5035 - MAINTENANCE ENGINEERING ✓

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
					Theory		Practical Ex.	Total
Lectures	Practical	Credits						
3	2	5	25	25	3 Hrs.	100	25 oral	175

Pre-requisite	Source
2004	MEC

Semester	Theory	Test	Total	TW	PR	Gr Total
	75	25	100	25	50	175

RATIONALE:- Every Mechanical engineer he works in the field of design, Production, projects, planning etc. has to have reasonable exposure to maintenance. As an Engineer working in the field of maintenance he should have thorough knowledge of the subject matter. A maintenance engineer should be accustomed to both the aspects of maintenance, namely field maintenance and maintenance management. This subject is aimed at imparting knowledge to students of mechanical engineering in both these areas.

COURSE CONTENT	Hrs	Mks
A. MAINTENANCE MANAGEMENT	5	10
1. CONCEPT OF MAINTENANCE		
1. Introduction to concept of maintenance: 1. Need for maintenance, Types of maintenance practices: Breakdown, preventive, predictive. Their comparison and areas of application		
2. Preventive maintenance, Importance of preventive maintenance, Schedules of preventive maintenance, Preventive maintenance programming, Manpower & machine scheduling, Colour coding, Case studies (any two)		
3. Concepts of online maintenance: Online maintenance: Need for online maintenance, safety aspects in online maintenance, Attending to joints, valves and pump leakage, Developing codes for temporary and safe closures of parts of machine or plants.		
4. Shutdown maintenance: Planning for a shutdown by using Pert and CPM technician, efficient use of manpower & machinery during shut down period, need for external maintenance services.		
5. Concept of corrective maintenance. Systematic recording of maintenance viz. Maintaining log Books, history cards etc.		
2. PREDICTIVE MAINTENANCE & CONDITION MONITORING	6	15
1 Importance of predictive maintenance		
2 Introduction to programming of predictive maintenance: Detection, analysis and correction, Organising predictive maintenance programme,		
3 Vibration as a parameter for condition monitoring, Introduction to vibration of simple spring mass system., Terminology used in vibration monitoring, Vibration amplitudes, Displacement, Velocity, Acceleration, Use & selection of vibration amplitude parameter, Detection of defects in rolling elements bearings & gear, Establishing levels of vibration, Baseline, warning & danger limits, Reference standards & charts used in defining levels, Introduction to concept of raw data & filtered data. Instruments used in vibration monitoring		
4 Displacement pickups: Velocity pickups, Accelerometers, Spike energy meter, Stroboscope etc.,		
5 Vibration analysis. Introduction to machine signatures, Analysis of common defects using vibration monitoring instruments viz Unbalance, misalignment, looseness & Defects in RC bearings.		
6 Introduction to noise monitoring (no question to be asked in examination)		
3. PLANNING & SCHEDULING MAINTENANCE WORK:	3	5
Work authorisation and control, Standard times for maintenance work, Work simplification in maintenance		

4. MAINTENANCE STORES AND CONTROL: Maintenance stores control, Maintenance store rooms, Inventory & classification of inventory related to maintenance, Standardisation of maintenance parts.	6	12
5. MAINTENANCE ESTIMATES Approach to maintenance estimation. Classification of jobs, Preparation of estimates, Estimating techniques and selection of estimating method.	3	4
6. MAINTENANCE, MANUAL AND REPORTS: Need for manuals and types of manuals., Contents of maintenance manuals, Manual writing or reporting, Maintenance practices.	3	6
B. MAINTENANCE PRACTICES		
7. RECONDITIONING OF WORN OUT COMPONENTS: Why and when to recondition; Reconditioning and repair of: a. Flat surfaces, b. Shafts and spindles, c. Bushes, d. Keys, Gears, e. Valves; Metal spraying, welding, grinding and re-boring for reconditioning, Balancing of reconditioned components	4	8
8. LUBRICATION: Types of lubricants : Liquid, semi fluid and solid, Requirements of lubricants, Selection of lubricants for various applications using some, available commercial grades, use of equivalence charts, Various modes of lubrication, Lubrication methods: Drip feed Ring type, Cup type, Wick, Forced lubrication; Lubrications schedules; Grease cups and greasing nipples; Use of grease gum / pressurised greasing	4	10
9. MAINTENANCE OF MACHINE COMPONENTS: Bearings: Pulling out and installing RC bearings, maintenance of journal bearings, Seals: Changing of oil seals, Attending a leaking gland, mechanical seals, Adjusting coupling, adjusting belt tensioners, Greasing of bearings, Clearing of filters, Keys: Removal & replacement of a broken key, Servicing of hydraulic pistons cylinder arrangement, Servicing of hydraulic and pneumatic valves	10	20
10. GAUGES IN MAINTENANCE: Linear measurement: Joint callipers, dividers, vernier callipers, micrometers, vernier height gauge, bore gauge, and depth gauge; Angular measurement: Bevel protractor; angle gauges; Measurement of surface finish: Stylus probe instruments. Tomilson's surface meter, straight edge.	4	10
Total	48	100

PRACTICAL: (any eight of the following)

1. One assignment on preparing maintenance schedule using pert and C.P.M. Technique.
2. One assignment on analysis of failure using condition-monitoring (data given)
3. One assignment on preparing maintenance estimate.
4. One assignment on study lubrication practices.
5. One assignment on use of maintenance manual
6. Study and demonstration of angle gauges.
7. Demonstration of stylus probe instrument.
8. Use of puller in pulling out gears, bearings, etc.
9. Study of different types of spanners and jacks used in maintenance.
10. To do static & dynamic balancing of rotating masses.
11. To replace grand packaging of a grand and stuffing box provided in a machine such as a pump.
12. Dismantling and assembly of different types of valves such as: i) Ping valve, ii) Feed valve, iii) Check valve, iv) Globe valve
13. Alignment of two rotating shafts connected through a coupling using different Maintenance equipment.

REFERENCE BOOK:

1. Installation, Servicing & Maintenance by S. N. Bhattacharya , S. Chand & Co.
2. Maintenance Engineering Handbook, by Lindley R. Higgins, Tata Mc Graw Hill Publisher
3. PERT & CPM by K.C. Jain & Agarwal, Khanna Publisher .
4. Industrial maintenance by Garg.