



## **C.U.SHAH UNIVERSITY – Wadhwan City**

**FACULTY OF:** - Technology and Engineering (Diploma Engineering)

**DEPARTMENT OF:** - Mechanical Engineering

**SEMESTER:** - VI                      **CODE:** - 2TE06MTN1

**NAME OF SUBJECT:** - Maintenance Engineering

### **Teaching & Evaluation Scheme:-**

Subject Code	Name of the Subject	Teaching Scheme				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hours	Marks	Hours	Pr/Viva	TW	Pr	
<u>2TE06MTN1</u>	Maintenance Engineering	4	0	2	6	5	30	1.5	70	3	--	20	30	150

### **Objective: -**

This subject provides knowledge regarding maintenance problems, their causes and remedies in industries. It is concern with competencies development for solving maintenance problems. By learning this subject, student will be able to diagnose faults in machineries of plant so that she/he can analyze and resolve it using various maintenance techniques to retain its operational condition for long period of time.

### **Prerequisites: -**

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency.

### **Course Outcomes: -**

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

### **Course outline:-**

Sr. No.	Course of contents	No. of Hours
1	<b>Fundamentals of maintenance engineering</b> 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, Service life of equipment.	06
2	<b>Tribology</b> Wear- types, causes , effects and Wear reduction methods, Lubricants-types and applications, Lubrication methods –General sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication.	06
3	<b>Corrosion and its prevention</b> Definition, principle and factors affecting the corrosion, Types of corrosion, Corrosion prevention methods like cathodic protection.	06

4	<b>Fault tracing</b> Fault tracing-concept and importance, Decision tree-concept, need and applications, Sequence of fault finding activities, show as decision tree, Draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipments like: Any one machine tool, Pump, Air compressor, Internal Combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.	05
5	<b>Periodic and breakdown maintenance</b> Types of faults in machine tools, Periodic inspection-concept and need, Degreasing, cleaning and repairing schemes. Breakdown maintenance-causes, strategies to attend, remedial actions, types of spares to be stored, examples. Overhauling of mechanical components like tail stock, lead screw and nut, ball and roller bearing, journal bearing, gear pump etc., Repair complexities and its use.	07
6	<b>Preventive maintenance</b> Definition, need, steps and advantages of preventive maintenance, Two major divisions of activities, Frequency cycle, Program and schedule of preventive maintenance, Repair complexity, Typical forms for preventive maintenance, Aids to a good preventive maintenance, its type and effect on preventive maintenance., Steps/procedure for preventive maintenance of: Machine tools, Pumps, Air compressors, Diesel generating (DG) sets. Program and schedule of preventive maintenance of mechanical and electrical equipments, Repair cycle-concept and importance.	08
7	<b>Condition monitoring</b> Need, scope and application of condition monitoring, various techniques	02
8	<b>Recovery, reconditioning and retrofitting</b> Definition of recovery, reconditioning and retrofitting, Methods of recovery and their applications, Selection criteria of recovery methods. Reconditioning - process, features and advantages, Retrofitting - concept, need and applications.	06
9	<b>Installation, erection and commissioning of equipments</b> Design and planning of foundation, Erection and commissioning of equipments, Alignment and testing of equipments.	05
10	<b>Industrial safety</b> Accident - causes, types, results and control, Mechanical and electrical hazards-types, causes and preventive steps/procedure. Safety awareness-need and ways to impart, Safety color codes, Methods of safe guarding machines and equipments, Fire prevention and fire fighting methods, Duties of fire and safety officer.	05

### Suggested List of Exercises/Practicals

- **Preparatory Activity**  
Study and demonstrate use of various types of tools. (Fix spanners, box spanners, ring spanners, allen keys, types of pliers, screw drivers, bearing puller, etc.).
- **Measurement of Wear**  
Measure wears of anyone of the given case: Machine guide ways, Shaft –sleeve, Piston –cylinder, Bearing.
- **Corrosion**  
Each student will collect corroded component from field and identify the types of corrosion and possible causes. Student will also suggest prevention methods.
- **Fault Tracing and Decision Tree**  
Identify fault with the help of decision tree for **any two** items from: Internal combustion (IC) engine, Boiler, Pump, Machine tool, Air compressor, Electric motor.
- **Maintenance of Mechanical Based Equipment/Device/Machine**  
Maintenance of any two(Batch may be divided in to two groups and each group may be given one case) from:Head stock, Tail stock, Feed box, Indexing head, Internal combustion (IC) engine, Pump.(Dismantle of given case, observe rules, follow sequence of dismantling operations, cleaning, inspection, measuring deviations , recovery methods, testing and assembling).

- **Preventive Maintenance**  
Prepare a preventive maintenance schedule of the typical workshop.
- **Safety**  
Demonstrate use of fire fighting and safety related equipments.
- **Test Chart**  
Prepare test chart of newly installed or repaired machine tool.
- **Condition monitoring**
- **Industrial Visit**  
Arrange visit to nearby automobile workshop/machine shop.

#### **Suggested List of Student Activities**

- Monitor functionality of machine element and try to judge fault in it.
- Visit nearby Industry/plant/workshop/hospital and collect samples of periodic & preventive maintenance format.

#### **Suggested Learning Resources**

##### **(A) List of Books**

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

##### **(B) List of Software/Learning Websites**

- [www.mt-online.com](http://www.mt-online.com)
- [www.pmxpert.com](http://www.pmxpert.com)
- [www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)
- [en.wikipedia.org](http://en.wikipedia.org)
- [webstore.ansi.org/preventive-maintenance](http://webstore.ansi.org/preventive-maintenance)
- [www.mapcon.com](http://www.mapcon.com)

##### **(C) List of equipments**

- Tool kit.
- Fire extinguishers.
- Lubricants.
- Cotton waste.
- Kerosene.
- Measuring instruments.