • Elements and rules of dimensioning • Direction of dimensioning • Dimensioning angles • Dimensioning arcs • Dimensioning through and blind holes • Exercises and assignments 	1	6	7
6	Interpret drawing projections	<ul style="list-style-type: none"> • Introduction • Types of projection • Projection of plain • Projection of solids 	2	0	2
7	Interpret pictorial projection	<ul style="list-style-type: none"> • Draw isometric projection • Draw oblique projection • Exercises and assignments 	1	3	4

9	Draw isometric drawing in scale	<ul style="list-style-type: none"> • Rules for presenting the lines in isometric projection. • Methods of constructing isometric drawings. • Isometric drawing of rectangular plane. • Isometric drawing of pentagonal plane • Isometric drawing of circular plane. • Exercises and assignments 	2	10	12
10	Draw sectional views	<ul style="list-style-type: none"> • Introduction • Cutting plane line • Types of section views • Method of section views • Full section drawing • Half section drawing • Exercises and assignments 	2	7	9
11	Interpret sheet metal fabrication drawing	<ul style="list-style-type: none"> • Introduction • Method and process of developing sheet metal fabrication drawing • Draw a right cylinder development • Draw a right prism development • Draw a right cone development • Method and process of symbolization of riveting joints. • Exercises and assignments 	2	8	10
			15	45	60

Section B: Institute Based Training One Day Per Week (78 Days/13 Academic Weeks)

S. N.	Tasks Statement	Related Technical Knowledge	Time (hrs.)		
			Th.	Pr.	Total
1.	Perform basic computer skill	<ul style="list-style-type: none"> • Introduction • Function of computer peripherals and programs. • Creating new folders • Cut, copy, paste and rename the files and folders • Deleting the files and folders • Exercises and assignments 		8	8
2	Acquaint the Computer Aided Design/Drafting/Drawing.	<ul style="list-style-type: none"> • Introduction to AutoCAD software • Auto CAD user interface. • Navigation tools. 		6	6

		<ul style="list-style-type: none"> • Execution of co-ordinate system. • Select unit and status bar option. • Selection procedure of the objects. • Exercises and assignments 			
3	Construct geometric outline with basic draw command	<ul style="list-style-type: none"> • Introduction • Construction of geometric outlines with line command • Construction of geometric outlines with rectangle & polygon command • Construction of circular geometric outlines with circle & arc command • Construction of geometric outlines with polyline and spline command • Exercises and assignments 		22	22
4	Transform the drawing objects with modify command	<ul style="list-style-type: none"> • Changing the position of the drawing object using move and copy command • Changing the position of the drawing object using rotate command • Changing the position of the drawing object using mirror and scale command • Adjusting the drawing object using trim and extend command • Editing the drawing object using erase, explode and overkill command • Modifying the edges of the drawing object using fillet and chamfer command. • Enhancing the drawing object using offset mode. • Enhancing the drawing object using rectangular, polar and path array mode. • Exercises and assignments 		12	12
5	Apply basic drawing features	<ul style="list-style-type: none"> • Applying the polar, ortho and object snap mode to ease the drafting. • Finding the measurement of plain drawings. 		7	7

		<ul style="list-style-type: none"> • Creating and assign layers. • Applying basic hatches. • Exercises and assignments 			
6	Annotate a drawing with text, color, line type and dimension	<ul style="list-style-type: none"> • Creating and modifying basic dimension in drawing. • Creating and edit single line and multiline texts. • Finding replace and import texts. • Applying colors in outline of drawing. • Specifying the line type and thickness of drawing outline. • Creating and format the table in drawing sheet. • Exercises and assignments 		8	8
7	Create output	<ul style="list-style-type: none"> • Introduction • Setting up page layout • Configure the plotter/printer • Converting DWG to PDF file • Printing out the drawing from PDF file and CAD screen. • Exercises and assignments 		2	2
	Total			65	65

Reference Books:

1. Luintel Mahesh Chandra, Engineering Drawing I and II, Heritage Publishers & Distributors Pvt. Ltd.,2021
2. Gill, P.S., Engineering Drawing I and II, S.K. Kataria & Sons; 2013
3. Karaiskos Pete , Fulton Nancy ,AutoCAD for Mechanical Engineers and Designers,Wiley,1995

Maintenance Practice

Total : 177 hrs
Theory : 13 hrs
Practical:164 hrs

Course Description:

This course intends to fit and assemble metal parts to fabricate production machines and other equipment. They use a range of tools and engineering techniques to maintain and repair mechanical plant machinery and equipment to operational standards. They test and identify defective or worn mechanical components or equipment. Mechanical fitters also use precision measuring instruments to check parts for accuracy and fit.

Maintenance worker usually works in workshops or production areas that can be noisy, hot and dusty. They may spend most of their day standing and often need to bend, crouch or climb. Workers must be aware of safety regulations and wear personal protective equipment.

Course Objectives:

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

1. Perform schedule maintenance
2. Perform condition-based maintenance
3. Apply lubrication according to machine maintenance manual.
4. Maintain a history card of every machine.
5. Carryout run to failure maintenance
6. Identify machine elements required to assembly the machine,
7. Identify tool and equipment used in breakdown maintenance.
8. Remove broken screws from machine bodies.
9. Overhaul the simple workshop machines.

Section A: Institute Based Training (15 Academic Weeks)					
S.N.	Tasks Statement	Related Technical Knowledge	Time (hrs)		
			Th.	Pr.	Total
Perform Predictive Maintenance					
1	Perform Predictive Maintenance	<ul style="list-style-type: none"> • Prepare maintenance plan, • Carry out routine check, • Ensure that safety standards are maintained • Ensure that the machine areas and work environment are free of hazardous objects and substances. • Submit reports on issues that arises to the supervisor. 		1	1
2	Apply Lubricants and Lubrications	<ul style="list-style-type: none"> • Lubricate on oil circulation system, • Lubricate on every sliding surfaces, • Lubricate on gear and chain drives, • Lubricate on every oiling points that indicated by maintenance manual, • Apply coolant as maintenance manual indicated, 		2	2
Perform Breakdown maintenance					
3	Take pre-procedure before breakdown maintenance	<ul style="list-style-type: none"> • Check the history card of the machine, • Read the report of condition-based maintenance, • Follow instructions as per maintenance manual, • Interpret the drawings provided on machine maintenance manual. • Disconnect the electrical power connection. 		2	2
4	Dismantle the machine components	<ul style="list-style-type: none"> • Barricade the maintenance zone, • Prepare maintenance trolley with materials, • Drain out the oils that filled, • Loose the nut-bolts, screws • Take the photos, • Take out and ensure the usability of machine elements, 		6	6

		<ul style="list-style-type: none"> • Take out and ensure the worn out or broken parts, • Clean all part & machine elements, • Separate the parts that have to be repair and replace, • Prepare a list of repair and replace, • Report to the supervisor, 			
5	Assemble the machine components	<ul style="list-style-type: none"> • Clean and wipe the machine parts, • Put the parts and elements back together the way it was dismantled, • Check the tolerances of fitting, • Ensure repair parts are functioning, • Keep lubricated as necessary, • Tighten all screws, nut and bolts, • Check or test the function manually 		6	6
6	Repair machine parts by Filing plain/curve surface	<ul style="list-style-type: none"> • Measure and mark the excess surface of the part. • Hold work piece on Bench Vice. • File surface following the safety. • Check the flatness or radius of the surface. • Ensure the dimension is obtained. 		8	8
7	Repair machine parts by lathe work	<ul style="list-style-type: none"> • Measure and mark the excess surface of the part. • Hold work piece on Lathe chuck. • Obtain concentricity of the part. • Give tailstock support. • Turn the surface following the safety. • Check the diameter and length of the part. • Ensure the dimension is obtained. 		16	16
8	Repair machine parts by drilling operation	<ul style="list-style-type: none"> • Introduction • Types of drill machine • Types of drilling stools 		6	6

