COURSE TITLE : MAINTENANCE ENGINEERING
COURSE CODE : 6026
COURSE CATEGORY : E
PERIODS/ WEEK : 4
PERIODS/ SEMESTER : 60
CREDIT : 4

TIME SCHEDULE

MODULE	TOPIC	PERIODS
1	Basic Concept of maintenance	15
2	Reliability	15
3	Misalignment & Imbalance	15
4	Ferrography	15
TOTAL		60

COURSE OUTCOME :

sl.no.	sub	student will be able to
1	1	Understand the basic concept of maintenance.
	2	Comprehend the principles of reliability.
	3	Understand the concept of misalignment and imbalance
	4	Understand the theory of Ferrography.

SPECIFIC OUTCOME

MODULE I

1.1.0 Understand the Basic concept of maintenance
1.1.1 Explain the importance and benefits of sound maintenance systems
1.1.2 Categorize the activities of maintenance
1.1.3 Compare the merits of each maintenance category
1.1.4 State the principles and methods of lubrication
1.1.5 Describe the condition monitoring and cost comparison with & without CM
1.1.6 Illustrate the basic principles of maintenance planning
1.1.7 Explain the principles of planned maintenance activity

MODULE II

2.1.0 Comprehend the principles of Reliability 2.1.concepts - reliability, maintainability and available
2.1.1 Determine the failure rate, mean time between failures, Reliability and machine availability

2.1.2 Illustrate Bath tub curve
2.1.3 Explain the Factors of availability
2.1.4 Estimate the reliability using exponential distribution function

MODULE III

3.1.0 Understand the concept of misalignment and imbalance
3.1.1 Describe the vibration monitoring and analysis
3.1.2 Identify the Methods and instruments for CM
3.1.3 Describe the wear debris analysis & shock pulse analysis, application and condition monitoring of ball & roller bearings
3.1.4 Illustrate the vibration signature analysis and transducers for vibration measurement

MODULE IV

4.1.0 Understand the theory of Ferrography
4.1.1 Describe the spectral oil analysis procedure
4.1.2 Describe the non-destructive testing methods
4.1.3 Identify the technique providing information on plant regarding corrosion monitoring
4.1.4 Identify the Repair methods for beds, slide ways, spindles, gears, lead screws and bearings
4.1.5 Describe the Failure analysis Methods
4.1.6 Explain the repair methods for Material handling equipment
4.1.7 Identify the use of computers in maintenance.

CONTENT DETAILS

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 -availability- failure rate-mean time between failures - Reliability and machine availability – MTBF- MTTR -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 - instruments for CM - Temperature sensitive tapes - Pistol thermometers - wear-debris analysis - shock pulse analysis - application -condition monitoring of ball - 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 - 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**

REFERENCE

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
3. White E.N., "Maintenance Planning", I Documentation, Gower Press, 1979.
4. Garg M.R., "Industrial Maintenance", S. Chand & Co., 1986.
5. Higgins L.R., "Maintenance Engineering Hand book", McGraw Hill, 5th Edition, 1988.
6. Armstrong, "Condition Monitoring", BSIRSA, 1988.
7. Davies, "Handbook of Condition Monitoring", Chapman &Hall, 1996.
8. "Advances in Plant Engineering and Management", Seminar Proceedings - IIPE, 1996.
9. L.S. Sreenath vibration spectrum analysis -A practical approach