GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-II

Course Title: Chemical and Mechanical Engineering Workshop
(Course Code: C4320502)

Diploma programme in which this course is offered	Semester in which offered
Chemical Engineering	Second

1. RATIONALE

Chemical Engineering Diploma holders are expected to know and understand about various chemical engineering equipments in the chemical & mechanical workshop. They have to supervise work related to operation of chemical engineering units. They are also expected to understand the unit operation symbols used in chemical process. This course helps to understand various flow diagram & instrumentation used in chemical process.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Prepare, interpret and working of symbols, sketches, & drawings of various equipment, valves, devices and flow diagrams for chemical engineering applications.

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Sketch the symbols, equipments and flow diagrams of chemical engineering.
b) Identify the symbols, equipments and flow diagrams of chemical engineering.
c) Understand the working of chemical engineering equipments.
d) Prepare simple jobs in pipe fitting and metal joining shop while following safe working and good housekeeping practices.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
0	0	6	3	00	00	25	25	50

(*): For this practical only course, 50 marks under the practical CA have two components i.e. the assessment of micro-project, which will be done out of 10 marks and the remaining 15 marks are for the assessment of practical. 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,* ***CA*** *- Continuous Assessment;* ***ESE*** *-End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

Following practical outcomes (PrOs) are the sub-components of the Course Outcomes (Cos). Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	Chemical Workshop		
1	Draw symbols of various equipment and devices for heat exchange, mass transfer and mechanical operations for example crusher, filter press, rotary filter, conveyors, screen, distillation and absorption columns, scrubbers, dryers, condenser, heat exchanger, jacketed vessel, cyclone, ESP, pump etc. in sketch book.		04
2	Draw various types of valves such as Globe valve, Gate valve, Diaphragm valve and non-return valves in a sheet.		04
3	Draw sketches of different pumps such as Centrifugal, reciprocating.		04
4	Draw sketches of different size reduction equipment's such as Jaw crusher, Gyratory crusher, Roll crusher, Ball mill in sketch book.		04
5	Draw Jacketed reactor with agitator.		04
6	Draw 1-1 Shell & Tube Heat exchanger.		04
7	Draw complete distillation tower assembly (Packed tower & Tray tower).		04
8	Draw a process flow sheet for Bio Diesel Production.		04
9	Draw a process flow sheet of Petroleum Refining Process.		04
10	Prepare a model of Heat Exchanger. (Any Suitable material)		04
11	Prepare a model of Distillation Tower. (Any Suitable material)		04
12	Working of Centrifugal Pump & Reciprocating Pump and distillation tower assembly (Packed tower & Tray tower).		04
13	Working of Heat Exchanger, Evaporators & Mechanical Operation Equipment.		04
14	Preparation of Model of Process Flow Sheet.		04
	Mechanical Workshop		
15	Prepare carpentry and fitting shop layout.		02
16	Demonstrate use of different pipe fitting tools. Student will also prepare the report with sketch, specifications and applications of pipe fitting tools demonstrated.		02
17	Prepare pipe fitting jobs as per drawings-two jobs.		04
18	Demonstrate use of different welding transformers and consumables. Also demonstrate arc welding, gas cutting, soldering and brazing operations. Student will also prepare the report with sketch, specifications and applications of fitting tools		04

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	demonstrated		
19	Prepare jobs using arc welding, gas cutting, spot welding, brazing and soldering process- three jobs.		08
20	PROBLEM BASED LEARNING: Group of 6 students will take rejected work pieces in workshop practice (at least two in each fitting, carpentry, tin smithy, pipe fitting and welding). Group will draw the work pieces, will identify type of defects and will discuss the reasons of such defects. Outcome of discussion has to be written in logbook and report.		04
21	SCHOOL WITHIN SCHOOL: i: Each student will demonstrate and explain at least one tool (to be assigned by teacher) to all batch colleagues. ii: Each student will share his/her student activities outcome. He/she will also share the experience for the student activities he/she has carried out.		04
	Minimum 14 Practical Exercises		**84**

Note

*i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii. Care must be taken in assigning and assessing study report as it is a first year study report. Study report, data collection and analysis report must be assigned in a group. Teacher has to discuss about type of data (which and why) before group start their market survey.

The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Prepare the sketches.	20
2	Prepare the model of equipments.	20
3	Follow the instructions given.	10
4	Understand the operation of equipment.	30
5	Interpret the outcome & conclude.	20
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipments with broad specifications for the PrOs is a guide to procure them by the administrators to user in uniformity of practical's in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.

