

# CURRICULUM

Technical School Leaving Certificate

## **Mechanical Engineering**

(18 months programme)



Council for Technical Education and Vocational Training

## **Curriculum Development Division**

**Sanothimi, Bhaktapur**

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## Table of Contents

Introduction:	3
Title:	3
Aim:	3
Objectives:	3
Program Description:	3
Course Duration	3
Entry criteria:	3
Group size:	3
Medium of Instruction:	4
Pattern of Attendance:	4
Instructors' Qualification:	4
Teacher and Student Ratio:	4
Instructional Media and Materials:	4
Teaching Learning Methodologies:	4
Evaluation Details:	4
Grading System:	5
Certificate Awarded:	5
Job Opportunity:	5
Course Structure	6
Mechanical Fitting & Maintenance	7
Welding Technology	11
Lathe Operation	16
Milling and Shaping Operation	20
GTAW (TIG) and GMAW (MIG)	24
Structural Fabrication	26
Engineering Drawing	30
Computer Aided Drafting	32
Material Science	38
Applied Mathematics	41
Workshop Technology	44
Entrepreneurship Development	50
On the Job Training (OJT)	54

**Introduction:**

Nepal Government, Ministry of Education implemented the Letter grading system in SLC. The door of TSLC program is open for those who have appeared 10th grade exam and achieved any GPA and any grade in any subject. Focusing on such students the curriculum of TSLC of 29 months and 15 months have been converted into 18 months.

The TSLC curriculum of Mechanical Engineering is designed to produce competent workforce equipped with knowledge, skills and attitudes related to the field of mechanical engineering. This curriculum focuses on basic mechanical skills and knowledge related to mechanical engineering to be used in related mechanical workshop and industries.

**Title:**

The title of the programme is TSLC in Mechanical Engineering

**Aim:**

The aim of the programme is to produce mechanical sub-overseer equipped with knowledge, skills and attitudes in related occupation and make them able to perform their job independently and accurately.

**Objectives:**

After the completion of the training program the graduates will be able to:

- Perform basic mechanical works carried out in mechanical workshops.
- Perform basic computer applications
- Perform mechanical drawings/drafting.
- Design and perform sheet metal, steel and aluminum fabrications.
- Operate lathe, milling and shaping machines.
- Repair and maintain mechanical devices

**Program Description:**

This curriculum includes skills and knowledge related to disciplinary subjects like Mechanical Fitting & Maintenance, GMAW and GTAW (TIG/MIG), Bench work, Engineering drawing, lathe operation, material science, welding technology, computer aided drafting, milling and shaping operation, structural fabrication. This course also imparts the skills on computer application and entrepreneurship development.

This course also includes on the job training (OJT) so as to provide exposure of the world of work.

**Course Duration**

This course will be completed within 18 months (40 hrs/week X 39 weeks a year = 1560 hrs.) class plus 6 months (40 hrs/week X 24 weeks = 960 hrs. on the job training (OJT).

**Entry criteria:**

Individuals with following criteria will be eligible for this program:

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

**Group size:**

The group size will be maximum 40 (forty) in a batch.

**Medium of Instruction:**

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

**Pattern of Attendance:**

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

**Instructors' Qualification:**

- Instructors should have bachelor degree in Mechanical Engineering or Diploma in Mechanical Engineering with minimum 5 years practical based experiences.
- The demonstrator should have Diploma in Mechanical Engineering with minimum 2 years practical based experiences.
- Good communicative/instructional skills

**Teacher and Student Ratio:**

- Overall at institutional level: 1:10
- Theory: 1:40
- Practical: 1:10
- Minimum 75% of the teachers must be fulltime

**Instructional Media and Materials:**

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

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

**Teaching Learning Methodologies:**

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

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

**Evaluation Details:**

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

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

- There will be three internal assessments and one final examination in each subject. Moreover, the mode of assessment and examination includes both theory and practical or as per the nature of instruction as mentioned in the course structure.
- Every student must pass in each internal assessment to appear the final exam.

- Continuous evaluation of the students' performance is to be done by the related instructor/trainer to ensure the proficiency over each competency under each area of a subject specified in the curriculum.
- The on-the-job training is evaluated in 500 full marks. The evaluation of the performance of the student is to be carried out by the three agencies; the concerned institute, OJT provider industry/organization and the CTEVT Office of the Controller of Examinations. The student has to score minimum 60% for successful completion of the OJT.

**Grading System:**

The grading system will be as follows:

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

**Certificate Awarded:**

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

**Job Opportunity:**

The graduate will be eligible for the position equivalent to Non-gazetted 2nd class/level 4 (technical) as Mechanical Sub-Overseer or as prescribed by the Public Service Commission. The graduate is eligible for registration with the related professional council in the grade as mentioned in the council act (if any).

## Course Structure

SN	Subjects	Nature	Class / Week	Total hours / Year			Full Mark		
				Th.	Pr.	Total	Th.	Pr.	Total
1	Mechanical Fitting & Maintenance	P	8		312	312		200	200
2	Welding Technology (SMAW)	P	4		156	156		100	100
3	Lathe Operation	P	6		234	234		150	150
4	Milling and Shaping Operation	P	6		234	234		150	150
5	GMAW and GTAW (TIG/MIG)	P	2		78	78		50	50
6	Structural Fabrication-	P	2		78	78		50	50
7	Engineering Drawing	P	2		78	78		50	50
8	Computer Aided Drafting (CAD)	P	2		78	78		50	50
9	Material Science	T	2	78	0	78	50		50
10	Applied Math	T	2	78	0	78	50		50
11	Workshop Technology	T	2	78	0	78	50		50
12	Entrepreneurship Development	T+P	2	39	39	78	50		50
	<b>Total</b>		<b>40</b>	<b>273</b>	<b>1287</b>	<b>1560</b>	<b>200</b>	<b>800</b>	<b>1000</b>

### On-The-Job Training

S. N.	Subjects	Nature	Weeks	Total Hours	Full Marks
1	On-the-job training	P	24	960	500
<b>Grand Total (In House +OJT)</b>				<b>2520</b>	<b>1500</b>

## Mechanical Fitting & Maintenance

**Course Nature: Practical**

**Class per Week: 8 hrs.**

**Full marks: 200**

**Total Class: 312 hrs.**

<b>Subject: Mechanical Fitting and Maintenance</b>	
<b>Description:</b>	This subject provides essential skill and knowledge to perform mechanical fitting, sheet metal works and repair and maintenance works. This subject mainly focused on measuring, marking, filing, sawing, punching, drilling, die, tapping, cutting, folding, riveting, bending with repair maintenance of tools equipment and machinery etc.
<b>Objectives:</b>	<p><b>At the end of the course the participants will be able to:</b></p> <ul style="list-style-type: none"> <li>▪ Apply safety rules.</li> <li>▪ Use measuring, marking and cutting tools, instruments and machines.</li> <li>▪ Perform basic operation related to mechanical fitting, such as: measure, mark, cut bend, file, drill, and rivet according to the specification.</li> <li>▪ Perform sheet metal works.</li> <li>▪ Perform repair maintenance works</li> </ul>

S.N.	Skills	Contents	Time Hours		
			Th/ Demo.	Pr.	Total
<b>Mechanical Fitting</b>					
1.	<b>Perform filing</b>		<b>10</b>	<b>74</b>	<b>84</b>
	Introduce hand tools	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Hand tools</li> <li>• Application of hand tools</li> <li>• Handling and care</li> <li>• Safety precaution</li> </ul>	2		2
	File flat surface	<ul style="list-style-type: none"> <li>• Materials of work piece</li> <li>• Bench vice</li> <li>• Flat file</li> <li>• Measuring and marking tools (steel ruler, marking scriber, center punch, try square)</li> <li>• Proper way of holding file and position of person while filing</li> <li>• Techniques of filing (eg. Straight, cross and draw filing)</li> <li>• Safety precaution</li> </ul>	4	42	46
	File external radius	<ul style="list-style-type: none"> <li>• Marking and measuring tools (Divider, steel ruler, radius gauge, center punch, marking scriber)</li> <li>• Method of filing radius</li> <li>• Flat File</li> <li>• Needle file</li> </ul>	2	18	20
	File internal profiles	<ul style="list-style-type: none"> <li>• Types of file used for profile</li> <li>• Filing prouder</li> </ul>	2	14	16
2.	<b>Perform measuring marking and punching</b>		<b>4</b>	<b>18</b>	<b>22</b>

	<ul style="list-style-type: none"> <li>• Measure and mark on the work piece</li> <li>• Stamp letter and number on work piece</li> <li>• Punch Dot and Center</li> </ul>	<ul style="list-style-type: none"> <li>• letter and Number punch</li> <li>• Punching tools</li> <li>• Hammer</li> <li>• Procedure</li> <li>• Safety precautions</li> </ul>			
3.	<b>Perform sawing</b>		2	16	18
4.	<ul style="list-style-type: none"> <li>• Saw metal by hand hacksaw</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Hand hacksaw Types/Parts</li> <li>• Hand hacksaw Blades</li> <li>• Procedure of sawing</li> <li>• Safety precautions</li> </ul>			
5.	<b>Perform drilling</b>		3	12	15
6.	<ul style="list-style-type: none"> <li>• Drill a hole</li> <li>• Drill countersunk on hole</li> <li>• Perform Counter bore on drilled hole</li> <li>• Ream on drilled hole</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types, Parts (Bench drill and Pedestal drill)</li> <li>• Drill bit (parallel and taper sank) and countersink</li> <li>• Drill chuck, drill drift, sleeve</li> <li>• Counter bore</li> <li>• Drill size for reamer</li> <li>• Reamer</li> <li>• RPM selection</li> <li>• Procedure</li> <li>• Safety precautions</li> </ul>			
7.	<b>Perform Tapping / die</b>		2	10	12
8.	<ul style="list-style-type: none"> <li>• Cut external thread by die</li> <li>• Cut internal thread by taps</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Thread and its nomenclature</li> <li>• Describe Tap and die</li> <li>• Selection of drill bit for tapping(TDS)</li> <li>• Measuring and marking tools, drill bits, tap and die</li> <li>• Procedure of tapping and die</li> <li>• Safety precautions</li> </ul>			
9.	<b>Perform off hand grinding</b>		3	9	12
10.	<ul style="list-style-type: none"> <li>• Grind center punch</li> <li>• Grind marking scribe</li> <li>• Grind twist drill</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types/parts (Bench/ pedestal grinding)</li> <li>• Grinding wheel</li> <li>• Drill grinding gauge</li> <li>• Bevel Protector</li> <li>• Procedure of offhand grinding (Center punch, marking scribe, twist drill)</li> </ul>			
11.	<b>Handle Measuring Instruments</b>		3	12	15