		<ul style="list-style-type: none"> • Work holding method on drill machine. • Safe handling of drilling tools and machines. • Method of re-sharpening drilling tools. • Exercises and assignments 			
9	Repair machine parts by chiseling and chipping	<ul style="list-style-type: none"> • Introduction • Safety precaution of chisels and chipping. • Method of re-sharpening chisels. • Work holding method on bench vice for chiseling. • Method of chipping plain surface. • Exercises and assignments 		4	4
10	Repair machine parts by internal and external thread cutting	<ul style="list-style-type: none"> • Introduction • Types of standard 'V' thread. • Types of hand tools use for cutting internal and external thread. • Safety precaution of thread cutting • Work holding method for thread cutting • Thread cutting process for internal and external threads. • Remove the broken screw from the machine body. • Repair internal thread using helicoil on machine body. • Exercises and assignments 		6	6
11	Repair machine parts by Grinding	<ul style="list-style-type: none"> • Introduction • Safety precaution on grinding. • Types of grinder and grinding machine. • Abrasive, types and application of grinding wheel. • Emery clothes, sand paper, its types and their application. • Safe handling of grinder and grinding machine. • Exercises and assignments 		3	3
				60	60

Section B: Institute Based Training One Day Per Week (78 Days/13 Academic Weeks)

Perform Predictive Maintenance					
13	Carryout Condition Based Maintenance	<ul style="list-style-type: none"> • Introduction of periodic maintenance • Notify and analyze the machine vibration, • Notify and analyze the machine heating, • Notify and analyze the machine to slow down the efficiency, • Submit reports on issues that arises to the supervisor. 	2	4	6
14	Maintain Machine History Card	<ul style="list-style-type: none"> • Keep the information of machine manufacturer, • Maintain the machine description and its capacity, • Maintain analysis of previous breakdown, • Maintain schedule of machine maintenance, • Maintain oiling, lubrication on machine, • Tightens loose screws, nut, bolts etc. 	2	2	4
15	Apply Lubricants and Lubrication	<ul style="list-style-type: none"> • Lubricate on oil circulation system, • Lubricate on every sliding surfaces, • Lubricate on gear and chain drives, • Lubricate on every oiling points that indicated by maintenance manual, • Apply coolant as maintenance manual indicated 		4	4
Perform Breakdown maintenance					
16	Take pre-procedure before breakdown maintenance	<ul style="list-style-type: none"> • Check the history card of the machine, • Read the report of condition based maintenance, • Interpret the drawings provided on machine maintenance manual. 	1	2	3

		<ul style="list-style-type: none"> • Disconnect the electrical power connection. 			
17	Dismantle the machine components	<ul style="list-style-type: none"> • Barricade the maintenance zone, • Prepare maintenance trolley with materials, • Drain out the oils that filled, • Loose the nut-bolts, screws • Take out and ensure the usability of machine elements. • Take out and ensure the worn out or broken parts. • Clean all part & machine elements, • Separate the parts that has to be repair and replace, • Prepare a list of repair and replace, • Report to the supervisor 	1	4	5
18	Assemble the machine components	<ul style="list-style-type: none"> • Clean and wipe the machine parts, • Put the parts and elements back together the way it was dismantled, • Check the tolerances of fitting, • Ensure repair parts are functioning, • Keep lubricated as necessary, • Tighten all screws, nut and bolts, • Check or test the function manually, 		6	6
19	Repair machine parts by Filing plain/curve surface	<ul style="list-style-type: none"> • Measure and mark the excess surface of the part. • Hold work piece on Bench Vice. • File surface following the safety. • Check the flatness or radius of the surface. • Ensure the dimension is obtained. 		12	12
20	Repair machine parts by lathe work	<ul style="list-style-type: none"> • Introduction, • Safety precaution of lathe work, • Measure and mark the excess surface of the part. 	2	12	14

		<ul style="list-style-type: none"> • Hold work piece on Lathe chuck. • Obtain concentricity of the part. • Give tailstock support. • Clamp and set lathe cutting tool, • Set rpm and feed transmission gear, • Turn first cut, • Set '0' on compound slide • Give depth for second cut, • Give depth for third and finishing cut, • Check the diameter and length of the part. • Ensure the dimension is obtained. 			
21	Repair machine parts by Grinding	<ul style="list-style-type: none"> • Introduction • Safety precaution on grinding. • Types of grinder and grinding machine. • Abrasive, types and application of grinding wheel. • Emery clothes, sand paper its types and their application. • Safe handling of grinder and grinding machine. • Exercises and assignments 	1	5	6
22	Repair machine parts by welding	<ul style="list-style-type: none"> • Follow arc welding safety • Prepare welding tools, equipment and machine, • Make a bevel on welding joint, • Set machine part to be repair, • Weld tack-weld on necessary number of spots, • Align to position as its required, • Weld root to fixed, • Check the position and align if necessary, • Weld full to ensure strength enough • Place the tools equipment on their original place, • Clean up the welding area. 		5	5

23	Repair / replace Hydraulic Components	<ul style="list-style-type: none"> • Introduction • Principle of hydraulic system, • Safety precaution of hydraulic system • Identify hydraulic components, • Clean up various components, • Replace valves, • Replace oil seals, • Replace supply hose 	2	10	12
24	Repair / replace Pneumatic Components	<ul style="list-style-type: none"> • Introduction • Principle of Pneumatic system, • Safety precaution of Pneumatic system • Identify Pneumatic components, • Clean up various components, • Replace valves, • Repair of air compressor 	2	10	12
25	Perform project work	<ul style="list-style-type: none"> • Overhaul of Bench vice. • Overhaul of a shearing machine • Overhaul of a Tailstock of a lathe machine. • Overhaul of a bench drilling machine • Overhaul of a gear box • Overhaul of a power hacksaw. 		28	28
			13	104	117

Reference Books:

1. Raghuwanshi B. S. , A Course in Workshop Technology-Vol 1 and 2 , Dhanpat Rai & Company(P) Limited, 2003.
2. Hajra Choudhury S. K. , Elements of Workshop Technology-Vol 1 and 2, Media Promoters & Publishers, 1971
3. Ballaney Prof. P.L. ,Theory of Machines & Mechanisms, Khanna Publishers,1965
4. Gerling Heinrich, All About Machine Tools, New Age International Publisher,2006

Basic Electrical and Electronics

Total: 30 hours
Theory: 11 hours
Practical: 19 hours

Course Description:

This course consists of two parts. The first part intends to provide basic knowledge on basic domestic and industrial wiring. And the second part includes basic introduction to electronics components that are used in control of manufacturing processes. This course provides essential skill and knowledge to perform basic electrical works and identify the machine components used in manufacturing industries.

