

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION (MSBTE)**I – Scheme****I – Semester Course Curriculum**Course Title: **Workshop Practice** (FG, AE, ME, PT, EE, CE, CH, PS)

(Course Code:)

Diploma programme in which this course is offered	Semester in which offered
Mechanical, Production Technology, Automobile, Fabrication Technology and Erection Engineering, Civil, Electrical, Chemical, Plastics Engineering	First

1. RATIONALE

Workshop Practice is a basic practical engineering course. The knowledge of basic workshops such as wood working, fitting, welding, plumbing and sheet metal shop is essential for technician to perform his/her duties in industries. Students are able to perform various operations using hand tool equipment and machineries in various shops. Working in workshop develops the attitude of group working and safety awareness. This course provides miniature industrial environment in the educational institute.

2. COMPETENCY

The course should be taught and implemented with the aim to develop the course outcomes (COs) so that student demonstrates the following competency needed by the industry:

- **Prepare simple jobs on the shop floor of the engineering workshop.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Select tools and machinery according to job.
- Use hand tools in different shops for performing different operation.
- Operate equipment and machinery in different shops.
- Prepare job according to drawing.
- Maintain workshop related tools, equipment and machinery.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P	C	Theory Marks		Practical Marks		Total Marks
				ESE	PA	ESE	PA	
1#	0	4	4	-	-	50	50~ ²	100

(~²): For the *practical only* courses, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e. 30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e. 20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, Learning Outcomes i.e.LOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