12.	<ul style="list-style-type: none"> <li>• Measure dimension by using steel ruler</li> <li>• Measure dimension using bevel protector</li> <li>• Check square by using try square</li> <li>• Measure dimension by using vernier calipers</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types/parts</li> <li>• Importance and uses</li> <li>• Procedure of handling measuring instrument (steel ruler, bevel protector, try square and vernier calipers)</li> </ul>			
13.	Perform project work (any two)			56	56
14.	<ul style="list-style-type: none"> <li>• Manufacture Divider</li> <li>• Manufacture 500gm steel hammer</li> <li>• Manufacture Center Square</li> <li>• Manufacture Wing nut</li> </ul>			28	28
<b>Sheet Metal Works</b>					
					<b>39</b>
15.	Introduce sheet metal works	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Sheet metal related hand tools and materials</li> <li>• Safety precaution</li> </ul>	0.5		0.5
16.	Cut metal sheet in straight and curve shape by snip	<ul style="list-style-type: none"> <li>• Tools and materials</li> <li>• Straight snip</li> <li>• Curve snip</li> <li>• Application</li> <li>• Procedure</li> <li>• Safety precautions</li> </ul>	0.5	2	2.5
17.	Fold metal sheet by hand tools	<ul style="list-style-type: none"> <li>• Tools and materials</li> <li>• Mallet</li> <li>• Stack</li> <li>• Procedure</li> <li>• Safety precaution</li> </ul>	0.5	3	3.5
18.	Roll metal sheet by hand tools	<ul style="list-style-type: none"> <li>• Tools and materials</li> <li>• Procedure</li> <li>• Safety precaution</li> </ul>	0.5	3	3.5
19.	Fold metal sheet by folding machine	<ul style="list-style-type: none"> <li>• Tools and materials</li> <li>• Folding machine</li> <li>• Procedure</li> <li>• Safety precaution</li> </ul>	1	3	4
20.	Roll metal sheet by rolling machine	<ul style="list-style-type: none"> <li>• Tools and materials</li> <li>• Rolling machine</li> <li>• Procedure</li> <li>• Safety precaution</li> </ul>	1	3	4
21.	Perform seam joint	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types of seam joint</li> <li>• Tools/equipment</li> <li>• Margin calculation</li> <li>• Procedure</li> <li>• Safety</li> </ul>	1	3	4
22.	Perform riveting joint	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Rivets pin and its types</li> <li>• Tools and materials</li> </ul>	1	3	4

		<ul style="list-style-type: none"> <li>• Rivet pin</li> <li>• Rivet hole calculation</li> <li>• Rivet punch</li> <li>• Procedure</li> <li>• Safety precaution</li> </ul>			
23.	Develop pattern of rectangular box, cylindrical container and cone	<ul style="list-style-type: none"> <li>• Introduction of pattern development</li> <li>• Develop pattern of any one of the following project</li> </ul>	1	5	6
24.	Project work (Any one) <ul style="list-style-type: none"> <li>• Make rectangular/square box</li> <li>• Make dust pan</li> <li>• Make cone</li> </ul>			7	7
<b>Repair and Maintenance</b>				<b>39</b>	
25.	Perform preventive maintenance	<ul style="list-style-type: none"> <li>• Introduction of repair &amp; maintenance</li> <li>• Types of repair maintenance</li> <li>• Tools &amp; equipment</li> <li>• Application of lubricants</li> <li>• Introduction of electricity</li> <li>• Fuse</li> <li>• Fault of electrical supply</li> <li>• Mechanical and electrical safety</li> <li>• Preventive maintenance plan</li> </ul>	6	7	13
26.	Perform schedule maintenance	<ul style="list-style-type: none"> <li>• Schedule maintenance plan</li> </ul>	0	0	0
27.	Break down maintenance Diagnose faults	<ul style="list-style-type: none"> <li>• Complain report</li> <li>• Set of repair maintenance tools</li> <li>• Safety</li> </ul>	1	15	16
	Repair machine elements Replace machine elements	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Bush, gear, shaft</li> <li>• Pin, bearing, belt, gear, nut-bolt</li> <li>• Safety</li> </ul>	1	6	7
	Adjust / replace 'V' and 'Flat' belts	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types and uses of belts</li> <li>• Tools and equipment</li> <li>• Safety</li> </ul>	1	2	3
	Total		9	30	39

#### Reference Book:

- B. S. Raghuwanshi, A Course in Workshop Technology Vol 1 and 2, Dhanpat Rai and Co.
- S. K. Hajra Chaudhary, *Workshop Technology (Vol. 1)*, Media promoters
- Henp Fort, *Shop Theory (Vol. 1)*, Trade School
- W.A.J. Chapman, *Workshop Technology (Vol. 1)*, Elsevier Science
- Heinrich Gerling, *Elementary Metal Course Training Section I*
- ETHIO, *Arbeitsstelle fur Unterricht und Technik*, GERMAN Technical Institute, Holetta.
- Heinrich Gerling, *All about MACHINE TOOLS*, New, Wiley Eastern Ltd India, 1965.
- P S Gill, *Engineering Drawing*, S K Kataria & Sons.

## Welding Technology

**Course Nature: Practical**

**Class per Week: 4 hrs.**

**Full marks: 100**

**Total Class: 156 hrs.**

<b>Subject: Welding Technology (SMAW)</b>	
<b>Description:</b>	This course intends to impart the knowledge and skills required to SMAW. This course is mainly focused on position of welding, welding joint, Set of machine & selection of electrode
<b>Objectives:</b>	<p><b>At the end of the course the participants will be able to:</b></p> <ul style="list-style-type: none"> <li>• Perform flat, horizontal, vertical, &amp; overhead position welding</li> <li>• Perform pipe &amp; plate welding in flat position.</li> <li>• Handle welding equipment</li> <li>• Select electrode and ampere</li> <li>• Prepare welding material</li> </ul>

### 1. Perform Flat Position Welding

S.N.	Objectives	Contents	Time (hrs)		
			Th / Demo.	P	
1.1	<b>Perform striking</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of welding machine</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> <li>▪ Arc</li> <li>▪ Material</li> <li>▪ Striking Method</li> </ul>	1	4	5
1.2	<b>Perform surface weld</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> <li>▪ Procedure</li> <li>▪ Deposition</li> </ul>	1	8	9
1.3	<b>Grind off welding surfaces</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of grinding machine</li> <li>▪ Tools &amp; equipment</li> <li>▪ Material</li> <li>▪ Grinding process</li> </ul>	1	4	5
1.4	<b>Perform straight multi run beads</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Tools &amp; equipment</li> <li>▪ Set ampere</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> </ul>	1	6	7

S.N.	Objectives	Contents	Time (hrs)		
			Th / Demo.	P	
1.5	Perform tack weld for joints	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Set ampere</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	2	3
1.6	Weld corner joint	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Set ampere</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	8	9
1.7	Weld edge joint	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Set Ampere</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	8	9
1.8	Weld Lap joint	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> <li>▪ Arc</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Material</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	8	9
1.9	Weld square butt from both sides	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Set ampere</li> <li>▪ Penetration</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	10	11
1.10	Weld V-butt joint with backing	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> </ul>	1	10	11

S.N.	Objectives	Contents	Time (hrs)		
			Th / Demo.	P	
		<ul style="list-style-type: none"> <li>▪ Penetration</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Material</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>			

## 2. Perform Horizontal Position Welding.

S.N.	Skills	contents	Time (hrs)		
2.1	<b>Perform surface weld</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> <li>▪ Arc</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Material</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	8	9
2.2	<b>Perform fillet weld</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> <li>▪ Arc</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Material</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	10	11

## 3. Perform Vertical Position Welding

S.N.	Skills	contents	Time (hrs)		
			T	P	
3.1	<b>Perform surface weld</b>	<ul style="list-style-type: none"> <li>▪ Introduction and safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> <li>▪ Arc</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	8	9

<b>3.2</b>	<b>Perform fillet weld</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Tools &amp; equipment</li> <li>▪ Penetration</li> <li>▪ Set ampere</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	<b>1</b>	<b>10</b>	<b>11</b>
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#### 4 Perform overhead position welding

S.N.	Skills	contents	Time (hrs)		
			T	P	
4.1	<b>perform surface weld</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> <li>▪ Arc</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	8	9
4.2	<b>perform fillet weld</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Tools &amp; equipment</li> <li>▪ Set ampere</li> <li>▪ Arc</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	10	11

#### 5. Perform welding in Flat Position Pipe

S.N.	Skills	contents	Time (hrs)		
			T	P	
<b>5.1</b>	<b>Weld pipe to pipe joint in rotated position</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> <li>▪ Arc</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	8	9

5.2	Weld pipe to flat metal joint	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Electrode</li> <li>▪ Set ampere</li> <li>▪ Arc</li> <li>▪ Angle of electrode</li> <li>▪ Weaving and travel speed</li> <li>▪ Deposition</li> <li>▪ Welding process</li> </ul>	1	8	9
			Total		
			Grand Total		156

### **BIBLIOGRAPHY**

SN	Name	Author	Publication
1.	Welding Engineering and Technology	Dr. R. S. Parmar	Khanna Publishers
2.	Principal of Welding Technology	L M Gourd	Viva Books Private Ltd.
3.	Welding Principles and Applications	Larry Jeffus	Thomsom Delmar Learning
4.	AWS D1.1/D1.1M:2004 Structural Welding Code-Steel		American Welding Society
5.	Gas Metal Arc Welding Handbook	William H. Minnick	The Good heart-Willcox Company

## Lathe Operation

Course Nature: Practical  
Full Marks: 150

Class Per week: 6 hrs  
Total Class: 234 hrs

<b>Subject: Lathe Operation</b>	
Description:	This course provides essential skill and knowledge to perform lathe works. It focuses on performing set up, operate, turning/boring/facing/parting/thread cutting/off hand grinding etc in lathe machine workshop.
Objectives:	At the end of the course the participants will be able to: <ul style="list-style-type: none"> <li>• Set up lathe machine</li> <li>• Perform machine operation</li> <li>• Perform thread cutting</li> <li>• Perform off hand cutting</li> <li>• Conduct project</li> </ul>

<b>Subject: Lathe Operation</b>					
S.N.	Skills	Contents	Time Hours		
			Th/ Demo	Pr.	Total
<b>Unit 1: Set up Lathe machine</b>					
	Set work piece in three jaw chuck	<ul style="list-style-type: none"> <li>• Introduction of lathe machine safety</li> <li>• Introduction of lathe machine</li> <li>• Types</li> <li>• Parts and function</li> </ul>	1		1
	Set work piece in four jaw chuck	<ul style="list-style-type: none"> <li>• Introduction of chuck</li> <li>• Types of chuck</li> <li>• Principle of three and four jaw chuck</li> <li>• construction three and four jaw chuck</li> <li>• Clamping in three and four jaw chuck</li> </ul>	1	2	3
	Set work piece in collect chuck	<ul style="list-style-type: none"> <li>• Introduction of collect chuck</li> <li>• Type of chuck</li> <li>• Principle of chuck</li> <li>• Clamping in collect chuck</li> </ul>	1	1	2
	Set turning tool on tool post	<ul style="list-style-type: none"> <li>• Introduction of Lathe tool</li> <li>• type of lathe tool</li> <li>• Tool geometry</li> <li>• Introduction of tool post</li> <li>• Types of tool post</li> <li>• Principle of tool setting</li> <li>• Effect of tool height</li> </ul>	1	1	2
	Set machine control	<ul style="list-style-type: none"> <li>• Lathe machine operation</li> <li>• Selection of RPM</li> <li>• Selection of feed, depth of cut, number of cut</li> <li>• Setting of gear box.</li> <li>• Manual and automatic</li> </ul>	1	2	3