Course Objectives:

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

1. Perform basic electrical wiring
2. Identify the component of electronic circuit
3. Describe the safety practices in electric works

Section A: Institute-Based Training (15 Academic Weeks)

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Apply Electrical Safety	Electrical Hazard <ul style="list-style-type: none"> ▪ Types of electrical hazard ▪ Possible damages due to electric shocks ▪ Safe value of electric current and voltage through human body ▪ First Aid for electric shock Electrical Safety <ul style="list-style-type: none"> ▪ General Safety regulations ▪ Types of safety: <ul style="list-style-type: none"> ✓ personal safety, ✓ tools & equipment ✓ machine safety) ▪ Safe use of Electrical components ▪ Static charge in high voltage equipment ▪ Electrical insulation 	3		3

		techniques			
2.	Draw electrical symbols	Electrical drawing and wiring symbols: <ul style="list-style-type: none"> ▪ Introduction ▪ Basic symbols ▪ Common wiring circuits ▪ Single line representation of wiring diagrams 	1	2	3
3.	Install electric common accessories (One way switch, two-way switch, bell switch, dimmer switch, light and power socket, MCB,) to control the respective load with the concept of series and parallel. At least three exercises Demonstrate 3 phase accessories (Push bottom switch, triple pole MCB, Contactor, auxiliary contactor, Overload relay, Indicator) to control 3 phase motor.	<ul style="list-style-type: none"> ▪ Domestic Wiring ▪ Introduction ▪ Identify common tools used in electrical work. ▪ Connection and layout symbol ▪ Connection diagram ▪ Component rating ▪ Power circuit and light circuit ▪ Application ▪ Industrial wiring ▪ Introduction ▪ Power and control diagram ▪ Rating ▪ Application 	4	15	16
4.	Identify Basic Electronic components	Electronics: <ul style="list-style-type: none"> ▪ Active and Passive component ▪ Symbols used in electronics circuit for active and passive component. Demonstrate and Explain: <ul style="list-style-type: none"> ▪ Resistor, type and Application ▪ Capacitor type and Application ▪ Inductor and its Application ▪ PN diode and its type ▪ Transistor and Integrated Circuit ▪ Transformer (Step 	2	3	5

		<p>down) and its function</p> <ul style="list-style-type: none"> ▪ Demonstration and identification of different electronic components. 			
5	Identify commonly used Sensors	<p>Sensor Introduction</p> <p>Types and uses:</p> <ul style="list-style-type: none"> ▪ Pressure Sensor · ▪ Temperature Sensor ▪ Ultrasonic Sensor · ▪ Displacement Sensor · ▪ Flow Sensor · ▪ Inductive Sensor ▪ Speed Sensor <p>Demonstrate different types of Sensors</p>	1	3	4
		Total	11	19	30

References Books:

1. Singh Surjit, Electrical Engineering Drawing-I & II, S.K. Kataria & Sons,2020
2. Sharma Dr. Sanjay,Electronic Devices & Circuits, S.K. Kataria & Sons,2010
3. Stephen L. Herman, Electrical Wiring Industrial, Cengage Learning,2017

Workshop Technology

Total : 90 hours
Theory: 78 hours
Practical: 12 hours

Course Description:

This subject provides to equip selected general SLC/SEE graduates with basic theoretical knowledge about workshop technology in the mechanical engineering sector. Also it focuses on differentiating conventional machining and non-conventional machining processes along with basic fundamentals of hydraulic and pneumatic system

Course Objectives:

At the end of the course, the participants will be able to:

1. Apply safety rules in the workshop.
2. Describe the use of cutting tools, measuring instruments, machines & equipment's found in workshops.
3. Describe the basic operation related to lathe, drill, cut, grind, shape, mill according to the specification.
4. Describe the operation of Lathe, Drills, Shaper, Planer, Grinder, Power hacksaw and milling machines.
5. Describe the importance of coolants & lubricants.
6. Describe the basic machine components.
7. Describe the advantages of non-conventional machining practices.
8. Identify the basic pneumatic components
9. Identify the basic hydraulic components
10. Describe the working principle of hydraulic and pneumatic circuit
11. Describe the working principle of non-conventional machining processes
12. Describe the different types of engineering materials and their properties.

Institute Based Training (15 Academic Weeks) 30 hours @ 2 hours per week

Section one: Material Science

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1	Engineering materials	Introduction to Engineering Materials <ul style="list-style-type: none"> • Ferrous materials • Non-ferrous materials • Application 	3		3
2	Ferrous Materials	Introduction of <ul style="list-style-type: none"> • Cast Iron • Steel 			
3	Non Ferrous Materials	Introduction of <ul style="list-style-type: none"> • Aluminum • Copper • Brass • Bronze • Nickel • Lead • Zinc 	5		5

		<ul style="list-style-type: none"> • Tin • Ceramics • Polymers • Plastics • Rubber • Wood • Glass 			
4	Properties of materials	Introduction of <ul style="list-style-type: none"> • Physical • Thermal • Electrical • Magnetic • Mechanical 	2		2

Part II: Workshop Technology

1	Safety	General safety precautions Types of safety <ul style="list-style-type: none"> • Personal Safety • Workshop Safety • Machine safety 	1		1
2	Measuring Instruments	Most used Measuring Instruments <ul style="list-style-type: none"> • Steel Ruler • Protractor • Calipers • Dividers • Telescopic gauge • Depth gauge • Micrometers • Vernier calipers (Mechanical and Digital) • Vernier depth gauge • Vernier height gauge 	5	4	9
3	Welding	<ul style="list-style-type: none"> • Introduction • Application • Welding Symbols Welding joints <ul style="list-style-type: none"> • Butt joint • Corner joint • Lap joint • Tee joint • Edge joint Welding position <ul style="list-style-type: none"> • Flat • Horizontal • Vertical • Overhead 	10		10

		<p>Gas Welding Process & Equipment</p> <p>Arc Welding Processes & Equipment</p> <p>Resistance Welding (Spot welding)</p> <p>Tungsten Inert Gas Welding (TIG)</p> <p>Metal Inert Gas Welding (MIG)</p> <p>Types of welding machines</p> <p>Brazing</p> <p>Soldering</p> <p>Welding Defects</p>			
4	Sheet metal work	<ul style="list-style-type: none"> • Introduction • Application • Hand shears or snips • Mallet hammer • Stakes and stake holder <p>Common measuring tools</p> <ul style="list-style-type: none"> • Wire gauge • Folding rule • Circumference rule • Steel rule • Vernier caliper • Micrometer <p>Introduction of Machines used</p> <ul style="list-style-type: none"> • Rolling • Folding • Bending • Shearing • Crimping 	5		5
5	Fitting	<ul style="list-style-type: none"> • Introduction • Application • Tools used in fitting shop • Marking tools • Measuring devices • Measuring instruments • Supporting tools • Holding tools • Striking tools • Cutting tools • Tightening tools 	3		3
6	Lathe machine	<ul style="list-style-type: none"> • Introduction • Application 	12		12

		<ul style="list-style-type: none"> • Lathe tool and its nomenclature • Different Parts of Lathe Machine • Bed • Head stock • Tail stock • Carriage • Saddle • Cross slide • Chuck • Lead screw • Tool post • Compound rest • Spindle • Compound slide • Speed controller • Hand wheel • Sleeve <p>Basic working principle</p> <p>Introduction to</p> <ul style="list-style-type: none"> • Speed Lathe • Center or Engine Lathe • Bench Lathe • Tool Room Lathe • Capstan and Turret Lathe • Automatic Lathe • Accessories and attachments of Lathe <p>Basic Lathe Operations</p> <ul style="list-style-type: none"> • Facing • Turning • Step Turning • Taper Turning • Thread Cutting • Drilling • Center Drilling • Chamfering • Grooving • Knurling • Boring • 			
7	Drilling machine	<ul style="list-style-type: none"> • Introduction • Application • Construction of Drilling machine 	3		3

		<p>Introduction to</p> <ul style="list-style-type: none"> • Portable Drilling machine • Sensitive drilling machine • Upright drilling machine • Multiple spindle drilling machine • Automatic drilling machine <p>Types of drill</p> <ul style="list-style-type: none"> • Flat drill • Straight-fluted drill • Twist drill • countersink • Counter-bore • Boring head 			
9	Milling	<ul style="list-style-type: none"> • Introduction • Application • Introduction to • Column and knee type milling machines • Planer milling machine • Fixed-bed type milling machine • Milling cutter and its application • Work holding devices 	6		6
10	Shaper & Planer	Introduction and application	4		3
11	Grinder	<ul style="list-style-type: none"> • Introduction • Application • Types of Grinders • Hand • Pedestal 			
12	Metal Cutting	<ul style="list-style-type: none"> • Introduction to • Hand Hacksaw • Power Hacksaw • Cutoff Grinder 			
13	Lubrication	<ul style="list-style-type: none"> • Introduction • Types of Lubricants • Solid • Semisolid • Liquid • Application 	1		1
14	Cooling	<ul style="list-style-type: none"> • Introduction of coolants 	1		1