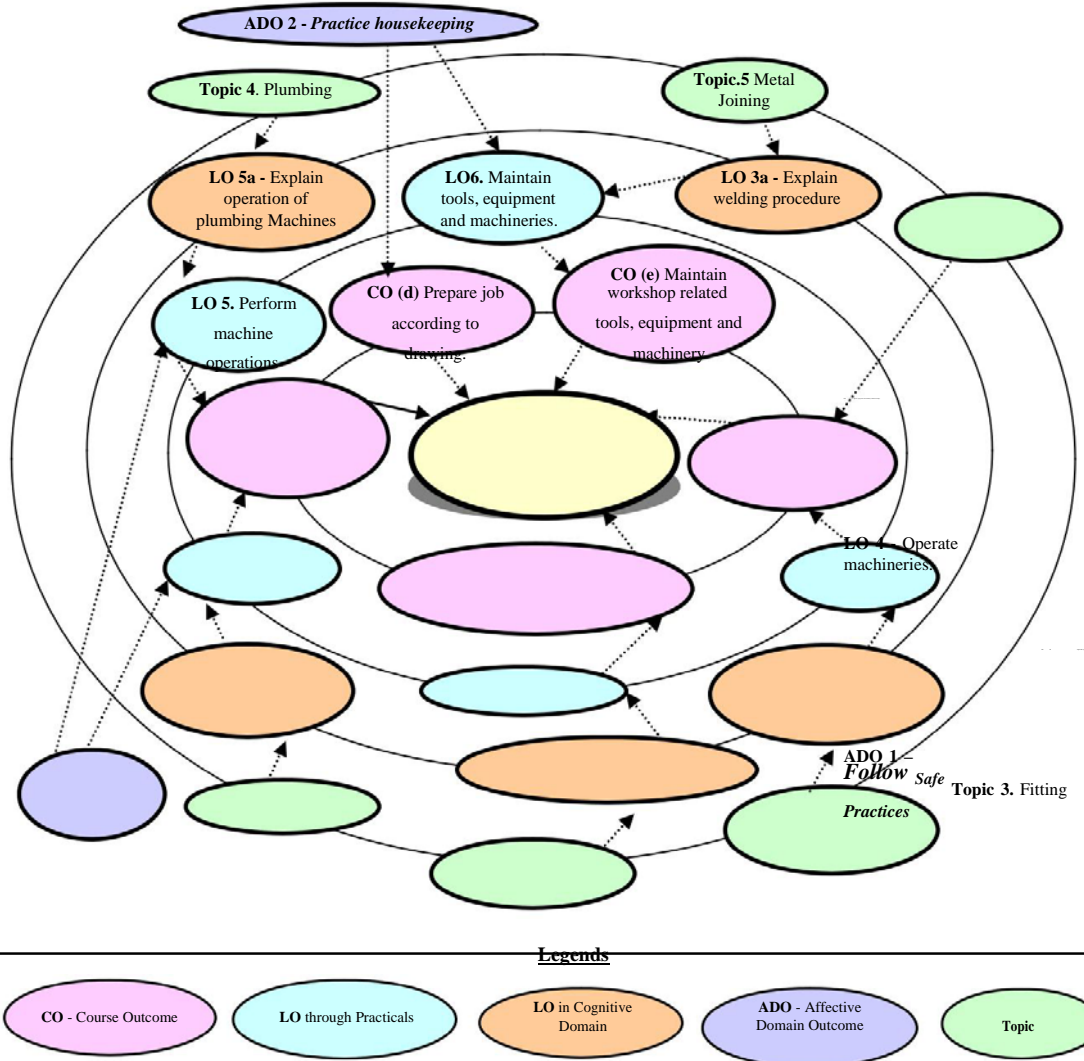


Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals/exercises/tutorials in this section are psychomotor domain LOs (i.e. sub-components of the COs), to be developed and assessed in the student to lead to the attainment of the competency.

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
1	Perform mock drill session in group of minimum 10 students for extinguishing fire – Part I	I	2*
2	Perform mock drill session in group of minimum 10 students for	I	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	extinguishing fire – Part II		
3	Prepare job with following operations: – Part I a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2*
4	Prepare job with following operations: – Part II a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
5	Prepare job with following operations: – Part III a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
6	Prepare job with following operations: – Part IV a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
7	Prepare job with following operations: – Part V a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
8	Prepare job with following operations: – Part VI a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing	II	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	f. drilling operation as per drawing g. tapping operation as per drawing		
9	Prepare job with following operations: – Part VII a. Marking operation as per drawing b. punching operation as per drawing c. filing operation as per drawing d. chamfering operation as per drawing e. sawing operation as per drawing f. drilling operation as per drawing g. tapping operation as per drawing	II	2
10	Prepare T joint pipe fitting job as per given drawing (individually)	III	2*
11	Prepare elbow joint pipe fitting job as per given drawing	III	2*
12	Prepare bill of material for given pipeline layout – Part I	III	2*
13	Prepare bill of material for given pipeline layout – Part II	III	2
14	Prepare lap joint using gas welding as per given drawing – Part I	IV	2*
15	Prepare lap joint using gas welding as per given drawing – Part II	IV	2
16	Prepare butt joint using gas welding as per given drawing – Part I	IV	2
17	Prepare butt joint using gas welding as per given drawing – Part II	IV	2*
18	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part I a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2 *
19	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part II a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
20	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part III a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2*
21	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part IV a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
22	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part V a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
23	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part VI a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2*
24	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part VII a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
25	Prepare utility job(like stool, benches, tables or similar jobs) involving arc welding and artificial wood as per given drawing (in group of 4 to 5 students) – Part VIII a. Fabrication operation involve measuring, marking, cutting, edge preparation, welding b. Carpentry operation involve measuring, marking cutting and assembly with fabrication part.	IV, V	2
26	Prepare sheet metal utility job using following operations – Part I: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2*
27	Prepare sheet metal utility job using following operations – Part II: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
28	Prepare sheet metal utility job using following operations – Part III: a. Cutting and Bending b. Edging c. End Curling d. Lancing	VI	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	e. Soldering f. Riveting		
29	Prepare sheet metal utility job using following operations – Part IV: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
30	Prepare sheet metal utility job using following operations – Part V: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
31	Prepare sheet metal utility job using following operations – Part VI: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
32	Prepare sheet metal utility job using following operations – Part VI: a. Cutting and Bending b. Edging c. End Curling d. Lancing e. Soldering f. Riveting	VI	2
Total			64

Note

- i. A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicial mix of *minimum 24 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as ‘*’ are compulsory*, so that the student reaches the ‘Precision Level’ of Dave’s ‘Psychomotor Domain Taxonomy’ as generally required by the industry.
- ii. Hence, the ‘Process’ and ‘Product’ related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Setting of experimental set up	20
2	Operate equipment skillfully	30
3	Follow Safety measures	10
4	Work in team	10

S. No.	Performance Indicators	Weightage in %
5	Record Observations	10
6	Interpret Results to conclude	10
7	Answer to sample questions	5
8	Submit report in time	5
Total		100

