

Course Code: 1ET4020404	Course Name: Plant Maintenance & Safety
Pre-Requisite	-----

RATIONALE:

Maintenance of equipment in industries is a very critical issue to ensure quality and quantity of production. Industries are not able to survive and progress if proper maintenance of equipment is not done. In the absence of proper maintenance, industries are busy in everyday firefighting to repair the breakdowns and manage production in a very unsafe manner. This course provides information about wear, corrosion, lubrication, preventive maintenance; decision tree to diagnose faults, important provisions of factory act, alignment of equipment, etc. This course also provides basic knowledge and skills regarding maintenance problems, their causes, and remedies in industries

Course Objective: -

The course content should be taught and implemented to develop different types of skills so that students can acquire the following competency:

- Manage maintenance operations satisfactorily by following safety rules.
- It would be very welcome for the students to get admission in the industries by getting such basic knowledge as they are selected in the operation and maintenance department in the industrial unit.
- The course covers maintenance as well as the Safety and Essential Factory Act which includes students' knowledge of Fire Safety, Road Safety, Mechanical Safety, Building Safety, Natural Hazard as well as First Aid Treatment which is an important requirement of today's industrial units.
- The subject will help the student to an understanding of maintenance, safety, machine installation recovery, reconditioning, and retrofitting in industrial units.

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
2	--	2	3	60	40	20	30

Subject Contents			
SR. 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 responsibility of maintenance department. • Types of maintenance. • Types and applications of tools used for maintenance. • Maintenance cost & its relation with replacement economy. • The service life of the equipment.	03	15
2.	Wear and Corrosion • Definition of Wear- its types, causes, and effects • The different methods used to reduce Wear. • The types and application of Lubricants • Different methods, with its working and applications used for Lubrication • Definition, principle, and factors affecting the corrosion. • Types of corrosion. • Different techniques used for the prevention of corrosion	06	20
3.	Periodic and preventive maintenance • Periodic inspection-concept and need. • Degreasing, cleaning, and repairing schemes. • Overhauling of mechanical components. • Overhauling of electrical motor. • Common troubles and remedies of Electric motor. • Repair complexities and their use. • Definition, need steps, and advantages of preventive maintenance. • Steps/procedure for periodic and preventive maintenance of: • Machine tools ii. Pumps. iii. Air compressors. iv. Diesel generating (DG) sets.	06	20

	• Program and schedule preventive maintenance of mechanical and electrical equipment. • Merits of Preventive maintenance. • Repair cycle and its concept with importance.		
4.	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.	04	15
5.	Installation, erection and commissioning of equipment • Design and planning of foundation. • Erection and commissioning of equipment. • Alignment and testing of equipment.	04	15
6.	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

Course Outcome:

The theory should be taught and practices should be carried out in such a manner that students can acquire different learning outcomes in the cognitive, psychomotor, and affective domains to demonstrate following course outcomes.

1. Recognize troubles in mechanical elements.
2. Assemble, dismantle and align mechanisms in sequential order.
3. Carry out plant maintenance using tribology, corrosion, and preventive maintenance.

List of Practical/ Experiments

1.	To Know Your Work And Work Area Study and demonstrate the use of various types of tools. (Fix spanners, box spanners, ring spanners, Allen keys, types of pliers, screwdrivers, bearing puller, etc.). Write Specification Of Lathe Machine, Shaper Machine, And Drilling Machine.
2.	Corrosion: Collect corroded parts. Also, discuss reasons. Students will collect corroded components (With Different Materials) from the field and identify the types of corrosion and possible causes. Students will also suggest prevention methods of Corrosion for the same Component.
3.	Wear Measurement Collect worn-out parts. Also, discuss reasons. Measure wears of anyone of the following. Machine guideways. Gear Train of Machine Shaft –sleeve. Piston –cylinder. Bearing.
4.	Fault Tracing and Decision Tree: Monitor functionality of machine element and try to judge fault in it. Develop a decision tree for the location of fault for any two items from the following- a. Internal combustion (IC) engine./Petrol Engine /Diesel Engine b. Boiler. c. Pump. Reciprocating/Centrifugal pump d. Machine tool. e. Air compressor. f. Electric motor. g. Electrical Generator.
5.	Maintenance of Mechanical Based Equipment/Device/Machine. Maintenance of any two from following. The batch may be divided into two groups and each group may be given one case. a. Headstock., b. Tailstock, c. Feed box, d. Indexing head. g. Internal combustion (IC) engine. h. Pump. (Dismantle of a given case, observe rules, follow the sequence of dismantling operations, cleaning, inspection, measuring deviations, recovery methods, testing and assembling).
6.	Preventive Maintenance: Prepare a preventive maintenance schedule of any workshop or industry having- air compressors, car washing pumps, tyre changers, lifts, welding machines, and wheel alignment.
7.	Industrial Safety: Demonstrate and explain the use of safety types of equipment. Discuss Different Factory Act, Discuss Safety Before and During Deagaster Demonstrate use of fire fighting and safety-related types of equipment.

8.	Industrial Visit: Visit nearby Industry/plant/workshop/hospital and collect samples of periodic & preventive maintenance format. Arrange a visit to a nearby GIDC/Industrial Park/automobile workshop/machine shop.
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List of References:

Sr no.	Title of Books	Author	Publication
1.	Maintenance Engineering	H.P.Garg	S. Chand and Company
2.	Maintenance Engineering Handbook	Higgins & Morrow	DA Information Services
3.	Pump-hydraulic Compressors	Audels.	McGraw Hill Publication.
4.	Foundation Engineering Handbook	Winterkorn, Hans.	Chapman & Hall London
5.	Maintenance of Machine Tools	Gilbirg & Morrow	

List of Software/Learning Websites:

- <http://www.firesafetyfirst.co.uk/>
- <http://www.sasurieengg.com/e-course-material/MECH/IV-Year%20Sem%208/ME2037%20ME.pdf>
- <https://www.slideshare.net/AnirudhGoyal4/maintenance-engineering-71967159>
- <https://www.trainanddevelop.ca/blog/fire-safety-training/>
- <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/lset495.pdf>
- <https://ravimachines.com/lathe-machine-testing/>