		<ul style="list-style-type: none"> • Air Cooling and Liquid Cooling • Application 			
15	Machine elements	Introduction to <ul style="list-style-type: none"> • Gears • Pulleys • Pins • Nut bolts • Washers • Locking devices • Keys • Seals • Belts • Screws • Springs • Bearings (Journal, Ball, Roller) • Bush • Application • Examples 	6		6

Part III: Advanced Manufacturing					
S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Total
1.	Describe the concept of non-conventional machining.	Conventional machining <ul style="list-style-type: none"> ▪ Introduction ▪ Merits and Demerits ▪ Application Non- Conventional machining <ul style="list-style-type: none"> ▪ Introduction ▪ Comparison between conventional and non-conventional machining ▪ Introduction and application of: <ol style="list-style-type: none"> 1. Water Jet Machining 2. Ultrasonic Machining 3. Laser Machining 4. Electric Discharge Machining 5. Electro-Chemical 	4	3	7

		Machining Demonstration of working of non-conventional machining from field visit			
1.	Describe Rapid Prototyping (3D Printing)	<ul style="list-style-type: none"> ▪ Introduction ▪ Application 	1	1	2
Part IV: Hydraulic and Pneumatic					
1.	Familiarize with Hydraulic System	<p>Hydraulic System:</p> <ul style="list-style-type: none"> ▪ Introduction ▪ Symbol used in Hydraulic circuit ▪ Basic component of Hydraulic system ▪ Safety and Hazards associated to Hydraulic system ▪ Application ▪ Practical demonstration of different component in hydraulic system 	3	2	5
2.	Familiarize with Pneumatic system	<p>Pneumatic System:</p> <ul style="list-style-type: none"> ▪ Introduction ▪ Symbol used in pneumatic circuit ▪ Basic component of Pneumatic system ▪ Safety and Hazards associated to Pneumatic system ▪ Application ▪ Practical demonstration of different component in Pneumatic system 	3	2	5
			78	12	90

References Books

1. Raghuwanshi B. S. , A Course in Workshop Technology-Vol 1 and 2 , Dhanpat Rai & Company(P) Limited, 2003.
2. Hajra Choudhury S. K. , Elements of Workshop Technology-Vol 1 and 2, Media Promoters & Publishers, 1971
3. Jain Er. R.K. ,Production Technology Vol I & II, khannapublishers, 1976
4. Sethi G.S & Singh Balbir, Machinist Trade Theory Book , Computech Publications,2013
5. Gerling Heinrich, All About Machine Tools, New Age International Publisher,2006
6. Salam Md. Abdus ,Fundamentals of Pneumatics and Hydraulics, Springer Verlag, 2022

Applied Mathematics

Total: 71 hours
Theory: 67 hours
Practical: 4 hours

Course Description:

This course provides skill and knowledge to solve the numerical problems related to Pre-diploma in Mechanical Engineering course (Apprenticeship model). This subject consists of basic mathematical calculation of work, energy, power, force, speed, velocity and other calculations related to mechanical engineering to develop mathematical background helpful for mechanical engineering works.

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. Evaluate the different types of mechanical machines' related calculation.

Section A: Institute Based Training (15 Academic Weeks) 45 hours @ 3 hours per week

Module I: Basic Mathematics

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Total
1	Calculate SI units / conversion factors	System of units <ul style="list-style-type: none"> • Basic Units, Derived units and SI units Conversion of units Example and exercises	3		3
2	Calculate percentage	Actual number and real number <ul style="list-style-type: none"> • Conversion of the percentage into actual number • Conversion of the real number into percentage Example and exercises	3		3
3	Calculate area and circumferences	Definition <ul style="list-style-type: none"> • Area and Circumference Area calculation of: <ul style="list-style-type: none"> • Square • Rhombus • Rectangle • Parallelogram • Triangle • Trapezium • Circle • Sector • Circular ring • Cube 	10	1	10

		<ul style="list-style-type: none"> • Prism • Cylinder Circumference calculation of: <ul style="list-style-type: none"> • Square • Rhombus • Rectangle • Parallelogram • Triangle • Trapezium • Circle • Sector • Polygons Example and exercises			
4	Calculate Sheet metal requirements and wastage	Divide area of sheet metal Wastage Examples and Exercises	2	1	4
5	Calculate volume of right bodies, pointed and truncated bodies	Concept of cube, prism and cylinder <ul style="list-style-type: none"> • Prism • Cylinder • Cone / Pyramid • Truncated cone / Pyramid Examples and Exercises	5	1	6
6	Calculate taper and inclination	Concept of taper & taper ratio Taper ratio Ratio of inclination Setting angles Taper length Examples and Exercises	5		5
7	Calculate weight, mass and force	Concept of weight, mass and force Mass Weight Density Force Examples and Exercises	5	1	6
8	Calculate work, power and efficiency	Work Power Efficiency Examples and Exercises	8		8
	Total		41	4	45

Section B: Institute Based Training (13 weeks @1 day per week) 26 hours@ hours per week

Module II: Basic Technical Mathematics

S.N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
9	Calculate Lever Forces	<ul style="list-style-type: none"> • Moment of force • One side lever • Two side lever • Elbow lever Examples and Exercises	2		2
10	Calculate uniform speeds	<ul style="list-style-type: none"> • Newtons law of motion • Velocity in a straight-line motion • Velocity in circular motion • Acceleration Examples and Exercises	4		4
11	Calculate Simple belt drive	Definition <ul style="list-style-type: none"> • Driven and driving pulley • Peripheral speed • Transmission ratio Calculation of <ul style="list-style-type: none"> • Diameter of driving and driven pulley • RPM of driving and driven pulley Examples and Exercises	2		2
12	Calculate Simple gear drive	Concept of <ul style="list-style-type: none"> • Driven and driving • Revolution per minute • Distance between axes • Transmission ratio Dependency of pitch diameter and revolution Dependency of number of teeth and revolution Examples and Exercises	2		2
13	Calculate Drilling time	Definition <ul style="list-style-type: none"> • Drilling Feed, Initial cut Calculation of drilling <ul style="list-style-type: none"> • Feed speed • Drilling time in min. • Initial cut 	4		4

		Examples and Exercises			
14	Calculate machining time for turning	Definition <ul style="list-style-type: none"> • Lathe feed Calculation of <ul style="list-style-type: none"> • Feed speed • Turning time in min. Examples and Exercises	4		4
15	Calculate taper turning	Definition <ul style="list-style-type: none"> • Taper • Taper ratio Calculation of taper Examples and Exercises	4		4
16	Calculate thread cutting	Thread nomenclature <ul style="list-style-type: none"> • Pitch • Thread depth Change gear calculation Example and Exercises	4		4
	Total		26		26

References Books:

1. Dahal Hukum Pd., United's Speedy Maths Book 1 and 2, Vedanta Publication (P) Ltd.,2021
2. Awasti Ramesh Prashad , Basic Mathematics, Unique Educational Publisher Pvt. Ltd, 2012
3. Technical Mathematics book for metal Trade, German Agency for Technical Cooperation (GTZ)

Entrepreneurship Development

Course Nature: Theory + Practical

Class per week: 2 hrs.

Theory: 30 hrs.

Practical: 48 hrs.

Full Marks: 50

Total: 78 hrs.

