

SUBJECT TITLE : MAINTENANCE ENGINEERING
SUBJECT CODE : 5028
PERIODS/WEEK : 4
PERIODS/SEMESTER : 72
CREDIT : 4

TIME SCHEDULE

<u>MODULE</u>	<u>TOPIC</u>	<u>PERIODS</u>
1.		
1.1	Introduction maintenance engineering	8
1.2	Different types of maintenance	7
1.3	lubrication & maintenance chart	2
2	2.1 concept of Reliability , Maintainability ,&Availability	8
	2.2 Failure rate analysis	9
	Test – I	2
3	3.1 Vibration analysis and condition monitoring	17
4		
4.1	Ferrography and non destructive testing	5
4.2	Repairing methods of general purpose machine	6
4.3	Repairing of material handling equipments	6
	Test – II	2
	<u>TOTAL</u>	72

OBJECTIVES

- To enable the student to understand the principles, functions and practices adapted industry for successful maintenance activities

MODULE I

1.1.0 Introduction maintenance engineering

- 1.1.1 Understand the function maintenance department
- 1.1.2 Identify the Benefit of maintenance, maintenance economics
- 1.2.0 Study the Different types of maintenance
 - 1.2.1 Explain Preventive maintenance
 - 1.2.2 Explain Brake down maintenance
 - 1.2.3 Explain Routine maintenance
 - 1.2.4 Explain Planned maintenance
 - 1.2.5 Comparison between the above
- 1.3.1 Explain Condition monitoring
- 1.3.2 Explain Principle of lubrication, lubrication chart
- 1.3.3 Explain the use of maintenance chart
- 1.3.4 Explain use of computers in maintenance

MODULE II

- 2.1.0 Understand the concept of reliability, maintainability& availability
 - 2.1.1 Explain the term reliability,
 - 2.1.2 Explain the term Maintainability
 - 2.1.2 Explain the term Availability
 - 2.1.2.1 Explain Series and parallel system
 - 2.2.1 Explain the term Failure rate
 - 2.2.2. Explain Mean Time Between Failure, (MTBF)
 - 2.2.3 Explain time taken for repair (MTTR)
 - 2.2.4 Explain waiting time (MWR)
 - 2.3.1 Discuss Bath tub curve
 - 2.3.2 Identify the importance factors of availability

MODULE III

- 3.0.0 Understand vibration and its effect
 - 3.1.0 Explain the term Misalignment
 - 3.2.0 Explain Unbalance
 - 3.3.0 Understand Vibration monitoring and analysis
 - 3.3.1 Explain the methods of vibration analysis
 - 3.3.2 Explain Proximity analysis
 - 3.3.3 Explain Frequency analysis

- 3.3.4 Explain Real time estimation
- 3.3.5 Discuss vibration limits,, severity criteria &severity charts
- 3.4.0 Introduction condition monitoring
- 3.4.1 .Study the different method of CM
- 3.4.2 Explain temperature sensitive method
- 3.4.3 Explain pistol thermometer method
- 3.4.4 Explain wear debris analysis
- 3.4.5 Explain shock pulse analysis
- 3.4.6 Study the CM of Ball and Roller bearing
- 3.5.1 Discuss vibration signature
- 3.5.2 Study transducer for vibration measurement

Module –IV

- 4.1.0 Introduction to ferrography
- 4.1.1 Explain the procedure of spectral oil analysis
- 4.1.2 Explain the term non destructive testing
- 4.1.3 Study the liquid penetrant testing
- 4.1.4 Study the radio graphic testing
- 4.1.5 Study the ultrasonic testing
- 4.1.6 Study the Acoustic emission testing
- 4.1.7 Discuss corrosion monitoring
- 4.1.8 Study different method of corrosion monitoring
- 4.2.0 Repairing methods of general purpose machine
- 4.2.1 Study the failure analysis methods
- 4.2.2 Discus failure and its development
- 4.2.3 Explain logical fault location method
- 4.2.4. Explain sequential fault location method

CONTENTS

Module I

Basic concept, purpose and function of maintenance — Importance and benefits of sound Maintenance systems- types of maintenance - Maintenance categories –

Comparative merits of each category – Preventive maintenance, TPM .maintenance schedules, repair cycle - Principles and methods of lubrication –Condition Monitoring – Cost comparison with and without CM – Basic Principles of maintenance planning - principles of planned maintenance activity

Module II

Reliability : basic concepts – reliability, maintainability and availability- failure rate-mean time between failures – Reliability and machine availability – MTBF, MTTR and MWT- Bath tub curve – Factors of availability – Maintenance economics- system reliability- reliability of series and parallel systems- reliability estimation using exponential distribution function

Module III

misalignment - unbalance - vibration monitoring and analysis -vibration analysis - proximity analysis - frequency analysis - - real time analysis vibration limits vibration severity criteria vibration severity charts -Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis - shock pulse analysis - application - condition monitoring of ball and roller bearings - vibration signature analysis transducers for vibration measurement

Module IV

Ferrography - spectral oil analysis procedure - non destructive testing - liquid penetrant testing- radio graphic inspection-ultrasonic testing -acoustic emission- corrosion monitoring-resistance techniques- technique providing information on plant regarding corrosion monitoring

Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

Repair methods for Material handling equipment - Equipment records –Job order systems - Use of computers in maintenance.

TEXT BOOKS

1. Srivastava S.K., “Industrial Maintenance Management”, - S. Chand and Co., 1981
2. Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995

REFERENCES

1. White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979.
2. Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.

3. Higgins L.R., "Maintenance Engineering Hand book", McGraw Hill, 5th Edition, 1988.
4. Armstrong, "Condition Monitoring", BSIRSA, 1988.
5. Davies, "Handbook of Condition Monitoring", Chapman &Hall, 1996.
6. "Advances in Plant Engineering and Management", Seminar Proceedings - IIPE, 1996.
- 7 L.S. Sreenath vibration spectrum analysis -A practical approach