		<ul style="list-style-type: none"> <li>• Safety</li> </ul>			
	Set work piece center to center with dog and clamp	<ul style="list-style-type: none"> <li>• Introduction of Lathe dog and dog clamp</li> <li>• Center drilling for dog clamp</li> <li>• Process of clamping work piece on center to center</li> <li>• Importance of center to center works</li> <li>• Safety</li> </ul>	1	1	2
<b>Unit 2: Perform Machine operation</b>					
	Perform truing	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Safety</li> <li>• Types of hammer</li> </ul>	1	2	3
	Perform facing	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Process of setting tailstock</li> <li>• In-center and out-center</li> <li>• Facing tool</li> <li>• Safety</li> </ul>	1	2	3
	Perform center drilling	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Center drill</li> <li>• Safety</li> </ul>	1	2	3
	Perform drilling	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Types of drill</li> <li>• Drill bit geometry</li> <li>• Sleeve and its types</li> <li>• safety</li> </ul>	1	4	5
	Perform plain turning	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Types of operation</li> <li>• Manual and automatic</li> <li>• safety</li> </ul>	1	10	11
	Perform step turning	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• safety</li> </ul>	1	6	7
	Perform Chamfering	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Angle for chamfering</li> <li>• Chamfer tool/Form tool</li> <li>• safety</li> </ul>	1	3	4
	Perform external grooving	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Grooving tools</li> <li>• safety</li> </ul>	1	3	4
	Perform boring	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Types of bore and its use</li> </ul>	1	8	9

	<ul style="list-style-type: none"> <li>• Introduction to boring tool</li> <li>• safety</li> </ul>			
Perform internal grooving	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Grooving tools</li> <li>• Process</li> <li>• safety</li> </ul>	1	5	6
Perform external and internal taper turning	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Taper calculation</li> <li>• Taper setting in machine</li> <li>• Methods of taper turning</li> <li>• safety</li> </ul>	2	15	17
Perform Knurling	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Types of knurling tool</li> <li>• safety</li> </ul>	1	3	4
Perform parting off operation	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Types and its importance</li> <li>• Introduction of parting tool</li> <li>• Chattering control</li> <li>• safety</li> </ul>	1	6	7
<b>Unit 3: Perform Thread Cutting</b>				
Cut thread by die/taps on lathe	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Types thread</li> <li>• Introduction of die and tap</li> <li>• Introduction of pitch gauge</li> <li>• safety</li> </ul>	1	14	15
Cut external Vee thread	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Process</li> <li>• Types thread</li> <li>• Introduction of threading tool</li> <li>• safety</li> </ul>	2	19	21
Cut internal Vee thread	<ul style="list-style-type: none"> <li>• Definition</li> <li>• process</li> <li>• safety</li> </ul>	2	21	23
<b>Unit 4: Perform Off Hand grinding</b>				
Re-sharpen twist drill bit	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Nomenclature of drill bit</li> <li>• Angle of drill bit tip</li> <li>• process</li> <li>• safety</li> </ul>	1	2	3
Grind lathe cutting tools <ul style="list-style-type: none"> <li>• Facing tool</li> <li>• Roughing tool</li> <li>• Thread cutting</li> <li>• Grooving tool</li> <li>• Boring tool</li> </ul>	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Types of tool</li> <li>• Tool geometry</li> <li>• Wheel dressing</li> <li>• safety</li> </ul>	2	18	20

	Perform eccentric turning	<ul style="list-style-type: none"> <li>• Introduction and its type</li> <li>• Importance</li> <li>• Work holding technique</li> <li>• Safety</li> </ul>	2	28	30
	<b>Unit 5: Conduct Project Works</b>				
	Manufacture Hinge	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types and application</li> <li>• Safety</li> </ul>		7	7
	Manufacture MT2 Tapper slip set	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types and application</li> <li>• Safety</li> </ul>			10
	Manufacture knurled head screw Jack (60 degree)	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types and application</li> <li>• Safety</li> </ul>		9	9
				<b>Total</b>	234

## Milling and Shaping Operation

**Course Nature: Practical**

**Class per Week: 6 hrs.**

**Full marks: 150**

**Total Class: 234 hrs.**

<b>Subject: Milling and shaping Operation</b>	
<b>Description:</b>	This subject provides essential skill and knowledge to perform milling and shaping operation This subject is mainly focused on Plane, stapes, angular surface, grooves, key way and gear milling operation on milling machine and. plane, stapes, angular surface and slotting on shaper machine.
<b>Objectives:</b>	At the end of the course the participants will be able to: <ul style="list-style-type: none"> <li>▪ Apply safety rules.</li> <li>▪ Perform milling machine operation (plane, stapes, angular surface ,grooves, gear)</li> <li>▪ Perform shaper machine operation (plane, stapes, surface)</li> </ul>

### 1 Milling Machine Operation

S.N.	Task/Skill	Contents	Time Hours		
			Th/ Demo.	Pr.	Total
	<b>1.1 Set up machine</b>				
	<b>Set up machine control</b>	<ul style="list-style-type: none"> <li>• Introduction of milling machine</li> <li>• Types</li> <li>• Parts &amp; function</li> <li>• Operation of machine</li> <li>• Safety</li> </ul>	<b>1</b>	<b>2</b>	<b>3</b>
	<b>Set up milling vice on machine table</b>	<ul style="list-style-type: none"> <li>• Introduction of vice/work holding device</li> <li>• Types</li> <li>• Tools and equipment</li> <li>• Clamps, dial test indicator</li> <li>• Parallel block</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>2</b>	<b>2</b>	<b>4</b>
	<b>Set up work piece on vice</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types Work holding device</li> <li>• Tools and equipment</li> <li>• Clamps Parallel block</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>1</b>	<b>2</b>
	<b>Mount milling cutters on long arbor in horizontal spindle</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types of cutter holding devices</li> <li>• Types and uses of milling cutters</li> <li>• Tools and equipment</li> <li>• Bracket</li> </ul>	<b>1</b>	<b>2</b>	<b>3</b>

		<ul style="list-style-type: none"> <li>• Procedure</li> <li>• Safety</li> </ul>			
	<b>Mount milling cutters on short arbor in vertical spindle</b>	<ul style="list-style-type: none"> <li>• Tools &amp; equipment</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>1</b>	2
	<b>Set up milling cutter in collect chuck</b>	<ul style="list-style-type: none"> <li>• Tools and equipment</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>1</b>	2
	<b>Grind single tip tool for fly cutter</b>	<ul style="list-style-type: none"> <li>• Introduction of grinding machine (pedestal, bench)</li> <li>• Parts</li> <li>• Grinding wheel</li> <li>• Nomenclature of tools</li> <li>• Safety</li> </ul>	<b>1</b>	<b>6</b>	7

## 2. Mill Plain surface

	<b>Mill plain surface on horizontal milling</b>	<ul style="list-style-type: none"> <li>• Introduction of fundamental of milling</li> <li>• Tools and equipment</li> <li>• Plain milling cutter, long arbor, brackets, collar</li> <li>• RPM selection</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>12</b>	13
	<b>Mill plain surface on vertical milling</b>	<ul style="list-style-type: none"> <li>• Introduction of vertical head</li> <li>• Tools and equipment</li> <li>• Short arbor</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>12</b>	13

## 3. Mill Stapes

	<b>Mill step surface in vertical milling with shell end milling cutter</b>	<ul style="list-style-type: none"> <li>• Tools and equipment</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>15</b>	<b>16</b>
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## 4. Mill angular surface

	<b>Produce angular surface tilting vertical head</b>	<ul style="list-style-type: none"> <li>• Tools and equipment</li> <li>• End mill cutter/short arbor</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>12</b>	<b>13</b>
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## 5. Mill grooves

	<b>Mill 'V' groove, concave and plan slots</b>	<ul style="list-style-type: none"> <li>• Types &amp; uses of cutters</li> <li>• Tools and equipment</li> <li>• Long arbor, collar, bracket double angular cutter,</li> </ul>	<b>2</b>	<b>12</b>	<b>14</b>
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		convex cutter, side and face cutter			
		<ul style="list-style-type: none"> <li>• Procedure</li> <li>• Safety</li> </ul>			

### 6. Mill key way

	<b>Mill blind key way in a round piece</b>	<ul style="list-style-type: none"> <li>• Tools and equipment</li> <li>• Key way cutter</li> <li>• "V" block</li> <li>• Collect chuck and holder</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>5</b>	<b>6</b>
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### 7. Index milling

	<b>Mill hexagonal shape on round work piece</b>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types of indexing head</li> <li>• Method of indexing</li> <li>• Tools and equipment</li> <li>• End mill cutter/fly cutter, dial test indicator, collect chuck</li> <li>• Dividing head (direct/indirect)</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>4</b>	<b>6</b>	<b>10</b>
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### 8. Project work

	<ul style="list-style-type: none"> <li>• <b>Manufacture a clamp</b></li> </ul>		<b>0</b>	<b>18</b>	<b>18</b>
	<ul style="list-style-type: none"> <li>• <b>Manufacture Slide Rule</b></li> </ul>		<b>0</b>	<b>24</b>	<b>24</b>
	<ul style="list-style-type: none"> <li>• <b>Manufacture a spur gear</b></li> </ul>		<b>0</b>	<b>6</b>	<b>6</b>

### 9. Shaper Machine Operation

	<b>Set up machine control</b>	<ul style="list-style-type: none"> <li>• Introduction of shaper machine</li> <li>• Types</li> <li>• Parts &amp; function</li> <li>• Operation of machine</li> <li>• Safety</li> </ul>	<b>2</b>	<b>1</b>	<b>3</b>
	<b>Set up shaper vice on machine table</b>	<ul style="list-style-type: none"> <li>• Introduction of vice/Work holding device</li> <li>• Types</li> <li>• Tools and equipment</li> <li>• Clamps, dial test indicator, machine vice</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>2</b>	<b>1</b>	<b>3</b>
	<b>Hold single point cutting tool (HSS)</b>	<ul style="list-style-type: none"> <li>• Describe cutting tool</li> <li>• Types of cutting tool</li> <li>• Nomenclature of cutting tool</li> </ul>	<b>2</b>	<b>1</b>	<b>3</b>

		<ul style="list-style-type: none"> <li>• Tool post/clapper box</li> <li>• Tools and equipment</li> <li>• Procedure</li> <li>• Safety</li> </ul>			
	<b>Adjust stroke length and position of the ram</b>	<ul style="list-style-type: none"> <li>• Function of stroke length adjustment shaft and positioning shaft</li> <li>• Tools and equipment</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>1</b>	<b>2</b>

#### 10. Perform plain surface

	<ul style="list-style-type: none"> <li>• <b>Produce flat surface</b></li> </ul>	<ul style="list-style-type: none"> <li>• Tools and equipment</li> <li>• Single point cutting tool</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>12</b>	<b>13</b>
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#### 11. Perform step surface

•	<ul style="list-style-type: none"> <li>• <b>Produce 90° step surface</b></li> </ul>	<ul style="list-style-type: none"> <li>• Tools and equipment</li> <li>• Corner tool/Plain grooving tool</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>12</b>	<b>13</b>
	<ul style="list-style-type: none"> <li>• <b>Perform angular surface tilting by tool post</b></li> </ul>	<ul style="list-style-type: none"> <li>• Tools and equipment</li> <li>• Corner tool/Plain grooving tool</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>12</b>	<b>13</b>
	<ul style="list-style-type: none"> <li>• <b>Perform plane slot</b></li> </ul>	<ul style="list-style-type: none"> <li>• Tools and equipment</li> <li>• Corner tool/Plain grooving tool</li> <li>• Procedure</li> <li>• Safety</li> </ul>	<b>1</b>	<b>12</b>	<b>13</b>