Description:	This course is designed to impart the knowledge and skills to deal with exploring, acquiring and developing entrepreneurial competencies, identification of suitable business idea and developing business plan.
Objectives:	<ul style="list-style-type: none"> ▪ Conceptualize entrepreneurship and business ▪ Explore entrepreneurial competencies ▪ Analyze business ideas and viability ▪ Prepare business plan

S.N.	Skills/ Topic	Contents	Time Hours		
			T.	Pr.	Total
Unit 1: Introduction to Entrepreneurship and Business					
1.	Overview of Entrepreneurship Development and Business	<ul style="list-style-type: none"> • Concept of entrepreneurship, enterprise and business • Difference between enterprise and business • Difference between employment, self-employment and business • Challenges in entrepreneurship • Advantages and disadvantages of being entrepreneur • Stages (socialization, startup, acceleration, expansion and sustainability) of entrepreneurship development • History of enterprise in Nepal. • Types of enterprise based on the Industrial Enterprise Act, 2076 of Nepal 	3.0	-	3.0
Unit 2: Exploring and Developing Entrepreneurial Competencies					
2.	Conduct self-assessment	<ul style="list-style-type: none"> • Importance of self-assessment to be a successful entrepreneur. • “Who am I?” technique of self-assessment. • Components of Johari Window. • Johari Window analysis process. • Characteristics of successful entrepreneur 	1.0	3.0	4.0
3.	Analyze Risk	<ul style="list-style-type: none"> • Concept of risk • Types of risk (external/internal, low/medium/high) • Risk taking behavior • Risk minimizing techniques 	2.0	2.0	4.0
4.	Assess Decision-Making Attitude	<ul style="list-style-type: none"> • Definition • Concept of Decision-making attitude • Decision making Process • Dos and Don'ts while making decision 	2.0		2.0

S.N.	Skills/ Topic	Contents	Time Hours		
			T.	Pr.	Total
5.	Overview of creativity and innovation in business	<ul style="list-style-type: none"> Stages of creativity (preparation, concentration, incubation, illumination, evaluation and application) Barrier of creativity Way of developing creativity Innovation in business (SCAMPER Model) 	2.0		2.0
Unit 3: Market and Marketing					
6.	Develop Marketing Strategy	<ul style="list-style-type: none"> Definition of market and marketing Concept of marketing cycle 4 - PS (product, place, price and promotion) Basic marketing strategies. Factors to be considered while selecting marketing strategy. 	2.0		2.0
Unit 4: Business Identification and Selection					
7.	Overview of business identification and selection process	<ul style="list-style-type: none"> Sources and method of generating business ideas. Selection of viable business ideas (selection criteria) Legal provisions for the selected business (registration, documents requirements, facilities/subsidies) 	2.0		2.0
8.	Conduct Market Survey	<ul style="list-style-type: none"> Procedure of assessing market situation Market estimation process 	2.0	6.0	8.0
9.	Conduct SWOT Analysis	<ul style="list-style-type: none"> Four components of SWOT analysis matrix Factors to be considered during SWOT analysis SWOT analysis procedure 	1.0	4.0	5.0
Unit 5: Business Plan					
10.	Overview of Business Plan	<ul style="list-style-type: none"> Concept of business plan Importance of business plan Factors to be considered while preparing business plan Components of business plan 	1.0		1.0
11.	Prepare Marketing Plan	<ul style="list-style-type: none"> Description of product or service Targeted market and customers Location of business establishment Competitors analysis Estimation of market demand Estimation of market share Measures for business promotion Procedure of preparing marketing plan 	2.0	6.0	8.0
12.	Prepare Organizational	<ul style="list-style-type: none"> Legal status of business Management structure 	2.0	6.0	8.0

S.N.	Skills/ Topic	Contents	Time Hours		
			T.	Pr.	Total
	and human resource plan	<ul style="list-style-type: none"> Required human resource and cost Roles and responsibility of staff 			
13.	Prepare Business Operation Plan	<ul style="list-style-type: none"> Process of product or service creation Required fix assets Level of capacity utilization Depreciation & amortization Estimation of office overhead and utilities Procedure of preparing business operation plan 	2.0	6.0	8.0
14.	Prepare Financial Plan	<ul style="list-style-type: none"> Concept of financial plan Steps of financial plan Working capital estimation Pricing strategy Profit/loss calculation BEP and ROI analysis Procedure of preparing business operation plan 	2.0	6.0	8.0
15.	Appraise Business Plan	<ul style="list-style-type: none"> Return on investment Breakeven analysis Risk factors 	2.0	6.0	8.0
Unit 6: Book Keeping					
16.	Maintain basic book keeping	<ul style="list-style-type: none"> Concept and need of book keeping Methods and types of book keeping Procedure to maintain day book and sales records 	2.0	3.0	5.0

Reference book:

- जोशी बिष्णु, (२०७६). उद्यमशीलता विकास. अनुभूति नेपाल प्रा.लि.
- Agrawal, G.R. (2015). *Entrepreneurship Development in Nepal*. M.K. Publishers & Distributors
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Industrial Practice (Workplace Learning)

Program Description

Under the apprenticeship or the dual learning system of curricular program, the related industries are served as work place learning venues for apprentices. In addition, the related industries would have vital roles in providing platforms for learning occupational tasks, core skills and soft skills for the apprentices. Therefore, this curricular program is designed to acquire competencies by an apprentice through his/her engagement in hands-on practices (the real world of work experiences) as he/she involves in maintenance and repair all types of mechanical equipment and manufacturing machine parts as needed to related industries. It also helps the apprentices in enhancing employability, adaptability, confidentiality, independence and social and emotional intelligence.

For operating this curricular program, the technical schools or training institutes will make necessary arrangements to provide platforms for the industrial practices. Additionally, there will be a Tripartite training agreement among the apprentices, sponsoring industries and training institute. The terms and conditions of agreement will be implemented during the whole training period effectively based on the Apprenticeship Training Working Procedure, 2075 B.S.

This type of curricular program operates in two phases: training institutes or technical schools phase on the one hand and mostly sponsoring industries partly training institute phase on the other hand. The proposed apprentices have to engage for three and half months (15 academic weeks) theoretical and practical classes in the training institute. After completing the 15 weeks training from the training institute, the apprentices will be placed in industries as the apprentices under the supervision of In-company Trainer, whereas industrial practice & related occupational tasks/competencies and skills will be learned. The nature of training in the industries will be practical, and the duration will be of approximately 18 months (78 weeks/2600 hours). The apprentices will engage in the related sponsoring industries for 5 days in a week, and they should come back to the training institute for rest of 1 day per week during the second phase of whole training period.

Moreover, apprentices will engage in machining, manufacturing and fabrication industries, along with mechanical engineering core subjects such as mechanical fitter workshop practice, applied math, Engineering Drawing (Computer Aided Drafting),. 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 construction works and convenient.

Program Objectives

The main objective of this curricular program is to provide hands on practice platforms to experience the real world of works. However, the general objectives of the industrial practice program are to:

1. Ensure quality training and proper skills, work attitude and knowledge of apprentices;
2. Establish a national apprenticeship program through the participation of employers, workers and government and non-government agencies;
3. Apply acquired knowledge, skills and attitude in problem-based exercises in real life industrial projects; Provide occupational tasks learning platforms in the form of work-based learning;
4. Make apprentices familiar with the future occupation/ job platforms;
5. Provide platforms for learning and experiencing professional, organizational, team building, analytical and personal life skills;
6. Make apprentices familiar with the day to day administrative / management activities

- applicable in their related occupation;
7. Establish the strong linkage between industries and institution;
 8. Match the technical skills learned at the institute with the needs of the employer;
 9. Ensure the relevant degree coursework and training programs conducted according to the expectations of the industry, to ensure the subject contents are relevant and up to date;
 10. Provide opportunity for apprentice to acquire interpersonal skills and ability for team work through interaction with professionals in their field of study;
 11. Enhance employability, adaptability, confidentiality, independence and social and emotional intelligence;
 12. Provide an opportunity for apprentices to learn about the industry of their discipline and related environment;
 13. Provide an opportunity for the industry to identify potential employees and to feedback comments on the pre-diploma program at large;
 14. Provide opportunity to obtain knowledge and skills as of how to make optimal decisions to resolve work challenges;
 15. Earn ethics in the industries;
 16. Learn accepted safety practices in the industry;
 17. Increase better chances for career mobility;
 18. Ensure workforce development according to the company's needs; and
 19. Ensure better employment opportunities for its graduates.

