GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Semester-III

Course Title: Mechanical Maintenance and Safety

(Course Code: 1336504)

Diploma Programs in which this course is offered	Semester in which offered
Mechanical Engineering (CAD/CAM)	3rd Semester

1. RATIONALE

In industries, the mechanical engineers/CNC machine operators and supervisors are supposed to manage functioning of equipments/CNC machines. With proper planning, operation and adaption of maintenance schedule, one can manage to run the machines continuesly with good efficiency.

The objective of Mechanical maintenance is **to achieve minimum breakdown and to keep the machine shop 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 maintenace work at shopfloor and working sites.

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 shopfloor machines & all kind of CNC apparatus along with 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:

a) Understand different types unit systems and types of toolings prevailing in the market.

b) Understand ethics of dismentaling and assembling the job with proper usage of tools for different machines and mechanisms
c) Justify the role of maintenance in engineering along with selection of suitable maintenance procedures.
d) 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				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CA	ESE	CA	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. Required
1	**Preparatory Activity:** A. 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) B. 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,). C. Report writing regarding gauges which 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	06
2	**Study the types of CNC Manchines and their maintenance**	02

3	**To study and perform the Maintenance of Mechanical Based Equipment/Device/Machine:** Overhauling/Servicing 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)** 1. Head stock /Tail stock /Carriage of lathe 2. Indexing head/Milling table mechanism / True Chuck 3. Water cooler / Window AC/ Split Ac / Refrigerator of the institute 4. Shutter/Gates / R O system / any other similar auxiliary of the institute	04
4	**To study Fault Tracing and Decision Tree and preparation of detail report:** Develop decision tree to locate/identify the possible fault for following items 1. If your petrol two wheeler vehicle doesn't start 2. If your domestic fluid/water pump doesn't work effectively 3. Jaw of the chuck doesn't rotate 4 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 ie., near by Machine shop.	02
6	**Prepare a report on recognition of threats at work place with sign boards/safety symbols along with causes of Accidents** Causes of Accident Enlist / Designate the neccesary safety symbols required to create awareness among the industrial workers by using sign boards 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 level 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 the tasks performed. f. Assemble, test and if necessary, modify. Write the steps. g. Prepare power point presentation. Presentation for the project. This must include photographs / movies of group while working on project.	04
10	**Industrial visit** Visit of any work unit/workshop where Errectioning, testing, commissioning and installation of CNC machines and other automation instruments can be seen and understood easily OR Visit at any kind of work unit/ workshop where multi tasking assembling and dis assembling can be seen and understood easily.	
	Total Hours	28

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. PO - COMPETENCY - CO MAPPING

Semester III	PLANT MAINTENANCE AND SAFETY						
	POs						
Competency & Course Outcomes -Cos (concerned Units)	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
Understand different types unit systems and types of toolings prevailing in the market.	3	1		3			2
Understand ethics of dismentaling and assembling the job with proper usage of tools for different machines and mechanisms	3			2	1	2	2
Justify the role of maintenance in engineering along with selection of suitable maintenance procedures	3	1			1	1	2
Recognise the concept of safety for possible threats /hazards while working relevant safety.	3		2		2	1	3

10. SUPPORT LINKS :

PRACTICAL 1

https://www.amazon.in/Spanners-Wrenches-50-Off-or-more/s?rh=n%3A7355682031%2Cp_n_pct-off-with-tax%3A2665401031
https://www.amazon.in/Abn-Flaring-Tool-Set-Swaging/dp/B07DDPX3RD

https://www.google.com/search?q=sheets/pipes+gauge&rlz=1C1CAFB_enIN861IN861&hl=en-GB&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiJr7Wyxa38AhWjxjgGHUzbCG0Q_AUoAnoECAEQBA&biw=1366&bih=568&dpr=1cold
cold