#### 12. Perform project work

	<ul style="list-style-type: none"> <li>• Manufacture matching slot</li> </ul>	•	<b>0</b>	<b>15</b>	<b>15</b>
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#### Reference Book:

- Work Shop Technology (Volume I & II) – Hajra & Chaudhary
- Production Technology R.K. Jain S. C. Gupta
- Westerman Table book Metal
- All about Machine tool

## GTAW (TIG) and GMAW (MIG)

**Course Nature: Practical**

**Class per week: 2 hrs**

**Full marks: 50**

**Total class: 78 hrs**

<b>Description:</b>	This subject provides essential skill and knowledge to perform GTAW (TIG) and GMAW (MIG) Welding. This subject mainly focused to perform basic Welding Joint in Flat position.
<b>Objectives:</b>	<p>At the end of the course the participants will be able to:</p> <ul style="list-style-type: none"> <li>▪ Identify GTAW Welding Machine Equipment and tools</li> <li>▪ Identify and use of tungsten electrode</li> <li>▪ Identify and use of shielding gas</li> <li>▪ Select welding current and electrode wire</li> <li>▪ Set the Shielding gas flow rate.</li> <li>▪ Apply safety rules</li> <li>▪ Perform basic welding types such as surface welding butt joint tee joint corner joint in flat position</li> </ul>

S.N.	Task/Skill	Contents	Time Hours		
			Th.	Pr.	Total
<b>GTAW</b>					
1.	Set up welding machine and equipment	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types/parts/uses</li> <li>• Tools/equipment</li> <li>• Importance &amp; Applications</li> <li>• Process of setting</li> <li>• Safety precautions</li> </ul>	1	2	3
2	Perform surface welding in flat position a) Weld surface without filler rod b) Weld surface with filler rod	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Welding wave/deposition of bead</li> <li>• Tools/materials</li> <li>• Tungsten electrode/filler rod</li> <li>• Importance &amp; Applications</li> <li>• Shielding gases</li> <li>• Gas flow rate</li> <li>• Angle of torch and filler rod</li> <li>• Welding Process</li> <li>• Tip preparation of tungsten electrode</li> <li>• Safety precautions</li> </ul>	2	10	12
3.	Perform welding in flat position a) Weld square butt joint b) Weld T joint c) Weld corner joint	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Torch angle and filler rod</li> <li>• Tack welding</li> <li>• Welding process</li> <li>• Work piece setting</li> <li>• Welding current</li> <li>• Metal preparation</li> </ul>	3	21	24
<b>GMAW</b>					
4.	Set up welding machine and equipment	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Tools/equipment</li> <li>• Importance &amp; Applications</li> <li>• Process of setting</li> </ul>	1	2	3

		<ul style="list-style-type: none"> <li>• Safety precautions</li> </ul>			
5.	Weld surface in flat position a) Weld straight bead on surface	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Welding wave/deposition of bead</li> <li>• Tools/materials</li> <li>• filler wire</li> <li>• Importance &amp; Applications</li> <li>• Shielding gas</li> <li>• Gas flow rate</li> <li>• Welding Process</li> <li>• Safety rules</li> </ul>	1	5	6
	B)Weld in flat position 4 Weld square butt joint 5 Weld T joint 6 Weld corner joint	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Welding process</li> <li>• Work piece setting</li> <li>• Welding current</li> <li>• Angle of welding gun</li> <li>• Work piece preparation</li> <li>• Safety rules</li> </ul>	3	27	30
					78

## Structural Fabrication

**Course Nature: Practical**

**Class per Week: 2 hrs.**

**Full marks: 50**

**Total Class: 78 hrs.**

<b>Subject 2: Mechanical Fitting</b>	
<b>Description:</b>	This course intends to impart the knowledge and skills required for steel Structural Fabricator This course is mainly focus on marking, Cutting, welding and painting related on steel fabrication.
<b>Objectives:</b>	At the end of the course the participants will be able to: Fabricate Steel product , Prepare Welding Jigs and fixture, Produce assembly Structure, Paint steel products

### 1 Steel fabrication

S.N.	Skills	Content	Time (hrs)		
			T	P	Total
1.1	<b>Perform Sawing</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Holding device</li> <li>▪ Types of hack saw &amp; blade</li> <li>▪ Procedure</li> </ul>	0	2	
1.2	<b>Perform Cuts the material by Oxy acetylene gas cutting</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of gas</li> <li>▪ Tools &amp; equipment</li> <li>▪ Material</li> <li>▪ Procedure</li> </ul>	1	3	
1.3	<b>Perform off hand grinding</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of Grinding machine</li> <li>▪ Tools &amp; equipment</li> <li>▪ Clamping device</li> <li>▪ Procedure</li> <li>▪ Material</li> </ul>	0	2	
	<b>Sub total</b>		1	7	8

### 2.Perform Forming a ms bar

S.N.	Objectives	Content	Time (hrs)		
			T	P	Tot
2.1	<b>Perform Bending</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of Bending machine</li> <li>▪ Tools &amp; equipment</li> <li>▪ Clamping device</li> </ul>	1	3	

		<ul style="list-style-type: none"> <li>▪ Procedure</li> <li>▪ Material</li> </ul>			
<b>2.2</b>	<b>Perform Twisting</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of Twisting machine</li> <li>▪ Tools &amp; equipment</li> <li>▪ Clamping device</li> <li>▪ Procedure</li> <li>▪ Material</li> </ul>	<b>1</b>	<b>2</b>	
<b>2.3</b>	<b>Perform Forging</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Furnace</li> <li>▪ Tools &amp; equipment</li> <li>▪ Clamping device</li> <li>▪ Procedure</li> <li>▪ Material</li> </ul>	<b>1</b>	<b>4</b>	<b>5</b>
	<b>Sub total</b>		<b>3</b>	<b>9</b>	<b>12</b>

### 3. Prepare Jigs and fixture

S.N.	Objectives	content	Time (hrs)		
			T	P	
<b>3.1</b>	<b>Prepare Drill Jigs</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Procedure</li> <li>▪ Types of Drill</li> <li>▪ RPM Selection</li> </ul>	<b>2</b>	<b>12</b>	
<b>3.2</b>	<b>Prepare Welding Fixture</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Tools &amp; equipment</li> <li>▪ Procedure</li> </ul>	<b>2</b>	<b>7</b>	

### 4. Finish the Assembly Structure

S.N.	Objectives	content	Time (hrs)		
			T	P	
<b>4.1</b>	<b>Clean with emery</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of emery &amp; Grades</li> <li>▪ Procedure</li> </ul>	<b>1</b>	<b>2</b>	
<b>4.2</b>	<b>Clean with surface grinding</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of Grinding machine</li> <li>▪ Types of Grinding Wheels</li> </ul>	<b>1</b>	<b>2</b>	

		<ul style="list-style-type: none"> <li>▪ Tools &amp; equipment</li> <li>▪ Clamping device</li> <li>▪ Procedure</li> </ul>			
4.3	Clean with/emery wheel	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of emery wheel</li> <li>▪ Hand Grinding machine</li> <li>▪ Procedure</li> </ul>	1	2	
	<b>Sub total</b>		<b>3</b>	<b>6</b>	<b>9</b>

### 5 Perform Painting

S.N.	Objectives	content	Time (hrs)		
			T	P	
5.1	Perform enamel coating by brush painting	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types o enamel</li> <li>▪ Types of Brush</li> <li>▪ Procedure</li> </ul>	0	2	
5.2	Perform spray painting	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of compressor machine</li> <li>▪ Tools &amp; equipment</li> <li>▪ Clamping device</li> <li>▪ Procedure</li> </ul>	1	3	

### 6. Project Work

S.N.	Objectives	content	Time (hrs)		
			T	P	
6.1	Fabricate a Windows grill	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of welding machine</li> <li>▪ Tools &amp; equipment</li> <li>▪ Clamping device</li> <li>▪ Procedure</li> <li>▪ Material</li> </ul>	0	6	
6.2	Fabricate a Helical fixed stair	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of welding machine</li> <li>▪ Tools &amp; equipment</li> <li>▪ Clamping device</li> <li>▪ Procedure</li> <li>▪ Material</li> </ul>	0	6	

<b>6.3</b>	<b>Fabricate a collapsible gate</b>	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Safety</li> <li>▪ Types of welding machine</li> <li>▪ Tools &amp; equipment</li> <li>▪ Clamping device</li> <li>▪ Procedure</li> <li>▪ Material</li> </ul>		<b>8</b>	
	<b>Sub total</b>		<b>0</b>	<b>20</b>	<b>20</b>

## Engineering Drawing

Course Nature: Practical

Class per Week: 2 hrs.

Full marks: 50

Total Class: 78 hrs.

<b>Subject: Engineering Drawing</b>	
<b>Description:</b>	This 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 focused in Orthographic representation, Oblique/Isometric views, various types of lines, Dimensions, Tolerance, lettered notes, Sectional views, Development of Sheet metal and Symbols, etc.
<b>Objectives:</b>	At the end of the course the participants will be able to: <ul style="list-style-type: none"> <li>▪ Handle drawing instruments</li> <li>▪ Read and analyze engineering drawings.</li> <li>▪ Draw engineering drawings.</li> <li>▪ Annotate a drawing with Text, Dimensioning, Tolerance and related information.</li> <li>▪ Represent Drawing symbol</li> </ul>

S.N.	Skill	Contents	Time Hours		
			Th.	Pr.	Total
1	<b>Handle Drawing Instruments</b>	<ul style="list-style-type: none"> <li>• Introduction of Engineering drawing</li> <li>• Set up paper in drawing board</li> <li>• Draw title box using T set and Set square or Mini draft</li> <li>• Write engineering letter and numbers freehand</li> </ul>	1	1	2
2	<b>Construct Geometrical Figures</b>	<ul style="list-style-type: none"> <li>• Draw lines, Bisect Straight line / divide line</li> <li>• Draw Cercal/Square/Rectangle /Triangle/polygons, using set-square , Compasses &amp; protractor</li> <li>• Draw representative lines</li> <li>• Construct ellipse</li> </ul>	1	1	2
3	<b>Draw in Scale</b>	<ul style="list-style-type: none"> <li>• Represent the drawing in scale.</li> <li>• Represent the dimension in detail</li> <li>• Determine the tolerances</li> </ul>	1	7	8
4	<b>Draw Machine Elements</b>	<ul style="list-style-type: none"> <li>• Draw hexagon nuts and bolts</li> <li>• Draw the symbols Thread, M/C elements, Materials, Welding</li> </ul>	1	3	4
5	<b>Draw Pictorial Projection</b>	<ul style="list-style-type: none"> <li>• Draw Isometric projection</li> <li>• Draw oblique projection</li> </ul>	1	7	8
6	<b>Draw Orthographic Projection</b>	<ul style="list-style-type: none"> <li>• Draw three view in first angle projection</li> <li>• Draw three view in Third angle projection</li> <li>• Find and draw missing views.</li> </ul>	2	18	20
7	<b>Draw Sectional Drawing</b>	<ul style="list-style-type: none"> <li>• Draw full section views</li> <li>• Draw half section views</li> <li>• Draw partials section views</li> </ul>	1	9	10
8	<b>Development of Sheet Metal</b>	<ul style="list-style-type: none"> <li>• Draw cone development</li> <li>• Draw truncated cone development</li> <li>• Draw truncated cylindrical development</li> <li>• Draw truncated prism development</li> <li>• Draw Pyramid Development</li> </ul>	2	4	6