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1.	PIPE FITTING: (i) Various samples of pipe fittings-like joints, elbows, tees, unions, bend, nipples, couplers, reducers, four way etc. of Metal and PVC. (ii) Water taps, plug, farule (iii) Pipe bending machine manual/hydraulic (iv) Pipe vice (v) Pipe wrenches. (vi) Pipe spanners. (vii) Set of spanners-Fix, Ring, box, Allen and adjustable. (viii) Set of screw drivers-sorted. (ix) Set of chisels. (x) Hammers. (xi) Teflon taps, cotton thread (xii) Set of dies and holders. (xiii) Hacksaw, pipe cutter. (xiv) Adhesive for PVC pipe fittings	16 &17
2.	METAL JOINING: (i) Arc welding transformers. (ii) Spot welding machine with necessary accessories, tools and consumables. (iii) Welding cables. (iv) Electrodes. (v) Electrode holders. (vi) Ground clamps. (vii) Chipping hammer. (viii) Wire brush. (ix) Oxygen-acetylene cylinders with pressure regulators-torch-hoses, trolley and accessories. (x) Filler rods. (xi) Solder filler material. (xii) Flux for soldering. (xiii) Soldering iron. (xiv) Brazing/welding torch. (xv) Try Square (xvi) Hammers, tongs, chisels and anvil (xvii) Screw Wrench (xviii) Tip Cleaner (xix) Swage block. (xx) Personal Protective Equipment like safety gloves, face shield /screen	18 &19

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a) Work as a leader/a team member.
b) Understand safety practices for the operation of chemical equipment.
c) Follow safe and good housekeeping practices.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

Not applicable as only practical

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Not applicable as only practical

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: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Prepare specification of major chemical equipments.
b) Give seminar on reading a datasheet of chemical engineering equipments.
c) Undertake a market survey of different kinds of equipments.
d) Prepare Job Hazard Analysis of different equipments.
e) Prepare Standard Operating Procedure for all chemical engineering equipments.

11. SUGGESTED 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:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L' in section No. 4*** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.

e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

f) Guide students for reading data sheets.

12. SUGGESTED MICRO-PROJECTS

Not applicable as it only practical subject.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Outlines of Chemical Technology, for 21st Century	M. Gopala Rao, Marshall Sitting	East West Press, 3rd Edition
2	Shreve's Chemical Process Industries, 5th edition	Austin G.T	McGraw Hill publication –New Delhi
3	Unit Operations of Chemical Engineering	McCabe, Warren L., Julian C. Smith	McGraw Hill Publication, New York 2004 (Seventh Edition)
4	Mass Transfer Operations	Robert E. Treybal	Mc Graw- Hill, 3rd Edition, 1981
5	Mechanical workshop practice.	K.C. John	PHI.
6	Workshop Technology-I.	Hazra and Chaudhary	Media promoters & Publisher private limited.
7	Workshop Technology-I.	W.A. J. Chapman	Taylor & Francis

14. SOFTWARE/LEARNING WEBSITES

- https://www.conceptdraw.com/examples/chemical-engineering-equipment-symbols
- https://engineeringlearn.com/types-of-heat-exchanger-definition-parts-and-application-complete-guide/
- https://www.hiclipart.com/free-transparent-background-png-clipart-ywgka
- https://www.gustawater.com/blog/distillation-column.html
- https://www.essentialchemicalindustry.org/processes/chemical-reactors.html
- https://www.michael-smith-engineers.co.uk/resources/useful-info/centrifugal-pumps
- https://www.ksb.com/en-de/product/valves
- https://www.youtube.com/watch?v=XpcCUtYzwy0
- https://www.youtube.com/watch?v=GYRwWyG3Qqw
- https://www.youtube.com/watch?v=stSI42iF-r0
- https://www.youtube.com/watch?v=oXwKnDgVq5Q
- https://www.youtube.com/watch?v=OQv-Tr-k5Ic
- http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf
- http://www.weldingtechnology.org
- http://www.newagepublishers.com/samplechapter/001469.pdf

- http://www.youtube.com/watch?v=TeBX6cKKHWY
- http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related
- http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu
- http://www.piehtoolco.com
- http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/

15. PO-COMPETENCY-CO MAPPING

Semester II	Chemical Engineering & Mechanical Workshop (Course Code: C4320502)								
	POs								
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning	PSO1 Operation of Equipment	PSO2 Laboratory Practical
Competency	• Prepare, interpret and working of symbols, sketches, & drawings of various equipment, valves, devices and flow diagrams for chemical engineering applications.								
CO 1)	2	1	1	2	3	2	2	2	1
CO 2)	2	1	1	2	3	2	2	2	1
CO 3)	3	2	2	2	2	1	2	3	2
CO 4)	-	-	-	1	2	2	2	2	-

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No.	Name and Designation	Institute	Contact No.	Email
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