

Program Name : Mechanical, Civil Chemical & Plastic Program Group.

Program Code : CE/CR/CS/CH/PS/CM/EE/EP/AE/FG/ME/PG/PT

Semester : First

Course Title : Workshop Practice

Course Code : 22004

## 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			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
--	--	4	4	--	--	--	--	--	--	50@	20	50~	20	100	40

(~²): For the courses having **ONLY practical** examination, 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, PrOs, UOs, ADOs 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 in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for 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*
	Perform mock drill session in group of minimum 10 students for extinguishing fire – Part II	I	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
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 f. drilling operation as per drawing	II	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	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
	Prepare utility job( like stool, benches, tables or similar jobs)	IV,	2



S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	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.	V	
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 e. Soldering	VI	2

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
	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
<b>Total</b>			<b>64</b>

**Note**

- i. A suggestive list of **PrOs** is given in the above table. More such **PrOs** can be added to attain the **COs** and competency. A judicious mix of minimum 24 or more practical 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. The 'Process' and 'Product' related skills associated with each **PrO** is 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
5	Record Observations	10
6	Interpret Results to conclude	10





S. No.	Performance Indicators	Weightage in %
7	Answer to sample questions	5
8	Submit report in time	5
<b>Total</b>		<b>100</b>

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the 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 ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1<sup>st</sup> year
- 'Organising Level' in 2<sup>nd</sup> year
- 'Characterising Level' in 3<sup>rd</sup> 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°	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 Gauge 450 mm	III

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
12	Surface Plate 600 x 900 mm Grade I	III
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	I, 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, scriber, divider, trammel, punches, pliers, stakes, groovers, limit set	VI

#### 8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit – I General Workshop Practice</b>	1a. Describe the procedure for extinguishing the given type of fire	1.1 Safety Practices, Causes of accidents, General safety rules, Safety signs and symbols.
	1b. Describe the procedure to use the given firefighting equipment	1.2 First Aid
	1c. Locate the specified equipment in workshop	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
	1d. Describe the ways to maintain good housekeeping in the given situation.	1.4 Workshop Layout 1.5 Issue and return system of tools, equipment and consumables
<b>Unit – II</b>	2a. Explain operation of the given	2.1 Fitting hand tools bench vice,

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

	operate the given wood working machinery. 5e. Describe the procedure to maintain given wood working tools, equipment and machinery.	machineries - Wood turning lathe, circular saw, their specifications and maintenance. 5.4 Basic process- marking, sawing, planning, chiseling, turning, grooving, boring.
<b>Unit-VI Sheet Metal</b>	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 UOs need to be undertaken to achieve the 'Application Level' and above 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 PrOs, UOs and ADOs. 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.abmttools.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=QHF0sNHnttw&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](https://www.youtube.com/watch?v=9_cnkaAbtCM)