9	<b>Draw Assembly Drawing</b>	<ul style="list-style-type: none"> <li>• Copy simple assembly views</li> <li>• Draw detail from assembly view</li> <li>• Draw assembly view from detail drawings</li> </ul>	<b>1</b>	<b>11</b>	<b>12</b>
10	<b>Draw Steel structure</b>	<ul style="list-style-type: none"> <li>• Draw Steel windows</li> <li>• Draw Steel Stairs</li> <li>• Draw Roof Truss</li> </ul>	<b>1</b>	<b>5</b>	<b>6</b>
TOTAL			12	66	78

#### **BIBLIOGRAPHY**

<b>SN</b>	<b>Name</b>	<b>Author</b>	<b>Publication</b>
1.	Engineering Drawing	P S Gill,	S K Kataria & Sons
2.	Engineering Drawing for Mechanical Trade		Instructional Material for Vocational Training, India
3.	Elements of Mechanical Drafting	Samual Yaslov	Delmar Publishers
4.	Engineering Drawing	N.D. BHATT	Charotar Publishing House Pvt. Ltd.
5.	Machine Drawing (1 <sup>st</sup> Angle Projection)	Er. R.K. DHAWAN	S.CHAND

## Computer Aided Drafting

**Course Nature: Practical**

**Class per Week: 2 hrs**

**Full marks: 50**

**Total Class: 78 hrs.**

<b>Subject: Computer Aided Drafting (CAD)</b>	
<b>Description:</b>	This course intends to impart the knowledge and skills required to create two dimensional (2D) drawing and drafting using Computer Aided Drafting (CAD) software with a focus mainly on <i>civil engineering drawings</i> . Students develop competencies focusing mainly on different features such as Geometric shapes, Layers and Line types, Annotating a drawing with Text, Hatching and Dimensioning and creating output.
<b>Objectives:</b>	At the end of the course the participants will be able to: <ul style="list-style-type: none"> <li>▪ Use Computer Aided Drafting (CAD) Software</li> <li>▪ Construct 2D Engineering Drawing using AUTOCAD.</li> <li>▪ Annotate a drawing with Text, Dimensioning.</li> <li>▪ Edit drawing using CAD Software</li> </ul>

### Unit: 1 Computer Fundamentals (Review)

S.N.	Objectives	contents	Time (hrs)		
			T	P	
1.	Apply Basic Computer Skills	<ul style="list-style-type: none"> <li>▪ Overview of a computer operating system and peripherals (printers and plotters, system settings and the windows environment)</li> <li>▪ Computer handling</li> <li>▪ Open, save, save as, cut, copy, paste etc</li> </ul>	2	1	3

### Unit: 2 Familiarize with Computer Aided Drafting (CAD) Software

S.N.	Objectives	contents	Time (hrs)		
			T	P	
1.	Startup Computer Aided Drafting (CAD) software	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Enlist different types of CAD software.</li> <li>▪ System requirement for CAD</li> <li>▪ Startup CAD by start menu</li> <li>▪ Interpret CAD graphics window including screen layout, pull-down menus, screen icons, command line and dialogue boxes.</li> <li>▪ Modify display</li> <li>▪ Introduce and arrange toolbar</li> <li>▪ Managing unit/limit</li> <li>▪ Start, organize and save file</li> </ul>	1	1	2

S.N.	Skills	Contents	Time (hrs)		
			T	P	
2.	Setup a Drawing	<ul style="list-style-type: none"> <li>▪ Explain how to start drawing from scratch, using wizard and, using and creating a template file.</li> <li>▪ Describe setting preferences (units, angle, direction, area)</li> </ul>	0.25	0.5	0.75
3	Manage Toolbar	<ul style="list-style-type: none"> <li>▪ Standard tool bar</li> <li>▪ Draw tool bar</li> <li>▪ Modify toolbar</li> <li>▪ Dimensioning tool bar</li> <li>▪ Other</li> </ul>	0.25	0.5	0.75

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

S.N.	Skills	Contents	Time (hrs)		
			T	P	
1.	Draw lines	<ul style="list-style-type: none"> <li>▪ Different system Relative, Cartesian and absolute coordinate system.</li> <li>▪ Start and end point of a line</li> <li>▪ Different methods of drawing a line in CAD</li> <li>▪ Options available in drawing line in CAD (Undo, Close)</li> </ul>	1.50	1.00	2.5
2.	Draw rectangle	<ul style="list-style-type: none"> <li>▪ Corner points (first and other)</li> <li>▪ Options available in drawing rectangle (chamfer, fillet)</li> <li>▪ Chamfer distance</li> <li>▪ Fillet radius</li> </ul>	0.25	0.50	0.75
3.	Draw arc	<ul style="list-style-type: none"> <li>▪ Identify arc among various types of geometric shapes.</li> <li>▪ Describe different options for drawing arc (3 points method, Start Center method, Start End method, Center Start method)</li> </ul>	0.25	0.75	0.75
4.	Draw circle	<ul style="list-style-type: none"> <li>▪ Describe different options for drawing arc (Center Radius method, Center Diameter method, 2P method, 3P method, Tan, Tan Radius method, Tan, Tan, Tan method)</li> </ul>	0.25	0.50	0.75
5.	Draw polygon	<ul style="list-style-type: none"> <li>▪ Describe different options for drawing polygon (center, edge)</li> </ul>	0.25	0.50	0.75
6.	Manage lines	<ul style="list-style-type: none"> <li>▪ Line properties</li> <li>▪ Line weight</li> <li>▪ Line color</li> <li>▪ Line loading</li> </ul>	0.25	0.50	0.75

S.N.	Skills	Contents	Time (hrs)		
			T	P	
7.	Draw an Isometric drawing	<ul style="list-style-type: none"> <li>▪ Concept Isometric snap and rectangular snap</li> <li>▪ Setting of isometric snap</li> </ul>	0.50	1.00	1.5
8.	Draw Ellipse	<ul style="list-style-type: none"> <li>▪ Ellipse in rectangular snap <ul style="list-style-type: none"> <li>• Center Radius method <ul style="list-style-type: none"> <li>▪ Center Diameter method</li> </ul> </li> </ul> </li> <li>▪ Ellipse in isometric snap</li> </ul>	0.25	0.75	1.25

**Unit: 4 Edit drawing using CAD Software**

S.N.	Skills	Contents	Time (hrs)		
			T	P	
1.	Relocate object using Move command	<ul style="list-style-type: none"> <li>▪ Different methods of selecting objects for editing such as window, crossing, fence, all ... <ul style="list-style-type: none"> <li>• Base point <ul style="list-style-type: none"> <li>▪ Second point of displacement</li> </ul> </li> </ul> </li> </ul>	0.25	0.50	0.75
2.	Relocate object using rotate command	<ul style="list-style-type: none"> <li>▪ Define rotation angle</li> <li>▪ Explain Reference Point.</li> </ul>	0.25	0.50	0.75
3.	Duplicate object using Copy command	<ul style="list-style-type: none"> <li>▪ Differentiate multiple copy and Single copy.</li> <li>▪ Explain the procedure for duplicating object using copy command.</li> </ul>	0.25	0.50	0.75
4.	Duplicate object using Mirror command	<ul style="list-style-type: none"> <li>▪ State the purpose of Mirror.</li> <li>▪ Explain First point and Second point of mirror line</li> <li>▪ Second point of mirror line</li> <li>▪ Describe options available in mirror command</li> </ul>	0.25	1.00	1.25
5.	Duplicate object using Offset command	<ul style="list-style-type: none"> <li>▪ Describe options available for <ul style="list-style-type: none"> <li>▪ Offset distance</li> <li>▪ Through</li> </ul> </li> </ul>	0.25	1.00	1.25
6.	Duplicate object using Array command	<ul style="list-style-type: none"> <li>▪ Differentiate Rectangular Array and Polar Array</li> <li>▪ Explain Rows, Columns and Distance, Center point, number, angle and rotation</li> </ul>	0.25	1.00	1.25
7.	Modify object using Break command	<ul style="list-style-type: none"> <li>▪ Define break line</li> <li>▪ Break the selected object between two points</li> </ul>	0.25	0.50	0.75
8.	Modify object using Explode command	<ul style="list-style-type: none"> <li>▪ Define explode</li> <li>▪ Break a compounded object into its component object</li> </ul>	0.25	0.50	0.75

S.N.	Skills	Contents	Time (hrs)		
			T	P	
9.	Modify object using Trim command	<ul style="list-style-type: none"> <li>▪ Define Cutting edge</li> <li>▪ Explain the options available for trimming object (project, edge, undo)</li> </ul>	0.25	0.50	0.75
10.	Modify object using Extend command	<ul style="list-style-type: none"> <li>▪ Define Boundary edge</li> <li>▪ State the procedure for modifying object using Extend command.</li> </ul>	0.25	1.00	1.25
11.	Modify object using Fillet command	<ul style="list-style-type: none"> <li>▪ Differentiate Chamfer and Fillet.</li> <li>▪ Explain the options available for filleting object i.e. fillet radius</li> </ul>	0.25	0.50	0.75
12.	Modify object using chamfer command	Explain the options available for chamfering object i.e. Distance, angle	0.25	0.50	0.75

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

S.N.	Skills	contents	Time (hrs)		
			T	P	
1.	Create a Layer	<ul style="list-style-type: none"> <li>▪ Define Layer.</li> <li>▪ Explain different attributes and properties of a Layer (Line type, line weight, Global Scale Factor, Current Object Scale, Names, Of/Off, Freeze/Thaw, Lock/unlock, Color, Plot style, Plot/don't plot)</li> <li>▪ Explain the procedure for creating a layer.</li> </ul>	0.75	2.00	2.75
2.	Create text and text styles.	<ul style="list-style-type: none"> <li>▪ Differentiate Single line text [TEXT] and Multiline Text [MTEXT]</li> <li>▪ Explain Style name, Font Name, Style and Height</li> <li>▪ Describe Font effect, Width factor and Oblique angle</li> <li>▪ Explain the procedure for creating text styles.</li> </ul>	0.50	1.00	1.50
3.	Edit text	<ul style="list-style-type: none"> <li>▪ Multiline Text Editor <ul style="list-style-type: none"> <li>• Character</li> <li>• Properties</li> <li>• Line spacing</li> <li>• Find/replace, import text</li> </ul> </li> </ul> Layer and symbol	0.25	1.00	1.25