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	Fire buckets of standard size.	I, II, III, IV, V, VI
2	Fire extinguisher A,B and C types	I, II, III, IV, V, VI
3	Wood Turning Lathe Machine, Height of Centre: 200mm, Distance between Centers: 1200mm, Spindle Bore: 20mm with Taper, Range of Speeds: 425 to 2800 with suitable Motor Drive. with all accessories	II
4	Circular Saw Machine, Diameter of saw blade 200 mm, Maximum Depth of Cut 50 mm, Table Size -350 x 450 mm, Table Tilting - 45 ^o	II
5	Wood working tools- marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares,	II
6	Carpentry Vice 200 mm	II
7	Work Benches- size:1800 x 900 x 750 mm	III
8	Bench Drilling machine (upto 13 mm drill cap.) with ½ H.P. Motor 1000 mm. Height.	III
9	Power Saw machine 350 mm mechanical with 1 HP Motor & all Accessories.	III
10	Bench Grinder 200 mm Grinding Disc diameter 200 mm. with 25 mm. bore 32 mm. with ½ HP/1HP Motor.	III
11	Vernier height Guage 450 mm	III
12	Surface Plate 600 x 900 mm Grade I	III

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
13	Angle Plate 450 x 450 mm	III
14	Welding machine 20 KVA 400A welding current 300A at 50, 100, 200, 250, 300 with std. Accessories and Welding Cable 400 amp. ISI with holder	IV
15	Oxygen and acetylene gas welding and cutting kit with cylinders and regulators.	IV
16	Pipe Bending Machine	IV
17	Pipe Vice – 100 mm	IV
18	Pipe Cutter- 50 mm	IV
19	Bench Vice 100 mm	II,III,IV, V,VI
20	Portable Hammer Drill Machine 0-13 mm A.C. 230 V, 2.5Amp, Pistol type, having different types of bits	II, III, IV,V, VI
21	Sheet Bending Machine	VI
22	Sheet Cutting Machine	VI
23	Brazing Equipment	VI
24	Fitting tools - hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block, steel rule, twist drills, reamers, tap set, die set.	III
25	Plumbing tools- pipe vice, pipe bending equipment, pipe wrenches, dies.	IV
26	Gas welding hand tools- welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter	V
27	Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush.	V
28	Sheet metal hand tools- snip, shears sheet gauge, straight edge, L square, scribe, divider, trammel, punches, pliers, stakes, groovers, limit set	VI

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I General Workshop Practice	1a. Describe the procedure for extinguishing the given type of fire 1b. Describe the procedure to use the given firefighting equipment 1c. Locate the specified equipment in workshop 1d. Describe the ways to maintain good housekeeping in the given situation.	1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols. 1.2 First Aid 1.3 Fire, Causes of Fire, Basic ways of extinguishing the fire Classification of fire, Class A, B,C, D, Firefighting equipment, fire extinguishers, and their types . 1.4 Workshop Layout 1.5 Issue and return system of tools, equipment and consumables
Unit– II Fitting	2a. Explain operation of the given fitting shop machines	2.1 Fitting hand tools bench vice, hammers, chisels, files, hacksaw,

	<p>2b. Describe the procedure to use the given fitting tools</p> <p>2c. Describe the operation the given machinery.</p> <p>2d. Describe the procedure to perform fitting operations</p> <p>2e. Describe the procedure to maintain tools, equipment and machinery.</p>	<p>surface plate, punch, v block, angle plate, try square, marking block , steel rule, twist drills, reamers, tap set, die set and their Specifications</p> <p>2.2 Operation of fitting shops machineries - Drilling machine, Power saw, grinder their specifications and maintenance.</p> <p>2.3 Basic process chipping, filling, scraping, grinding, marking, sawing, drilling, tapping, dieing, reaming.</p>
Unit– III Plumbing	<p>3a. Explain operation of fitting shop machines</p> <p>3b. Describe the procedure to use the given plumbing tools</p> <p>3c. Describe the procedure to operate the given type of plumbing machinery.</p> <p>3d. Describe the procedure to maintain the given type of plumbing tools, equipment and machinery.</p>	<p>3.1 Plumbing hand tools pipe vice, pipe bending equipment, pipe wrenches, dies and their Specifications</p> <p>3.2 Pipe fittings- bends, elbows, tees, cross, coupler, socket, reducer, cap, plug, nipple and their Specifications</p> <p>3.3 Operation of Machineries in plumbing shops- pipe bending machine their specifications and maintenance.</p> <p>3.4 Basic process cutting, threading.</p>
Unit– IV Metal Joining	<p>4a. Describe the procedure to identify the given metal joining tools.</p> <p>4b. Explain the given type of welding procedure</p> <p>4c. Describe the procedure to use the given metal joining tools.</p> <p>4d. Describe the procedure to perform the given type of joining metals</p>	<p>4.1 Gas welding hand tools- welding torch, welding tip, pressure regulator, oxygen and acetylene cylinders, spark lighter and their Specifications</p> <p>4.2 Arc welding hand tools- electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush and their Specifications</p> <p>4.3 Operation of machineries in welding shops- arc welding transformer their specifications and maintenance.</p> <p>4.4 Welding Electrode, filler rod, fluxes, and solders.</p> <p>4.5 Basic process welding, brazing and soldering.</p>
Unit– V Furniture Making	<p>5a. Select wood working tools as per job/ requirement with justification</p> <p>5b. Explain operation of wood working machines</p> <p>5c. Describe the procedure to use the given furniture making tools</p> <p>5d. Describe the procedure to operate the given wood</p>	<p>5.1 Types of artificial woods such as plywood, block board, hardboard, laminated boards, Veneer, fiber Boards and their applications.</p> <p>5.2 Wood working hand tools carpentry vice, marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares, and their specifications</p> <p>5.3 Operation of wood working machineries - Wood turning lathe,</p>