Learning Outcomes

After completion of industrial practice, apprentices will be able to:

1. Extend the boundaries of knowledge and skills through work place practice;
2. Develop significant commitment in the apprentices' profession/ specialization;
3. Integrate classroom theory and basic practical skills with workplace practice;
4. Develop greater clarity about academic and career goals;
5. Develop new or advanced skills;
6. Develop lifelong learning skills;
7. Gain understanding of administrative functions and company culture;
8. Appreciate the ethical basis of professional practice in relevant industry;
9. Display a capacity for critical reasoning and independent learning;
10. Exercise the role of the professional worker/supervisor confidently in the relevant industry;
11. Write a formatted report explaining the work in industrial practice and describing the experience;
12. Assess the adequacy of industrial practice;
13. Explore options in career plans and goals; and
14. Make a gradual transition from academia to career

Industrial Placement Orientation Program

After having three parties training agreement among the apprentices, sponsoring industries and training institute, industrial placement orientation program will be organized for apprentices by the training providing institutes or technical schools in presence of sponsoring industries or companies representatives just before industry placements. The objectives of orientation of the program are as follows.

1. Orient apprentices regarding the agreement terms and conditions that will be implemented during the period of industrial practice;
2. Orient apprentices about highlights of the Apprenticeship Training Operation Working Procedure, 2075 B.S.;

3. Orient apprentices about daily learning and performing procedures;
4. Make sure that about work place safety and learnable environment;
5. Orient apprentices about industrial practice supervision and monitoring schedules that to be conducted from training providing institute;
6. Make familiar to apprentices about mandatory rules, regulation and code of conducts to be followed;
7. Orient apprentices about their attendance and daily dairy/logbook fill-up.
8. Orient apprentices about industry based continuous assessments (at the interval of three months plan and program) criteria and marking scheme that to be executed by the sponsoring industries (In- company Trainer and Supervisor jointly);
9. Orient apprentices about to prepare Industry Practice end-off Report covering all subjects that they are offered in industrial practice;
10. Inform apprentices about final practical examination criteria and venue of the industrial practice program;
11. Inform the apprentice about industries rotation practice (if any);
12. Inform apprentices about Industry Practice end-off Report submission date;
13. Inform apprentices about final report submission date at institute; and
14. Inform apprentices about marking weightage of Industry Practice end-off Report preparation and presentation (Report should be presented in the presence of In-company Trainer or Supervisor and Trainers/ Instructors of training providing institute).

Complete Apprenticeship Plan

S. N.	Activities	Duration	When
1	Orientation to apprentices	Two days	Before placement
2	Report to the site	One day	Before placement
3	Actual work at site	65 weeks	During apprenticeship (Maximum 78 weeks)
4	Evaluation conducted by the sponsoring industries		Continuous
6	Evaluation conducted by the training institute		At least one time in every three months
7	Final evaluation		Last month of the apprenticeship program conducted by the industries
6	Final report preparation and presentation	5 days	After completion of the apprenticeship

Industry Orientation Program

After arrival of apprentices at the allocated sponsoring industries, the industry will organize an orientation program for apprentices to share detail information about functions, infrastructures, organizational structure, construction works and working procedures. In addition, they will be oriented about established rules, regulation, codes of conducts of those building construction industries or companies. Similarly, the Agreement terms and conditions, Tripartite training agreement among apprentices, sponsoring industries and training institute; and the Apprenticeship Training Operation Working Procedure, 2075 B.S. will be reoriented and overviewed.

An orientation programs may focus on following areas:

1. Profile of the industry
2. Vision, mission, goals and objectives of industry
3. Layout of industry

4. Basic features of the industry
5. The service or delivery provided by industry
6. Organization structure of the industry
7. Departments, divisions, units structures and their functions
8. Special technology adapted
9. Safety concerns of the industry
10. General rules, regulations and code of conducts of the industry
11. Facilities being provided and to be provided by the companies
12. Introduction of In–company trainer and supervisors, site engineers, contractors, colleagues and owners
13. Working procedures and work schedule
14. Scope of related works
15. Industry practice rotation/venue changing

Guidelines for The Apprentices

Instructions for Apprentices:

1. Receive orientation for industrial practice.
2. Obtain curriculum.
3. Obtain official letter from sponsoring industries.
4. Maintain attendance.
5. Manage accommodation.
6. Finalize the daily/weekly tasks with your
 - In-company Instructor or
 - Supervisor
7. Practice / perform / occupational tasks.
8. Perform related administrative functions
9. Get help form the senior (s) / supervisor (s) to perform the tasks \develop skills as maximum as possible.
10. Receive logbook.
11. Fill logbook regularly.
12. Get signed by your supervisor regularly.
13. Seek & follow suggestion from seniors.
14. Show excellent job performance to influence your supervisor/instructor so that they could be willing to recommend to the employer to offer you the job after completion of industrial practice.
15. Follow established code of conducts of sponsoring industries.

General Behavior:

1. Maintain confidentiality of all work material.
2. Dress professionally and be well groomed.
3. Be polite and respectful.
4. Be sensitive and courteous to all your colleagues and clients.
5. Become acquainted with your colleagues from various departments and be appreciative of the services they provide.

Working Attitude and Behavior:

1. Show enthusiasm in the work assigned to you.
2. Give top priority in time, attention, and preparation to the work assigned by the company.
3. Be punctual for work.
4. Adhere to the working hours and working days as stated in the offer letter, and be willing to put in extra work hours if requested by your company.
5. Do not be absent from work unless you are sick, and you have obtained the medical certificate

from the doctor.

6. Inform your Company Supervisor or Manager in the event of an unavoidable
7. tardiness or absence as soon as possible and provide the medical certificate to your company when you return to work.
8. Prepare thoroughly and carefully before you meet your colleagues/superiors / clients.
9. Become acquainted with the various learning materials and resources available for your work.
10. Always have the initiative to explore solutions for the work assigned to you.
11. Clarify your doubts on the assigned work with your colleagues or company Supervisor after you have put in your best effort.
12. Take note of any advice given to you in your log book so that you do not need to ask your colleagues or company Supervisor again in the future.
13. Carry out your assigned duties and responsibilities responsibly and professionally.

Industry Practice Report

Format of Report:

A report needs to be submitted by all the apprentices on the basis of the following minimum guidelines at the end of their industrial practice.

- A hard copy of the 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, interns and report submission date.
- Approval page from the side of sponsoring industry.
- Acknowledgement
- Abstract
- Table of contents
- Chapter one: Introduction
 - Background of apprenticeship program
 - Introduction to industry, goal and organizational structure with role
 - Services of the construction industry/company
- Chapter two: Description of the construction industry/company
 - Industry/workshop layout
 - Departments/units with their functions
 - List of major tools and equipment with their functions
 - Material testing laboratories
- Chapter three: Practices on the construction industry/company
 - Basic and frequent practices
 - Special practices
 - Special technology found on industry/company
 - Major problems faced
- 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: Logbook, drawings, photographs and so others.

Mechanical Fitter

Section C: Industry Based Training 840 Hrs.