S.N.	Skills	contents	Time (hrs)		
			T	P	
4.	Hatch the sectional area	<ul style="list-style-type: none"> <li>▪ Define hatching.</li> <li>▪ Differentiate ISO Hatch Pattern, User Defined Hatch Pattern, Pre-Defined Hatch and Associative Hatch</li> <li>▪ Explain Boundary set, copying of hatch properties, pick point, hatch angle, scale, pattern, and object selection.</li> <li>▪ modify the hatched pattern</li> </ul>	0.25	2.00	2.50
5.	Create Block	<ul style="list-style-type: none"> <li>▪ Definition</li> <li>▪ Name</li> <li>▪ Pick point</li> <li>▪ selection</li> </ul>	0.25	1.00	1.25
6.	Add dimensions to a drawing	<ul style="list-style-type: none"> <li>▪ Interpret dimension elements (dimension text, lines and arrowheads, leader, extension lines, units, tolerance and center marks)</li> <li>▪ Describe dimension types (linear, aligned, ordinate, radius, diameter, angular, baseline and continue)</li> <li>▪ Dimension dialog box <ul style="list-style-type: none"> <li>▪ Lines and arrow</li> <li>▪ Dimension and text</li> <li>▪ Fit</li> <li>▪ Unit</li> <li>▪ Tolerances</li> </ul> </li> <li>▪ Modify Dimension style</li> <li>▪ Dimension in isometric drawing</li> </ul>	0.50	2.00	2.50

**Unit: 6 Create output**

S.N.	Skills	Contents	Time (hrs)		
			T	P	
1.	Configure Plotters/Printers	<ul style="list-style-type: none"> <li>▪ Define Plotter Manager</li> <li>▪ Explain Plot Style Manager</li> <li>▪ State the Printer/Plotter Installation process</li> </ul>	0.5	1.0	1.5
2.	Plot drawing	<ul style="list-style-type: none"> <li>▪ Explain paper size and paper units, drawing orientation, plot area and plot scale, plot offset.</li> <li>▪ Describe the procedure for printing a drawing.</li> </ul>	0.5	1.0	1.50
	<b>Sub total</b>		<b>1.00</b>	<b>2.00</b>	<b>3.0</b>

## Project works

1.	Following drawings are to be prepared and submitted (e-copy and hard copy both) using CAD software. <ul style="list-style-type: none"><li>• Draw an Isometric/ Oblique drawing</li><li>• Draw Orthographic drawing</li><li>• Draw an assembly drawing</li><li>• Draw Orthographic drawing</li><li>• Draw Workshop drawing</li><li>• Give dimension(Orthographic, Isometric)</li></ul>	0	40.0	40
	<b>Total</b>	<b>11.5</b>	<b>66.5</b>	<b>78</b>
		<b>Grand Total Hours</b>		<b>78</b>

### Suggested texts and references:

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

## Material Science

**Course Nature: Theory**  
**Full marks: 50**

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

Unit/sub unit	Topics	Time (hrs.)
<b>1</b>	<b>Introduction to Material Science</b>	
1.1	Introduction & history of material science	4
1.2	Elements and Its General properties (Symbol, Specific weight, Melting T. Tensile strength)	
<b>2</b>	<b>Classification of Materials</b>	
2.1	According to state, Metal and non-metal	4
2.2	Differentiate metal and non metal	
2.3	Differentiate ferrous and non ferrous metals	
<b>3</b>	<b>Ferrous Metal</b>	
<b>3.1</b>	<b>Iron and steel</b>	
3.1.1	Mining & Iron ore	8
3.1.2	Define & differentiate Iron and Steel	
3.1.3	Production of iron (blast furnace)	
3.1.4	Production of steel (open hearth, convertor, electric furnace and duplex process)	
<b>3.2</b>	<b>Carbon steel</b>	
3.2.1	Define carbon steel	6
3.2.2	Classification of carbon steel with their definition, properties and application	
3.2.3	Effect of carbon and other minor elements on steel	
3.2.4	Specification of steels according to code and classification(AISI/SAE/ISI specification)	
<b>3.3</b>	<b>Alloy steel</b>	
3.3.1	Definition of alloy steel	6
3.3.2	Classification of alloy steel	
3.3.3	Effect of alloying elements in steel	
3.3.4	Properties and uses of common alloy steels (Stain less Steel, High Speed Steel, Tool Steels, Spring Steels, Structural Steels)	
<b>3.4</b>	<b>Cast Iron</b>	
3.4.1	Introduction and definition	6
3.4.2	Types, properties and uses of cast iron (Gray, white & Malleable & alloy cast iron)	
3.4.3	Alloying elements in cast iron	
<b>4</b>	<b>Non Ferrous Metals</b>	
4.1	Aluminium Introduction and its properties & Applications	8
4.2	Aluminium alloys its properties & Applications	
4.3	Copper Introduction and its properties & Applications	
4.4	Copper alloys its properties & Applications	
4.5	Lead Introduction and its properties & Applications	
4.6	Lead alloys its properties & Applications	
4.7	Zinc Introduction and its properties & Applications	
4.8	Zinc alloys its properties & Applications	
4.9	Nickel Introduction and its properties/application	
4.10	Tungsten Introduction and its properties & Applications	
4.11	Powder metallurgy Introduction and process	
<b>5</b>	<b>Heat Treatment of Steel</b>	
5.1	Introduction, definition & objectives	
5.2	Describe Iron Carbon Phase Diagram	
5.3	Structures of Steel	

5.4	Heat treatment process	8
5.5	Annealing	
5.6	Normalizing	
5.7	Hardening	
5.8	Tempering	
5.9	Case/surface hardening(Carburizing process)	
<b>6</b>	<b>Mechanical Tests</b>	8
6.1	Definition and types of mechanical test	
6.2	Definition and types of Destructive tests	
6.3	Compression test	
6.4	Tensile Test	
6.5	Fatigue	
6.6	Bend Test	
6.7	Hardness testing	
6.8	Impact test	
6.9	Definition and types of Non destructive tests	
6.10	Visual examination	
6.11	Magnetic particle test	
6.12	X-ray test	
6.13	Radiographic test	
6.14	Ultra sonic test	
6.15	Dye penetrate test	
<b>7</b>	<b>Corrosion</b>	6
7.1	Introduction of corrosion	
7.2	Specific types of corrosion	
7.3	Atmospheric corrosion	
7.4	Underground corrosion	
7.5	Microbiological corrosion	
7.6	Uniform corrosion	
7.7	Crevice corrosion	
7.8	Stress corrosion	
7.9	Control and prevention of corrosion Metal and alloys, Cathodic precaution,	
<b>8</b>	<b>Non Metals</b>	8
8.1	Introduction to Non metals	
8.2	Polymers: properties, classification and uses	
8.3	Plastics: properties, classification and uses	
8.4	Rubber: properties, classification and uses	
8.5	Ceramics: properties, classification and uses	
8.6	Composite materials: properties, classification and uses	
8.7	Glass: properties, classification and uses	
<b>9</b>	<b>Abrasives &amp; Bonds</b>	6
9.1	Define & application of abrasive	
9.2	Types of abrasive (Natural & artificial abrasive)	
9.3	Aluminium oxide	
9.4	Silicon carbide	
9.5	Diamond	
9.6	Define bonds	
9.7	Rubber and Shellac bond	
9.8	Vitrified and silicate bond	
9.9	Resionoid bond	
<b>Total</b>		<b>78</b>

**BIBLIOGRAPHY:**

<b>SN</b>	<b>Name</b>	<b>Author</b>	<b>Publication</b>
1.	Technology of the metal trade,	Appold,Feiler, Reinhard, Schmidt,	Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) GmbH
2.	Callister's Material Science and Engineering	Adapted by R. Balsubramaiyam, Rajendra Sing	New Age International Publishers
3.	Manufacturing process	Vikas Upadhyay & Vikas Agrawal	S.K. Kataria & Sons

## Applied Mathematics

**Course Nature: Theory**  
**Full marks: 50**

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

Unit	Skills	Topic/ Contents	Time (hrs)
<b>Area calculations</b>			
1	Calculate SI units / conversion factors	System of units Conversion of units	2
2	Calculate percentage	Conversion of the percentage into actual number Conversion of the real number into percentage	2
3	Calculate circumferences	Definition Circumference of <ul style="list-style-type: none"> <li>• Sector</li> <li>• Polygons</li> </ul>	2
4	Calculate area	Area calculation of: <ul style="list-style-type: none"> <li>• Square</li> <li>• Rhombus</li> <li>• Rectangle</li> <li>• Parallelogram</li> <li>• Triangle</li> <li>• Trapezium</li> <li>• Circle</li> <li>• Sector</li> <li>• Circular ring</li> </ul>	4
5	Calculate Sheet metal requirements and wastage	Divide area of sheet metal Wastage Examples and Exercises	4
6	Calculate volume of right bodies, pointed and truncated bodies	Concept of cube, prism and cylinder <ul style="list-style-type: none"> <li>• Prism</li> <li>• Cylinder</li> <li>• Cone / Pyramid</li> <li>• Truncated cone / Pyramid</li> </ul> Examples and Exercises	4
7	Calculate taper and inclination	Concept of taper & taper ratio Taper ratio Ratio of inclination Setting angles Taper length Examples and Exercises	4
8	Calculate mass and force	Concept of mass and Density Mass Density Examples and Exercises Concept of force Weight	4

		Force Examples and Exercises	
9	Calculate Lever Forces	Moment of force One side lever Two side lever Elbow lever Several forces Examples and Exercises	2
10	Calculate uniform speeds	Laws of motion V is in a straight line V is circular Acceleration Examples and Exercises	4
11	Calculate work, power and efficiency	Work Power Efficiency Examples and Exercises	4
12	Calculate Simple belt drive	Peripheral speed Transmission ratio Examples and Exercises	2
13	Calculate Multiple belt drive	Components, transmissions Total transmission Examples and Exercises	4
14	Calculate gear wheel dimensions	Pitch Module Examples and Exercises	4
15	Calculate Simple gear drive	Dependency of pitch diameter and revolution Dependency of number of teeth and revolution Transmission ratio Distance between axis Examples and Exercises	2
16	Calculate Multiple gear drive	Component transmission Total transmission Examples and Exercises	2
17	Calculate processing time for drilling	Calculation of feed speed Calculation of processing time in min. Calculation of initial cut Examples and Exercises	4
18	Calculate processing time for turning	Calculation of feed speed Calculation of processing time in min. Examples and Exercises	4
19	Calculate processing time for planning, slotting & shaping	Processing time for planning Processing time for slotting (shaping) Examples and Exercises	4
20	Calculate processing time for milling	Calculation of run up Calculation of feed speed Calculation of processing time in min	4

		Examples and Exercises	
21	Calculate Indexing (Direct & Indirect indexing)	Calculation of Indexing numbers Examples and Exercises	4
22	Calculate taper turning	Calculation of taper Examples and Exercises	4
23	Calculate thread cutting	Change gear calculation Example and Exercises	4
	Total		78

**BIBLIOGRAPHY:**

- Technical Mathematics for the Metal Trade, German Agency for Technical Cooperation (GTZ).

