

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Plant Maintenance & Safety
(Course Code: 4341906)

Diploma Programs in which this course is offered	Offered in
Mechanical Engineering & Mech. Engg. (CAD/CAM)	4 th Semester

1. RATIONALE

In industries, the mechanical engineers/technicians are supposed to manage functioning of equipment/machines. With proper planning, operation and adaption of maintenance schedule, one can manage to run the machines continuously with good efficiency.

The objective of plant maintenance is **to achieve minimum breakdown and to keep the plant in good working condition at the lowest possible cost**. Machines and other facilities should be kept in such a condition which permits them to be used at their optimum (profit making) capacity without any interruption or hindrance

Students need to know about the combination of maintenance with safe conditions for better performance simultaneously. Students must be able to recognize the possible hazards and adverse effects while working for the maintenance work at site.

2. EXPECTED COMPETENCY

The importance of this course is closely related to the ability of the student to understand and analyse to find problem solutions for detected faults for machines and automation processes.

The course content should be taught and implemented with the aim to inculcate the safety practice while working on the machines and different types of skills so that students are able to acquire the following competency:

“Use ethics of assembly / dis-assembly in maintenance of various mechanisms, machines, and equipment with safety aspects”

3. COURSE OUTCOMES (COs)

The practical exercises, the relevant skills associated with this competency are to be developed in the student to satisfy the following COs:

CO	Statement
CO1	Understand different types unit systems and types of toolings prevailing in the market.
CO2	Understand ethics of dismantling and assembling the job with proper usage of tools for different machines and mechanisms
CO3	Justify the role of maintenance in engineering along with selection of suitable

	maintenance procedures.
CO4	Recognise the concept of safety for possible threats/hazards while working

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	50
0	0	2	1	0	0	25	25	

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

5. SUGGESTED LIST OF EXERCISES/PRACTICALS

Sr No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Hrs.
1	<p>Preparatory Activity:</p> <p>i. Interpret and write various types of units (i.e.,Foot/Pound/Second (FPS) system prevails in the most of the industries till today. So compare it with MKS and SI units and their conversions by table. Also comopare the types of threads i.e., Metrics Vs BSW/BSP)</p> <p>ii. Demonstration and report writing of various types of tools (Spanners, allen keys, pliers, Taps & wrenches to get internal small threadings, dies and die holders to get threads on pipes, bearing pullers, flaring tool kit for tubing operations in ACs, Water coolers and Refrigerators ...etc,).</p> <p>iii. Report writing regarding gauges whih are used for pipes, wires, metal sheets etc., along with their impact on cost. Also get list of commercial lubricants and the meanings of their properties to get proper selection for lubrication and overhauling to machines</p>	06
2	<p>Study the types of plants and their maintenance (i.e, Chiller palnt, Power plant, Process Plant, manufacturing..etc and preventive, predictive, condition monitoring, corrective, break down..etc)</p>	02
3	<p>To study and perform the Maintenance of Mechanical Based Equipment/Device/Machine:</p> <p>Overhauling/Serviceing of following are to be done and make the report along with snapshots of students while on the work of that (Approx. 4-5 students in each group)</p> <p>i. Head stock /Tail stock /Carriage of lathe ii. Indexing head/Milling table mechanism / True Chuck iii. Water cooler / Window AC/ Split Ac / Refrigerator of the institute</p>	04