S. N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Apply safety regulation	<ul style="list-style-type: none"> • Apply Safety rules of mechanical workshops, • Use fire hazards and extinguishers, • Apply emergency treatment and First Aid; <ul style="list-style-type: none"> • Burn, • Shock, • Bleeding, • Sprains, • Fracture, 		20	20
2	Perform Filing plain/curve surface	<ul style="list-style-type: none"> • Follow filing safety, • Follow techniques of holding work piece on bench vice, • File triangular hole and corner with triangular file, • Check right angle with back square • File angular surface and check angles, • File drilled groove with round file, • File curve surface with half round file, 		240	240
3	Perform Measuring and Marking	<ul style="list-style-type: none"> • Follow measuring and marking safety, • Check angels with angle gauge, • Check gaps with filler gauge, • Check thread profile with pitch gauge, • Measure flatness, roundness and run out with dial gauge, 		40	40
4	Perform metal cutting	<ul style="list-style-type: none"> • Follow metal cutting safety, • Follow techniques of holding work piece on vice for cutting, • Cut thin sheet, wire and round rod with flat chisel and hammer, • Cut metal workpiece with oxy-acetylene gas cutting. 		100	100
5	Perform drilling operation	<ul style="list-style-type: none"> • Follow drilling safety, • Follow techniques of clamping work piece on machine table, • Drill a counter bore, • Perform reaming a hole 		100	100

		<ul style="list-style-type: none"> • Perform honing a hole • Make hole enlargement with boring head, • Make spot facing. 			
6	Perform chiseling and chipping	<ul style="list-style-type: none"> • Follow chiseling and chipping safety, • Follow techniques of clamping work piece, • Cut grooves and slits using cross-cut chisel, • Clean keyways and cotter with side cut chisel, • Cut oil groove on bush bearing with round nose chisel, • Cut a groove on plain surface with diamond point chisel, • Sharpen the chisels 		80	80
7	Perform internal and external thread cutting	<ul style="list-style-type: none"> • Follow thread cutting safety, • Follow techniques of clamping work piece, • Cut internal thread using series of taps (first tap, plug tap and bottom tap) on machine, • Cut external thread using die and stock on machine, • Maintain the machine taps and dies. 		120	120
8	Perform Grinding	<ul style="list-style-type: none"> • Follow grinding safety, • Follow techniques of clamping and holding work piece, • Select grinding wheel for hard and soft metal. • Grind cutting tools with tool grinding machine, 		140	140
				840	840

Maintenance Practice

C. Industry Based Training (880 hrs.)

Perform Predictive Maintenance					
S. N.	Task Statements	Related Technical Knowledge	Time (Hrs.)		
			T	P	Tot
1.	Carryout Condition Based Maintenance	<ul style="list-style-type: none"> • Introduction of periodic maintenance • Notify and analyze the machine vibration, • Notify and analyze the machine heating, • Notify and analyze the machine to slow down the efficiency, • Submit reports on issues that arises to the supervisor. 		40	40
2.	Maintain Machine History Card	<ul style="list-style-type: none"> • Keep the information of machine manufacturer, • Maintain the machine description and its capacity, • Maintain analysis of previous breakdown, • Maintain schedule of machine maintenance, • Maintain oiling, lubrication on machine, • Tightens loose screws, nut, bolts etc. 		40	40
3.	Apply Lubricants and Lubrication	<ul style="list-style-type: none"> • Lubricate on oil circulation system, • Lubricate on every sliding surface, • Lubricate on gear and chain drives, • Lubricate on every oiling point that indicated by maintenance manual, • Apply coolant as maintenance manual indicated 		40	40

Perform Breakdown maintenance					
4.	Take pre-procedure before breakdown maintenance	<ul style="list-style-type: none"> • Check the history card of the machine, • Read the report of condition-based maintenance, • Interpret the drawings provided on machine maintenance manual. • Disconnect the electrical power connection. 		80	80
5.	Dismantle the machine components	<ul style="list-style-type: none"> • Barricade the maintenance zone, • Prepare maintenance trolley with materials, • Drain out the oils that filled, • Loose the nut-bolts, screws • Take out and ensure the usability of machine elements. • Take out and ensure the worn out or broken parts. • Clean all part & machine elements, • Separate the parts that have to be repair and replace, • Prepare a list of repairs and replace, • Report to the supervisor 		200	200
6	Assemble the machine components	<ul style="list-style-type: none"> • Clean and wipe the machine parts, • Put the parts and elements back together the way it was dismantled, • Check the tolerances of fitting, • Ensure repair parts are functioning, • Keep lubricated as necessary, • Tighten all screws, nut and bolts, • Check or test the function manually, 		200	200
7	Repair machine parts by Filing plain/curve surface	<ul style="list-style-type: none"> • Measure and mark the excess surface of the part. • Hold work piece on Bench Vice. • File surface following the safety. • Check the flatness or radius of the surface. • Ensure the dimension is obtained. 		40	40
8	Repair machine parts by lathe work	<ul style="list-style-type: none"> • Introduction, • Safety precaution of lathe work, 		100	100

		<ul style="list-style-type: none"> • Measure and mark the excess surface of the part. • Hold work piece on Lathe chuck. • Obtain concentricity of the part. • Give tailstock support. • Clamp and set lathe cutting tool, • Set rpm and feed transmission gear, • Turn first cut, • Set '0' on compound slide • Give depth for second cut, • Give depth for third and finishing cut, • Check the diameter and length of the part. • Ensure the dimension is obtained. 			
9	Repair machine parts by Grinding	<ul style="list-style-type: none"> • Introduction • Safety precaution on grinding. • Types of grinders and grinding machine. • Abrasive, types and application of grinding wheel. • Emery clothes, sand paper, its types and their application. • Safe handling of grinder and grinding machine. • Exercises and assignments 		20	20
10	Repair machine parts by welding	<ul style="list-style-type: none"> • Follow arc welding safety • Prepare welding tools, equipment and machine, • Make a bevel on welding joint, • Set machine part to be repair, • Weld tack-weld on necessary number of spots, • Align to position as it's required, • Weld root to fixed, • Check the position and align, if necessary, • Weld full to ensure strength enough • Place the tools equipment on their original place, • Clean up the welding area. 		40	40
11	Repair / replace Hydraulic Components	<ul style="list-style-type: none"> • Introduction • Principle of hydraulic system, • Safety precaution of hydraulic system • Identify hydraulic components, 		40	40

		<ul style="list-style-type: none"> • Clean up various components, • Replace valves, • Replace oil seals, • Replace supply hose 			
12	Repair / replace Pneumatic Components	<ul style="list-style-type: none"> • Introduction • Principle of Pneumatic system, • Safety precaution of Pneumatic system • Identify Pneumatic components, • Clean up various components, • Replace valves, • Repair of air compressor 		40	40
				880	880

Workshop Practice

Class per week: 40 hrs.

Total class: 880 hrs.

Course Description:

This is completely the different type of subject and this is the core subject of the apprenticeship training program. In this subject, all important skills are enlisted. The trainees will have to practice during staying in sponsoring industries. This course is 100% practical in nature. Workshop Practice is a 880 hours' apprenticeship training program that aims to provide trainees an opportunity for meaningful career related experience by working full time in industries where they can practice and expand their classroom-based knowledge and skills before graduating. It will also help trainees gain a clear sense of their future opportunity to build professional networks. The first assessment will be evaluated by the institute. The three assessments will be evaluated by the industry.

Course Objectives:

The overall objective of the Workshop Practice is to make trainees familiar with first-hand experience of the real work of industrial world, as well as to provide them an opportunity to enhance skills.

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

- Apply knowledge and skills learned in the classroom to actual work settings or conditions and develop practical experience before graduation.
- Familiarize with working environment.
- Work effectively with professional colleagues and share experiences of their activities and functions.
- Strengthen portfolio or resume with practical experience and projects. Develop professional/work culture.
- Broaden professional contacts and network.
- Develop entrepreneurship skills on related occupation.