## Workshop Technology

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

Unit/sub unit	Areas and Topics	Time (hrs.)
<b>1</b>	<b>General Safety Theory</b>	2
1.1	Safety introduction	
1.2	General workshop safety	
1.3	Electrical safety	
1.4	Fire hazards and fighting safety	
<b>2</b>	<b>Bench work Theory</b>	4
2.1	File	
2.1.1	Filing safety	
2.1.2	Introduction of File and its elements	
2.1.3	Size of files	
2.1.4	Types of file, Cuts of files.	
2.1.4.1	Profiles	
2.1.4.2	Cut of teeth	
2.1.4.3	Grades of cut	
2.1.5	Methods of filling	
<b>2.2</b>	<b>Bench work hand tools</b>	8
2.2.1	Introduction	
2.2.1.1	Safety precaution	
2.2.1.2	Hacksaws and sawing	
2.2.1.3	Types of Frame	
2.2.1.4	Hacksaw blades	
2.2.2	Hammers	
2.2.2.1	Introduction	
2.2.2.2	Safety precaution	
2.2.2.3	Types and use of Hammer	
2.2.3	Chisels and chippings	
2.2.3.1	Introduction	
2.2.3.2	Safety precaution	
2.2.3.3	Types and use of Chisels	
2.2.5	Pliers and Cutters	
2.2.5.1	Introduction	
2.2.5.2	Safety precaution	
2.2.5.3	Types and use of Pliers	
2.2.6	Taps and dies	
2.2.6.1	Introduction	
2.2.6.2	Safety precaution	
2.2.6.3	Types of Taps and Dies	
2.2.6.4	Tap handles and Die stocks	
2.2.6.5	Size of Tap drills (tapping drills)	
2.2.6.6	Screw extractor	
2.2.7	Wrench and spanners	
2.2.7.1	Introduction	
2.2.7.2	Safety precaution	
2.2.7.3	Types and use of Wrenches and Spanners	
<b>2.3</b>	<b>Work clamping devices</b>	2

2.3.1	Vices	
2.3.1.1	Introduction	
2.3.1.2	Types of vices	
2.3.1.3	Main parts of the vices	
2.3.1.4	Uses of vices	
2.3.2	C-clamps	
2.3.2.1	Introduction	
2.3.2.2	Types and Use of C-clamps	
2.3.3	V- Block with bridges	
2.3.3.1	Introduction	
2.3.3.2	Types and use of V-Blocks and Clamping	
<b>3</b>	<b>Measuring Instruments and Gauges</b>	<b>4</b>
3.1	Scales and meters	
3.1.1	Introduction	
3.1.2	Types of Scale and rules	
3.3	Vernier Calipers	
3.3.1	Introduction	
3.3.2	Safety precautions	
3.3.3	Main parts	
3.3.4	Least Count	
3.4	gauges	
3.4.1	Introduction	
3.4.2	Types and Use of (feeler gauge, radius gauge, Pitch gauge and Wire gauge) limit and adjustable.	
3.5	Introduce angle measuring instruments	
3.5.1	Introduction	
3.5.2	Types and Use of (Drill grinding gauge, Back Square, Center back square and Protractor)	
<b>4</b>	<b>Drills and Drilling</b>	<b>4</b>
4.1	Safety precaution	
4.2	Types of drills	
4.3	Elements of twisted drill	
4.4	Drill chucks, keys, and drift	
4.5	Drill sleeves and sockets	
4.6	Drilling machines	
4.7	Types of drilling machines	
4.8.1	Main Parts of drilling machine	
4.8.2	Cutting speed feed and RPM	
4.8.3	Drilling operations	
<b>5</b>	<b>Sheet Metal</b>	<b>4</b>
5.1	Safety precaution	
5.2	Sheet metal and its application	
5.3	Marking and laying out	
5.4	Hand tools used in sheet metal work	
5.5	Explain machines for sheet metal forming	
5.5.1	Shearing m/c, types and application	
5.5.2	Folding machine,	
5.5.3	Beading machine,	
5.6	Punches and punch tools	
5.7	Riveting	
<b>6</b>	<b>Arc Welding (SMAW)</b>	<b>4</b>
6.1	Introduce welding technology	

6.2	Safety precaution	
6.3	Welding and welding procedures	
6.3.1	Welding machines	
6.3.2	Definition of Current	
6.3.3	Types and use of electrodes	
6.3.4	Welding tools	
6.4	Welding joints, Symbols and Positions	
6.4.1	Edge and corner, Square butt joint, V joint, Lap joint, T joint and Flange	
6.4.2	Welding position (Flat, Horizontal, Vertical and Overhead)	
6.5	Welding defects and their remedies / prevention	
6.6	Drill jig and welding fixture	
<b>7</b>	<b>Lubrication and Cutting Fluid</b>	<b>2</b>
7.1	Introduction	
7.2	Characteristic of Lubricants	
7.3	Types and Application	
7.4	Characteristic of Cutting oil	
7.5	Types and Application	
<b>8</b>	<b>Cutting Tool Geometry</b>	<b>1</b>
8.1	Introduction	
8.2	Geometry of cutting tool	
8.3	Effects of angles on cutting tool	
8.4	Cutting tool material	
8.5	Recommended angles for different materials	
<b>9</b>	<b>Precision Instrument</b>	<b>3</b>
9.1	Introduction	
9.2	Dial Test Indicator	
9.3	Slip gauge	
9.4	Ring gauge and plug gauge	
9.5	Telescopic gauge	
9.6	Micrometer	
<b>10</b>	<b>Lathe Machine</b>	
10.1	<b><i>Introduction / Occupational Safety</i></b>	<b>1</b>
10.2	<b><i>Types of Machine</i></b>	<b>2</b>
10.2.1	Introduction of Engine Lathe	
10.2.2	Introduction of Capstan Lathe	
10.2.3	Introduction of Wheel Lathe (turret)	
10.2.4	Introduction of Vertical Lathe	
10.2.5	Introduction of Copy Lathe	
10.2.6	Introduction of Special Purpose Lathe	
10.2.7	Introduction of NC/CNC lathe machine.	
10.3	<b><i>Parts and Function of machine</i></b>	<b>1</b>
10.3.1	Head Stock	
10.3.2	Tail Stock	
10.3.3	Carriage	
10.3.4	Bed	
10.3.5	Feed Gear Box	
10.4	<b><i>Accessories of machine</i></b>	<b>2</b>
10.4.1	Work holding devices	
10.4.2	Chucks : 3 Jaws and 4 jaws (self centering & independent)	
10.4.3	Face plate	
10.4.4	Dog Plate	

10.4.5	Mandrel	
10.4.6	Sleeves and adaptors	
10.4.7	Centers	
10.4.8	Follower and Steady rest	
10.5	<b>Attachments of the machine</b>	1
10.5.1	Taper turning	
10.5.2	Grinding	
10.5.3	Relieving	
10.5.4	Copying	
10.6	<b>Types of Tool</b>	1
10.6.1	Left hand and right hand	
10.6.2	Solid and Tipped	
10.6.3	Form tool	
10.6.4	Thread cutting	
10.6.5	Parting off / Grooving	
10.6.6	Knurling tool	
10.7	<b>Lathe Operations</b>	2
10.7.1	Truing, plain turning	
10.7.2	Step turning	
10.7.3	Grooving	
10.7.4	Taper Turning	
10.7.5	Thread cutting	
10.7.6	Knurling	
10.7.7	Center to Center turning	
10.7.8	Parting Off	
10.7.9	Eccentric Turning	
11	<b>Milling Machine</b>	10
11.1	Introduction	
11.1.1	Introduction milling machine (Conventional)	
11.2	Machine safety	
11.3	Types of machine	
11.3.1	Column and Knee type	
11.3.2	Horizontal, vertical and universal	
11.4	Main parts and their function of the machine	
11.4.1	Over Arm	
11.4.2	Column	
11.4.3	Spindle	
11.4.4	Table	
11.4.5	Knee	
11.4.6	Saddle	
11.4.7	Base	
11.4.8	Elevating Shaft	
11.5	Milling Accessories	
11.5.1	Work holding devices	
11.5.1.1	Machine Vice	
11.5.1.2	T-bolts and Clamps	
11.5.1.3	V- blocks	
11.5.1.4	Angle plate	
11.5.2	Cutter mounting devices	
11.5.2.1	Short arbor, Stub arbor	
11.5.2.2	Long arbor	
11.5.2.3	Adopter / sleeve	

11.5.2.4	Collects	
11.6	Milling Attachments	
11.6.1	Vertical Head	
11.6.2	Slotting Head	
11.6.3	Rotary Table	
11.6.4	Indexing Head and it types	
11.6.5	Indexing method	
11.7	Cutting Speed, Feed and Depth of Cut	
11.8	Milling Fundamentals	
11.8.1	Up milling and down milling	
11.8.2	Face and peripheral milling- methods & operation.	
11.9	Milling Cutters and operations	
11.9.1	Shank type cutter	
11.9.2	Bore type cutter	
11.9.3	Fly cutter	
11.10	Milling Operations	
11.10.1	Plain milling by shell end/plain milling cutters	
11.10.2	Step milling by end mill/shell end	
11.10.3	Slot milling by end mill/key way/T slot	
11.10.4	Angular milling by single and double angular milling cutter	
11.10.5	Key way cutting by key way cutter	
11.10	Gear milling and gear cutter(Gear wheel dimension)	
11.11	Indexing calculation	
<b>12</b>	<b>Shaper machine</b>	<b>6</b>
12.1	Introduction and Safety	
12.2	Types of machine	
12.3	Parts and their function	
12.3.1	Ram	
12.3.2	Column	
12.3.3	Tool post	
12.3.4	Clapper box	
12.3.5	Table	
12.3.6	Base	
12.4	Stroke adjustment / Feed mechanism	
12.5	Quick return mechanism	
12.6	Work holding devices	
12.6.1	Machine vice	
12.7	Shaping tool	
12.7.1	Roughing tool	
12.7.2	Corner tool	
12.7.4	Finishing tool	
12.8	Shaper Operation	
12.8.1	Plain shaping	
12.8.2	Groove shaping	
12.8.3	Angular shaping	
<b>13</b>	<b>TIG/MIG</b>	<b>6</b>
13.1	Tig welding and types	
13.1.1	Tungsten Inert Gas Welding	
13.1.2	Safety Precautions	
13.1.3	Type of TIG electrode	
13.1.4	TIG welding equipment and tools	
13.1.5	Welding current	

13.1.6	Shielding gases	
13.1.7	Torch angle and filler metal movement	
13.2	Metal Inert Gas Welding	
13.2.1	Introduction and Safety Precaution	
13.2.2	Shielding gases	
13.2.3	Filler metal and deposition rate	
13.2.4	MIG welding equipment and tools	
13.2.5	Weaving pattern	
<b>14</b>	<b>Grinding</b>	<b>2</b>
14.1	Introduction and Safety	
14.2	Types of Grinding	
14.2.1	Emery sheet/paper	
14.2.2	Hand surface Grinder	
14.2.3	Cutting off grinder	
14.2.4	Pedestal / Bench Grinder	
<b>15</b>	<b>Machine Elements</b>	<b>6</b>
15.1	Introduction to thread	
15.2	Thread types and applications	
15.3	Introduction of shaft and axle	
15.4	Application of wheel and axle	
15.5	Introduction of gear and its types	
15.6	Types of belt and pulley	
15.7	Pulleys and Belts	
15.8	Types of bearing, pins and keys	
	Total	78