Sr No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Hrs.
	iv. Shutter/Gates / R O system / any other similar auxiliary of the institute	
4	To study Fault Tracing / Decision Tree and preparation of detail report: Develop decision tree to locate/identify the possible fault for following items i. If your petrol two wheeler vehicle doesn't start ii. If your domestic fluid/water pump doesn't work effectively iii. Jaw of the chuck doesn't rotate iv. Indexing mechanism of milling machine doesn't work properly and get stuck	04
5	Prepare report on Preventive and periodic Maintenance for any workshops/plants: (Approx. 4-5 students in each group) Collect and Prepare a preventive and periodic maintenance schedule of any institute/nearby workshop having- full fledge machines and mechanisms i.e., near by manufacturing unit / power plant/ cold storage or chiller plant of mall or a theatre	02
6	Prepare a report on recognition of threats at work place with sign boards/safety symbols along with causes of Accidents i. Causes of Accident ii. Enlist / Designate the necessary safety symbols required to create awareness among the industrial workers by using sign boards iii. Prepare and display different posters/sign boards for safety symbols (Attach group photo with posters/ banner in the report)	02
7	Study the report on requirement and usage of safety equipments to prevent any hazards or accident : i.e., safety helmets, gloves, eye protection/high-visibility goggles, safe clothing, safe footwear, and respiratory protective equipment (RPE).	02
8	Study the impact of cost/time for various assembly methods (i.e different ways of assembly / dis assembly methods)	02
9	Mini Project And Presentation a. Identify mechanical based any one equipment /device / machine at institute or near by industries which requires maintenance. b. Prepare general sketch. c. Perform fault tracing and prepare the decision tree. d. Dismantle the job. Write the sequence of dismantling. Also describe the steps. List the tools used for this activity. e. Attend necessary maintenance tasks. Write that asks performed. 1. f. Assemble, test and if necessary, modify. Write the steps. 2. g. Prepare power point presentation. Presentation for the project. This must include photographs / prepare video while working on project.	02

Sr No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Hrs.
10	Industrial Visit	02

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

'Well Equipped machine shop and workshop will be sufficient for demonstration/study type work'

7. AFFECTIVE DOMAIN OUTCOMES

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

- a. Follow ethical practices.
- b. Work as a team leader/a team member.
- c. Fault finding and ability to resolve it.

8. SUGGESTED STUDENT ACTIVITIES

Other than the laboratory learning, the following are the suggested student-related **co-curricular** activities that can be undertaken to accelerate the attainment of the various outcomes in this course. Students should conduct the following activities in a group and prepare reports of each activity. They should also collect/record physical evidence for their (student's) portfolio which will be useful for their placement interviews:

- a) Charts can be prepared.
- b) A short report on any topic given by concerned faculty
- c) Small groups of students can be formed for assigned work. Assigned work should be such that it encompasses market survey, Model making, Powerpoint presentation, time management... etc.

9. SUGGESTED LEARNING RESOURCES

Sr. No	Title of Book	Author	Publication with place, year and ISBN
1	Plant equipment and maintenance engineering handbook 1st Edition	Duncan C, Recharadson PE	Publication Date & Copyright: 2014

Sr. No	Title of Book	Author	Publication with place, year and ISBN
			McGraw-Hill Education
2	Industrial maintenace management	S K Srivastava	S chand & co
3	Process equipment malfunctions : Techniques to identify plant problems	Norman P. Lieberman	Publication Date & Copyright: 2011 McGraw-Hill Companies, Inc.

10. SOFTWARE/LEARNING WEBSITES

- i. <https://nptel.ac.in/courses/112105048>
- ii. https://onlinecourses.nptel.ac.in/noc20_ce09/preview
- iii. <https://youtu.be/ZEShNJX3kcg>
- iv. <https://youtu.be/bzG8xGtj29U>
- v. <https://youtu.be/jamEeEWUa5s>
- vi. <https://youtu.be/222dZ6oKPyg>
- vii. https://youtu.be/ikbC5_6qTvs
- viii. <https://youtu.be/VhuZ6M7a8N8>
- ix. <https://youtu.be/SPDKEZBsydg>
- x. <https://youtu.be/Rr-xFmErOTk>
- xi. <https://youtu.be/n7oUOUCIblg>

11. PO - COMPETENCY - CO MAPPING

Semester IV	PLANT MAINTENANCE & SAFETY (4341906)						
	POs						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
Competency & Course Outcomes	Basic & Discipline specific knowledge	Problem Analysis	Design/ development of solutions	Engineering Tools, Experimentation & Testing	Engineering practices for society sustainability & environment	Project Management	Life-long Learning
CO 1. Understand different types unit systems and types of toolings prevailing in the market.	3	1	-	3	-	-	2
CO 2. Understand ethics of dismantling and assembling the job with proper usage of tools for different machines and mechanisms	3	-	-	2	1	2	2

CO 3. Justify the role of maintenance in engineering along with selection of suitable maintenance procedures	3	1	-	-	1	1	2
CO 4. Recognise the concept of safety for possible threats /hazards while working relevant safety.	3	-	2	-	2	1	3

12. COURSE CURRICULUM DEVELOPMENT COMMITTEE**GTU Resource Persons**

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BOS Resource Persons

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