	working machinery. 5e. Describe the procedure to maintain given wood working tools, equipment and machinery.	circular saw, their specifications and maintenance. 5.4 Basic process- marking, sawing, planing, chiseling, turning, grooving, boring.
Unit-VI Sheet Metal	6a. Identify sheet metal tools. 6b. Explain operation of sheet metal machineries. 6c. Use sheet metal tools 6d. Describe the procedure to operate the sheet metal machinery. 6e. Describe the procedure to perform the given bending operations 5f. Describe the procedure to maintain the given sheet metal tools, equipment and machinery.	6.1 Sheet metal hand tools snip, shears sheet gauge, straight edge, L square, scriber, divider, trammel, punches, pliers, stakes, groovers, limit set and their Specifications 6.2 Operation of machineries in sheet metal shops- sheet cutting and bending machine their specifications and maintenance. 6.3 Basic process- marking, bending, folding, edging, seaming, staking, riveting.

Note: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN - Not applicable.-

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Prepare work diary based on practical performed in workshop. Work diary consist of job drawing, operations to be perform, required raw materials, tools, equipments, date of performance with teacher signature.
- Prepare journals consist of free hand sketches of tools and equipments in each shop, detail specification and precautions to be observed while using tools and equipment.
- Prepare/Download a specifications of followings:
 - Various tools and equipment in various shops.
 - Precision equipment in workshop
 - Various machineries in workshop
- Undertake a market survey of local dealers for procurement of workshop tools, equipment machineries and raw material.
- Visit any fabrication/wood working/sheet metal workshop and prepare a report.

11. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- '*L*' in *item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. Arrange visit to nearby industries and workshops for understanding various manufacturing process.
- g. Show video/animation films to explain functioning of various processes like shaping, lapping, honing, turning, milling, knurling etc.
- h. Prepare maintenance charts various workshop machineries.

12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Prepare a utility job using various wood working shop operations as per given drawing.
- b. Prepare a utility job using various plumbing operations as per given drawing.
- c. Prepare a utility job using various sheet metal operations as per given drawing.

Note:

- i. *Utility job will be assigned by the teacher.*
- ii. *Utility Job will be completed in a group of 4 to 5 students and students have to maintain work diary consist of job drawing, operations details, required raw materials, tools, equipments, date wise performance record.*

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Workshop Practice	Bawa, H.S.	McGraw Hill Education, Noida; ISBN: 978-0070671195
2.	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta, J.K.; Khurmi, R.S.	S.Chand and Co. New Delhi ISBN:81-219-3092-8
4.	Introduction to Basic Manufacturing Process & Workshop Technology	Singh, Rajender	New Age International, New Delhi; 2014, ISBN: 978-81-224-3070-7

14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.asnu.com.au>
- b. <http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf>
- c. <http://www.weldingtechnology.org>
- d. <http://www.newagepublishers.com/samplechapter/001469.pdf>
- e. <http://www.youtube.com/watch?v=TeBX6cKKHWY>
- f. <http://www.youtube.com/watch?v=QHF0sNHttw&feature=related>
- g. <http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu>
- h. <http://www.piehtoolco.com>
- i. <http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/>
- j. https://www.youtube.com/watch?v=9_cnkaAbtCM