#### BOOK AND REFERENCES

- B. S. Raghuwanshi, *A Course in Workshop Technology Vol 1 and 2*, Dhanpat Rai and Co.
- S. K. Hajra Chaudhary, *Workshop Technology*(Vol. 1,II and III), Media promoters
- Henp Fort, *Shop Theory* (Vol. 1,II and III), Trade School
- W.A.J. Chapman, *Workshop Technology*(Vol. 1,II and III), Elsevier Science
- Heinrich Gerling, *Elementary Metal Course Training Section I*
- ETHIO, *Arbeitsstelle fur Unterricht und Technik*, GERMAN Technical Institute, Holetta.
- Heinrich Gerling, *All about Machine Tools*, New ,Wiley Eastern Ltd India,1965.
- Dhanpat Rai & Co., *A Course in Workshop Technology*, Vol. I & II, Educational and Technical Publishers

# Entrepreneurship Development

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

## Course description

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

## Course objectives

After completion of this course students will be able to:

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

S.No.	Skills	Contents	Time (hrs)		
			T	P	Tot
<b>Unit 1: Introduction to Entrepreneurship</b>			5.75	4.08	9.83
1	Introduce business	Introduction of business: <ul style="list-style-type: none"> <li>• Definition of business/enterprise</li> <li>• Types of business</li> <li>• Classification of business</li> <li>• Overview of MSMEs(Micro, Small and Medium Enterprises) in Nepal</li> </ul>	1.5		1.5
2	Define entrepreneur/entrepreneurship	<u>Definition of entrepreneur:</u> <ul style="list-style-type: none"> <li>• Definition of entrepreneur</li> <li>• Definition of entrepreneurship</li> <li>• Entrepreneurship development process</li> </ul>	0.5	0.5	1.0
3	Describe entrepreneur's characteristics	<u>Entrepreneur's characteristics:</u> <ul style="list-style-type: none"> <li>• Characteristics of entrepreneurs</li> <li>• Nature of entrepreneurs</li> </ul>	0.67	0.83	1.5
4	Assess entrepreneur's characteristics	<u>Assessment of entrepreneur's characteristics:</u> <ul style="list-style-type: none"> <li>• List of human characteristics</li> <li>• Assessment of entrepreneurial characteristics</li> </ul>	0.5	1.0	1.5

5	Compare entrepreneur with other occupations	<p><b><u>Entrepreneur and other occupations:</u></b></p> <ul style="list-style-type: none"> <li>• Comparison of entrepreneur with other occupations</li> <li>• Types and styles of entrepreneurs</li> </ul>	1.0		1.0
6	Differentiate between entrepreneur and employee	<p><b><u>Entrepreneur and employee:</u></b></p> <ul style="list-style-type: none"> <li>• Difference between entrepreneur and employee</li> <li>• Benefit of doing own business</li> </ul>	0.5	0.5	1.0
7	Assess “Self”	<p><b><u>“Self” assessment:</u></b></p> <ul style="list-style-type: none"> <li>• Understanding “self”</li> <li>• Self disclosure and feedback taking</li> </ul>	0.6	0.4	1.0
8	<p><b>Entrepreneurial personality test:</b></p> <ul style="list-style-type: none"> <li>• Assess “Self” inclination to business</li> </ul>	<p><b><u>Entrepreneurial personality test:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of entrepreneurial personality test</li> <li>• Assessing self entrepreneurial inclination</li> </ul>	0.67	0.83	1.5
<b>Unit 2: Creativity and Assessment</b>			<b>6.5</b>	<b>4.0</b>	<b>10.5</b>
9	Create viable business idea	<p><b><u>Creativity:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of creativity</li> <li>• Barriers to creative thinking</li> </ul>	1.67	0.33	2.0
10	Innovate business idea	<p><b><u>Innovation:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of innovation</li> <li>• SCAMPER Method of innovation</li> </ul>	0.83	0.67	1.5
11	Transfer ideas into action	<p><b><u>Transformation of idea into action:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of transferring idea into action</li> <li>• Self-assessment of creative style</li> </ul>	1.0	0.5	1.5
12	Assess personal entrepreneurial competencies	<p><b><u>Personal entrepreneurial competencies:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of entrepreneurial competencies</li> <li>• Assessing personal entrepreneurial competencies</li> </ul>	0.5	1.0	1.5
13	Assess personal risk taking attitude	<p><b><u>Risk taking attitude:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of risk</li> <li>• Personal risk taking attitude</li> <li>• Do and don’t do while taking risk</li> </ul>	1.5	1.0	2.5
14	Make decision	<p><b><u>Decision making:</u></b></p> <ul style="list-style-type: none"> <li>• Concept of decision making</li> <li>• Personal decision making attitude</li> <li>• Do and don’t do while making decision</li> </ul>	1.0	0.5	1.5

<b>Unit 3: Identification and Selection of Viable Business Ideas</b>			<b>0.83</b>	<b>3.42</b>	<b>4.25</b>
15	<p>Identify/ select potential business idea</p> <ul style="list-style-type: none"> <li>Analyze strength, Weakness, Opportunity and Threat (SWOT) of business idea</li> </ul>	<p><b><u>Identification and selection of potential business:</u></b></p> <ul style="list-style-type: none"> <li>Sources of business ideas</li> <li>Points to be considered while selecting business idea</li> <li>Business selection process</li> <li>Potential business selection among different businesses</li> <li>Strength, Weakness, Opportunity and Threats (SWOT) analysis of business idea</li> <li>Selection of viable business idea matching to “self”</li> </ul>	0.83	3.42	4.25
<b>Unit 4: Business Plan</b>			<b>16.67</b>	<b>36.58</b>	<b>53.25</b>
16	Assess market and marketing	<p><b><u>Market and marketing:</u></b></p> <ul style="list-style-type: none"> <li>Concept of market and marketing</li> <li>Marketing and selling</li> <li>Market forces</li> <li>4 Ps of marketing</li> <li>Marketing strategies</li> </ul>	1.33	0.75	2.08
17	<p><b>Business exercise:</b></p> <p>Explore small business management concept</p>	<p><b><u>Business exercise:</u></b></p> <ul style="list-style-type: none"> <li>Business exercise rules</li> <li>Concept of small business management</li> <li>Elements of business management <ul style="list-style-type: none"> <li>Planning</li> <li>Organizing</li> <li>Executing</li> <li>Controlling</li> </ul> </li> </ul>	1.58	1.67	3.25
18	Prepare market plan	<p><b><u>Business plan/Market plan</u></b></p> <ul style="list-style-type: none"> <li>Concept of business plan</li> <li>Concept of market plan</li> <li>Steps of market plan</li> </ul>	2.0	2.0	4.0
19	Prepare production plan	<p><b><u>Business plan/Production plan:</u></b></p> <ul style="list-style-type: none"> <li>Concept of production plan</li> <li>Steps of production plan</li> </ul>	1.25	1.5	2.75
20	Prepare business operation plan	<p><b><u>Business plan/Business operation plan:</u></b></p> <ul style="list-style-type: none"> <li>Concept of business operation plan</li> <li>Steps of business operation plan</li> <li>Cost price determination</li> </ul>	2.5	2.67	5.17
21	Prepare financial plan	<p><b><u>Business plan/Financial plan:</u></b></p> <ul style="list-style-type: none"> <li>Concept of financial plan</li> <li>Steps of financial plan</li> </ul>	4.5	7.5	12.0

		<ul style="list-style-type: none"> <li>• Working capital estimation</li> <li>• Pricing strategy</li> <li>• Profit/loss calculation</li> <li>• BEP and ROI analysis</li> <li>• Cash flow calculation</li> </ul>			
22	Collect market information /prepare business plan	<p><b><u>Information collection and preparing business plan:</u></b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Market survey <ul style="list-style-type: none"> <li>• Precaution to be taken while collecting information</li> <li>• Sample questions for market survey</li> <li>• Questions to be asked to the customers</li> <li>• Questions to be asked to the retailer</li> <li>• Questions to be asked to the stockiest/suppliers</li> </ul> </li> <li>• Preparing business plan</li> </ul>	2.0	13.0	15.0
23	Appraise business plan	<p><b><u>Business plan appraisal:</u></b></p> <ul style="list-style-type: none"> <li>• Return on investment</li> <li>• Breakeven analysis</li> <li>• Cash flow</li> <li>• Risk factors</li> </ul>	0.5	5.5	6.0
24	Maintain basic book keeping	<p><b><u>Basic book keeping:</u></b></p> <ul style="list-style-type: none"> <li>• Concept and need of book keeping</li> <li>• Methods and types of book keeping</li> <li>• Keeping and maintaining of day book and sales records</li> </ul>	1.0	2.0	3.0
<b>Total:</b>			<b>30</b>	<b>48</b>	<b>78</b>

**Text book:**

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

२०६९

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

अप्रकाशित), २०६९

**Reference book:**

Entrepreneur's Handbook, Technonet Asia, 1981.

## **On the Job Training (OJT)**

**Full Marks: 500**

**Practical: 24 weeks/960Hrs**

### **Description:**

On the Job Training (OJT) is a 6 months (24 weeks/144 working days) program that aims to provide trainees an opportunity for meaningful career related experiences by working fulltime in real organizational settings where they can practice and expand their classroom based knowledge and skills before graduating. It will also help trainees gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks. The trainee will be eligible for OJT only after attending the final exam. The institute will make arrangement for OJT. The institute will inform the CTEVT at least one month prior to the OJT placement date along with plan, schedule, the name of the students and their corresponding OJT site.

### **Objectives:**

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

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

### **Activities:**

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

- Measuring, marking, filling, sawing, punching, drilling, die, tapping, cutting, folding, riveting, bending with repair maintenance of tools equipment and machinery
- Set up, operate, turning/boring/facing/parting/thread cutting/off hand grinding etc in lathe machine
- Perform GTAW (TIG) and GMAW (MIG) Welding Joint in Flat position.
- Welding, marking, cutting, and painting on steel
- Position of welding, welding joint, Set of machine & selection of electrode
- Plane, stapes, angular surface, grooves, key way and gear milling operation on milling machine and. plane, stapes, angular surface and slotting on shaper machine
- Draw Geometric shapes, Layers and Line types, Annotating a drawing with Text, Hatching and Dimensioning and creating output by using Auto CAD.

### **Potential OJT Placement site:**

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

- Mechanical workshops
- Hydropower
- Industries (Manufacturing, Production)

### Requirements for Successful Completion of On the Job Training:

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

- submit daily attendance record approved by the concerned supervisor and minimum 144 working days attendance is required
- maintain daily diary with detail activities performed in OJT and submit it with supervisor's signature
- prepare and submit comprehensive final OJT completion report with attendance record and diary
- secured minimum 60% marks in each evaluation

### Complete OJT Plan:

SN	Activities	Duration	Remarks
1	Orientation	2 days	Before OJT placement
2	Communicate to the OJT site	1 day	Before OJT placement
3	Actual work at the OJT site	24 weeks/144 days	During OJT period
4	First-term evaluation	one week (for all sites)	After 6 to 7 weeks of OJT start date
5	Mid-term evaluation	one week (for all sites)	After 15 to 16 weeks of OJT start date
6	Report to the parental organization	1 day	After OJT placement
7	Final report preparation	5 days	After OJT completion

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

### Evaluation Scheme:

Evaluation and marks distribution are as follows:

S.N	Activities	Who/Responsibility	Marks
1	OJT Evaluation (should be three evaluation in six months –one evaluation in every two months)	Supervisor of OJT provider	300
2	First and mid- term evaluation	The Training Institute	200
	<b>Total</b>		500

### Note:

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

### OJT Evaluation Criteria and Marks Distribution:

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