

Branch Name:	Mechanical Engineering
Program Code:	ET402
Course Title:	Industrial Maintenance & Safety
Course Code:	2ET4020404
Pre-requisite Course:	-----

Course Objectives:

1. Students should learn and apply the course material to develop a variety of skills that will enable them to successfully manage maintenance operations while adhering to safety regulations.
2. It would be very appreciated if students who are chosen for the operation and maintenance department in the industrial unit could get admittance to the industries by acquiring such fundamental knowledge.
3. The course covers maintenance as well as the Safety and Essential Factory Act, which requires students to be knowledgeable about first aid treatment, fire safety, road safety, mechanical safety, building safety, and natural disasters. These topics are crucial for today's industrial units.
4. The course will provide the student with knowledge of upkeep, safety, machine installation, recovery, reconditioning, and
5. After completing the course, students will be able to perform their own home appliance maintenance, which will allow them to work for themselves.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	0	2	3	60	40	20	30	150

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Introduction of Maintenance Engineering • Appreciate the need for maintenance in the industry • Definition and aim of maintenance engineering. • Primary and secondary functions and responsibilities of the maintenance department. • Types of maintenance. • Types and applications of tools used for maintenance. • Maintenance cost & and its relation with replacement economy. • The service life of the equipment.	04	15
2	Preventive Maintenance • Definition, need steps, and advantages of preventive maintenance. • Steps/procedure for periodic and preventive maintenance of: a. Machine tools b. Pumps c. Air compressors d. Diesel generating (DG) sets. • Program and schedule preventive maintenance of mechanical and electrical equipment. • Merits of Preventive maintenance. • Inspection Techniques for Plant Maintenance • Transformational Trends Reshaping Industrial Maintenance	08	30

3	Fault tracing - Fault tracing-concept and importance. - Decision tree-concept, need, and applications. - The sequence of fault-finding activities, show as a decision tree. - Draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal, and electrical equipment like i. Anyone machine tool. ii. Pump iii. Air compressor. iv. Internal Combustion engine. v. Boiler. vi. Electrical motors. - Types of faults in machine tools and their general causes.	05	15
4	Industrial safety - Accident - causes, types, results and control. - Mechanical and electrical hazards-types, causes and preventive steps/procedures. - Describe salient points of Factories act 1948. For health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc. - Safety color codes. - Fire prevention and firefighting, equipment and methods.	05	15
5	Maintenance of Home Appliances. - Basic safety practices - Preventive and routine Maintenance of top household appliances like geyser, RO system, microwave, Refrigerator, and air conditioner, etc. - Maintenance of Electrical Equipment - Routine Maintenance of Domestic Which Like Car, Two-wheeler, bicycle etc. - Electrical Appliance Testing Equipment. - Specialty Tools used for Appliance Care.	06	25

List of Practical:

- Demonstration and report writing of various types of tools (Spanners, Allen keys, pliers, Taps, and wrenches to get internal small threading, dies and die holders to get threads on pipes, bearing pullers, flaring tool kit for tubing operations in ACs, Water coolers and Refrigerators ...etc.,).
- Study the types of plants and their maintenance. (i.e., Chiller plant, Power plant, Process Plant, manufacturing. and preventive, predictive, condition monitoring, corrective, breakdown.)
- To study and perform the Maintenance of Mechanical Based Equipment/Devices/Machine: Overhauling/Serviceing of the following (Approximately. 4-5 students in each group) i. Head stock /Tail stock /Carriage of lathe ii. Indexing head/Milling table mechanism / True Chuck.
- Fault Tracing and Decision Tree: Monitor functionality of machine elements and try to judge faults in it. Develop a decision tree for the location of fault for any two items from the following-
 - Internal combustion (IC) engine. /Petrol Engine /Diesel Engine
 - Pump.
 - Reciprocating/Centrifugal pump
 - Machine tool.
 - Air compressor.
 - Electric motor.
 - Electrical Generator.
- Preventive Maintenance: Prepare a preventive maintenance schedule for any workshop or industry having- air compressors, car washing pumps, tire changers, lifts, welding machines, and wheel alignment.
- Industrial Safety: Demonstrate and explain the use of safety types of equipment. Discuss Different Factory Acts, Discuss Safety Before and During Disaster Demonstrate use of fire fighting and safety-related types of equipment.
- Study the report on the requirement and usage of safety equipment to prevent any hazards or accidents: i.e., safety helmets, gloves, eye protection/high-visibility goggles, safe clothing, safe footwear, and respiratory protective equipment (RPE).
- Maintenance Of household Hold Appliance Like Water cooler / Window AC/ Split AC / Refrigerator of the institute and make a report on it.

- Industrial Visit: Visit nearby Industries/plants/workshops/hospitals and collect samples of periodic & preventive maintenance formats. Arrange a visit to a nearby GIDC/Industrial Park/automobile workshop/machine shop.

Reference Books:

- Maintenance Engineering, H.P.Garg, S. Chand and Company.
- Maintenance Engineering Handbook, Higgins & Morrow, DA Information Services
- Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
- Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

List of Open-Source Software/learning website:

- <http://www.firesafetyfirst.co.uk/>
- <http://www.sasurieengg.com/e-course-material/MECH/IVYear%20Sem%208/ME2037%20ME.pdf>
- <https://www.slideshare.net/AnirudhGoyal4/maintenance-engineering-71967159>
- <https://www.machinerylubrication.com/Read/468/wear-rate-maintenance>
- <https://www.intechopen.com/books/tribology-fundamentals-and-advancements/lubrication-and-lubricants>
- https://prog.lmu.edu.ng/colleges_CMS/document/books/MCE321%20-%20Lubrication%20and%20Lubricants.pdf
- <http://home.iitk.ac.in/~vinaykg/Iset495.pdf>
- <https://ravimachines.com/lathe-machine-testing/>

Course Learning Outcomes (CLO):

- To ensure the desired plant availability at an optimum cost within the safety prescription.
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Students can know about the objectives of maintenance.
- To ensure the desired plant availability at the optimum cost within the safety precautions.
- To minimize the total cost of unavailability and resources.
- Explain the repair/recovery/retrofitting methods of different machines or elements.
- Students can recognize troubles with mechanical elements.
- Students can assemble, dismantle, and align mechanisms of various machine elements in sequential order.

Mapping of CLO with PO and PSO

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	H												H	M		
CLO2	H													H	L	
CLO3	H	M											M			
CLO4			M	L	L				M	L				M	L	
CLO5		H	M	L						L			H	M	M	
CLO6		M		M	L				M	L			M	L		
	M												H			

H: High, M: Medium, L: Low