https://www.google.com/search?q=types+of+lubricants+and+designations&tbm=isch&ved=2ahUKEwiB6KW2xa38AhXHiNgFHQVtCOwQ2-cCegQIABAA&oq=types+of+lubricants+and+designations&gs_lcp=CgNpbWcQDDoICAAQgAQQsQM6CwgAEIAEELEDEIMBOgUIABCABDoECAAQQzoGCAAQBRAeOgQIABAeOgcIABCABBAYUMcNWKFcYJh1aABwAHgAgAGRAogBiTOSAQYwLjMzLjSYAQCgAQGqAQtnd3Mtd2l6LWltZ8ABAQ&sclient=img&ei=4j61Y4HvFceR4t4Phdqh4A4&bih=568&biw=1366&rlz=1C1CAFB_enIN861IN861&hl=en-GB#imgrc=Prv2OYwFhpDDFM

PRACTICAL 6

https://www.google.com/search?q=RECOGNITION+OF+THREATS+WHILE+WORKING+AT+MANUFACTURING+UNIT+%2FPLANT+&tbm=isch&ved=2ahUKEwjQ9e7R3q38AhUdi9gFHQjTDdcQ2-cCegQIABAA&oq=RECOGNITION+OF+THREATS+WHILE+WORKING+AT+MANUFACTURING+UNIT+%2FPLANT+&gs_lcp=CgNpbWcQDDoICAAQgAQQsQM6BAgAEEM6CAgAELEDEIMBOgUIABCABDoLCAAQgAQQsQMQgwE6BAgAEAM6CQgAEIAEEAoQGDoHCAAQgAQQGDoGCAAQCBAeUK0NWLjqAWDO_QFoBXAAeACAAYACiAGMZJIBBjAuNjQuOJgBAKABAaoBC2d3cy13aXotaW1nwAEB&sclient=img&ei=U1m1Y5CABJ2W4t4PiKa3uA0&bih=568&biw=1366&rlz=1C1CAFB_enIN861IN861&hl=en-GB

PRACTICAL 7

https://www.google.com/search?q=REQUIREMENT+AND+USAGE+OF+SAFETY+INSTRUMENTS+&tbm=isch&ved=2ahUKEwjH9J_Z4K38AhXbkdgFHatdBRoQ2-cCegQIABAA&oq=REQUIREMENT+AND+USAGE+OF+SAFETY+INSTRUMENTS+&gs_lcp=CgNpbWcQDDoGCAAQBRAeOgYIABAIEB46BggAEAcQHjoECAAQQzoICAAQgAQQsQM6CAgAELEDEIMBOgUIABCABDoHCAAQsQMQQzoLCAAQgAQQsQMQgwE6CQgAEIAEEAoQGDoHCAAQgAQQGFAAWLdqYO6IAWgAcAB4AoAB5AKIAapNkgEIMS40My45LjGYAQCgAQGqAQtnd3Mtd2l6LWltZ7ABAMABAQ&sclient=img&ei=e1u1Y4fLGduj4t4Pq7uV0AE&bih=568&biw=1366&rlz=1C1CAFB_enIN861IN861&hl=en-GB

PRACTICAL 8
https://www.highlandmachine.com/assembly-options-cost-savings/

11. Study Resourses :

Book name	Auther	Publication
Plant equipment and maintenance engineering handbook 1st Edition	Duncan C, Rechardson PE	**Publication Date & Copyright:** 2014 McGraw-Hill Education
Industrial maintenanace management	S K Srivastava	S chand & co
Process equipment malfunctions : Techniques to identify plant problems	Norman P. Lieberman	**Publication Date & Copyright:** 2011 McGraw-Hill Companies, Inc.
Machine Tools (specifucation, Purchase & Installation)	Russel Gamblin	**McGrow-Hill Education ISBN: 978-0-07-181223-8**

12. COURSE CURRICUM DEVELOPMENT COMMITTEE

Sr No	Name and Designation	Institute	Contact No.	Email
1	Prof. G R Khunt Sr.Lecturer in Mech Engg.	R. C. Technical Institute Sola, Ahmedabad.	8128291616	grkhunt@gmail.com
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