S.N.	Skill	Tasks	Time Hours		
			Th .	Pr.	Tota l
1	Introduction	<ul style="list-style-type: none"> • Rules & regulation • Job description • Level of employees • Facilities for trainees • Importance of industry • Production • Quality control 		15	15
	Orientation class and workshop safety	<ul style="list-style-type: none"> • Maintain work area 			

S.N.	Skill	Tasks	Time Hours		
			Th .	Pr.	Total
		<ul style="list-style-type: none"> • Maintain shop equipment • Utilize personal protection equipment • Provide safety instructions • Recognize & control hazards • Perform safety-related administrative functions • Perform emergency procedures • Demonstration 			
	Understanding drawing projects	<ul style="list-style-type: none"> • Prepare a project plan sheet including bill of materials & plan of procedure • Recording monthly project • Report to Institute • Verification by Industry 			
2	Handle Measuring Instruments	<ul style="list-style-type: none"> • Measure dimensions by using measuring tape & steel ruler • Measure dimensions using bevel protector • Check square by using try square • Measure dimensions by using Vernier calipers • Demonstration • Exercises 		15	15
3	Perform measuring	<ul style="list-style-type: none"> • Check squareness and flatness with try square 		15	15

S.N.	Skill	Tasks	Time Hours		
			Th	Pr.	Total
		<ul style="list-style-type: none"> • Check with radius, filler gauge, wire gauge & screw pitch gauge • Measure angular surface using bevel protector • Measure the dimension using Vernier calliper. • Measure the dimension by using inside and outside • Micro meters • Check surface with a dial • Indicator • Demonstration • Exercises 			
4	Perform measuring, marking and punching	<ul style="list-style-type: none"> • Measure and mark on the work Piece • Stamp letter and number on work pieces Punch Dot and Center • Exercises 		15	15
5	Perform filing	<ul style="list-style-type: none"> • File flat surfaces • File external radius • File internal profiles • Exercises 		15	15
6	Perform sawing	<ul style="list-style-type: none"> • Saw metal by hand hacksaw & power hacksaw • Demonstration • Exercises 		10	10
7	Perform drilling	<ul style="list-style-type: none"> • Drill holes in different metals in different positions • Drill countersunk on hole Perform Counter bore on drilled hole • Ream on drilled hole 		80	80

S.N.	Skill	Tasks	Time Hours		
			Th	Pr.	Total
		<ul style="list-style-type: none"> • Demonstration • Exercises 			
8	Set up Lathe machine	<ul style="list-style-type: none"> • Set up machine control • Set work piece in three jaws chucks • Set work piece in four jaws chucks • Set turning tools on tools post • Set machine control • Set up work piece center to center with dog & clamp • Set up irregular work piece on faceplate • Set up work piece with fixed & follower rest • Demonstration • Exercises 		10	10
9	Perform Lathe Machine operation	<ul style="list-style-type: none"> • Perform plain turning • Perform facing • Perform center drilling • Perform drilling • Perform steps turning • Perform chamfering • Perform boring • Perform external grooving • Perform internal grooving • Perform external & internal taper turning • Perform knurling • Perform parting off operation • Perform simple eccentric turning • Demonstration • Exercises 		350	350
10	Perform Threads cutting	<ul style="list-style-type: none"> • Cut threads by die/taps • Cut external v-threads on a lathe • Cut internal v-threads on a lathe 		55	55

S.N.	Skill	Tasks	Time Hours		
			Th	Pr.	Total
		<ul style="list-style-type: none"> • Demonstration • Exercises 			
11	Perform off-hand grinding	<ul style="list-style-type: none"> • Grind single point cutting tools • Grind drill bits • Part off stock • Grind horizontal surfaces • Grind vertical surfaces • Grind angular surfaces • Grind external cylindrical surfaces • Re-sharpen twist drills • Grind facing or corner tool in HSS bit • Grind roughing tool in HSS bit • Grind grooving tool • Grind threads cutting tool • Prepare boring tool • Grind center punch • Demonstration • Exercises 		30	30
12	Perform sheet metal work	<ul style="list-style-type: none"> • Cut metal sheet in straight and curve shape by snip • Fold/Roll metal sheet by folding machine • Perform soldering joint • Perform Riveting joint • Develop Pattern of rectangular box, Cylindrical Container & cone • Exercises 		30	30
13	Perform Repair and Maintenance	<ul style="list-style-type: none"> • Perform preventive & schedule maintenance • Repair machine elements • Replace machine elements • Exercises 		50	50

S.N.	Skill	Tasks	Time Hours		
			Th .	Pr.	Total
14	Perform Shaper Machine operation	<ul style="list-style-type: none"> • Set up machine control • Set up shaper vice on machine table • Hold single point cutting tool • Adjust stroke length and position of the ram • Perform plain surface • Produce flat surface • Perform step surface: • Produce 90° step surface • Perform angular surface tilting by tool post • Perform plane slot • Demonstration • Exercises 		25	25
15	Perform Arc Welding	<ul style="list-style-type: none"> • Get familiar with Arc welding equipment • Learn the sequence of operation • Demonstration • Exercises 		20	20
16	Perform Gas Welding	<ul style="list-style-type: none"> • Get familiar with Gas welding equipment • Learn the sequence of operation • Demonstration • Exercises 		25	25
17	Perform forging works	<ul style="list-style-type: none"> • Get familiar with common forging tools • Learn the sequence of operation • Prepare a work piece by forging • Demonstration • Exercises 		40	40
18	Perform casting works	<ul style="list-style-type: none"> • Get familiar with common casting tools and setup • Learn the sequence of operation • Prepare a work piece by forging 		30	30

S.N.	Skill	Tasks	Time Hours		
			Th .	Pr.	Tota l
		<ul style="list-style-type: none"> • Demonstration • Exercises 			
19	Perform Hot working of metals	<ul style="list-style-type: none"> • Get familiar with common tools and setup • Learn the sequence of operation • Prepare a work piece by forging • Demonstration • Exercises 		40	40
20	Perform cold working of metals	<ul style="list-style-type: none"> • Get familiar with common tools and setup • Prepare a work piece by forging • Learn the sequence of operation • Demonstration • Exercises 		10	10
Grand Total				880	880

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: _____

Sigh 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.

Mark Scale	Very Poor	Poor	Fair	Good	Very Good
	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 multitasks	.../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:	

Monitoring Tools (For Training Institute/CTEVT Purpose)

To be filled by the Instructor /Training Coordinator/ /Principal/CTEVT Official at the time of monitoring.

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

Mark Scale	Very Poor	Poor	Fair	Good	Very Good
	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 multitasks	.../4
4.3. Initiative to learn	.../4
4.4. Ability to work independently	.../4
4.5. Commitment to work	
4.6. Value-added contribution	.../4
Total Marks Obtained	/100

Comments (if any):
Name of Monitoring Official:

Designation:
Tel/ Mobile No:
Signature:
Date:
Comments/Feedback/from Training Coordinator/Principal:
Name of Training Coordinator/Principal:
Sign of Training Coordinator/Principal:
Date filed:

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S. No.	Name	Organization	Contact No.
1	Mr. Shisir Pokhrel		
2	Mr. Raju Bajrachaya		
3	Mr. Arjun kumar shrestha		
4	Mr. Raiendra pd Manandhar		
5	Mr. Iswar lal Shrestha		
6	Mr. Rajan Sharma		
7	Mr. Tej parkasha sapkota		
8	Mr. Rajendra Aryal		
9	Mr. Sujjan Pradhan		
10	Mr. Arjun Bhattarai		
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12	Mr. Ganesha sapkota		
13	Moti Kumar Maharjan		

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Council for Technical Education and Vocational Training (CTEVT)

Madhyapur Thimi-17, Sanothimi, Bhaktapur, Nepal

P.O.Box No. 3546, Kathmandu, Tel#6630408, 6630769, 6631458,

Web: <http://www.ctevt.org.np>

Email: curriculum@ctevt.org.np, info@ctevt.org.np