

2nd Semester

MT-551 RELIABILITY AVAILABILITY AND MAINTAINABILITY ENGINEERING

Introduction to Reliability Availability and Maintainability (RAM), Development of RAM Engineering, Reliability Availability and Maintainability utilization factors, down time consequences.

Reliability engineering fundamentals and applications, Historical perspectives, Definition of Reliability, Role of Reliability evaluation, Reliability assessment, relationship between different Reliability functions, typical Hazard functions, Mean time to failure, Cumulative Hazard function and average failure rate, Application of Probability distribution function in Reliability evaluation combinational Aspects of Reliability, Markov models optimization of system Reliability, Heuristic Methods applied to optimal system Reliability. Maintainability : Definition and application of Maintainability Engineering, Factors affecting Maintainability. Maintainability design criteria, operating and down time categories, Maintainability and its quantification, Mean time to activity restore an equipment, Mean Maintenance man hours, Mean time for corrective and Preventive Maintenance, Replacement Policies. Availability, types of Availability, approaches to increase equipment Availability.

References:

1. SERC School on RAM Engineering for Manufacturing servicing and Process Industries. : April 14-25 , 1997, IIT, Delhi.
2. Reliability Engineering Fundamentals : R. Ramakumar and Applications.
3. Maintainability, Availability and : Dimitri Kececelogu Vol. - I Operational Readiness Engineering
4. Reliability Engineering : Govil
5. Reliability Engineering : Balguruswamy

MT-552 FAILURE ANALYSIS & PREVENTION

Introduction: Engineering aspects of failure & failure analysis

Defects: Types and characteristics, Effects of defects on service properties

General Procedures for Failure Analysis

Basic Failure Mechanisms: Distortion Failures, Overload Failures, Fatigue Failures, Wear Failures, Corrosion Failures, Elevated Temperature Failures, Fractures.

Failure Analysis Techniques and Preventive Measures: Non Destructive Testing Techniques and Metallographic Techniques.

Component Failures: Bearings, Chain and Belt Drives, Gears, Lifting Equipments, Mechanical Fasteners, Pressure Vessel, Seals, Shafts, Springs

Failure Modes and Effect Analysis: Failure Modes, Categories of Failure Modes, Failure Effects, Sources of Information about modes and effects, failure consequences

Case Studies on failure Analysis

References :

1. Metals Hand Book 9th Edition, Vol. 11, Failure Analysis and Prevention.
2. Failure of materials in Mechanical Design: Analysis, Prediction and Prevention.-----Jacks A. Collins.
3. Metallurgy of Failure Analysis.-----A.K. Das.
4. CRC Hand book of lubrication Vol.I Application and maintenance.-----E.R.Boosy

MT – 553 TPM, CBM AND RCM

Introduction: Definition concept of TPM, characteristics of TPM, Benefits of TPM, losses of TPM, implementing TPM. Philosophy of TPM. Indications of TPM.

TPM Development: Preparation phase, TPM introduction education, TPM Promotion organization, TPM policies and goods, TPM Master Plan TPM initiatives, Implementation phase; consolidation phase.

Measuring TPM effectiveness: Philosophy of setting goals Measuring TPM effectiveness Indicators topos, Plant effectiveness quelling and Energy saving Maintenance Measuring TPM Benefits.

Application of TPM in Process Industries Administrative & Support departments and other Industrial enterprises

Reliability Centred Maintenance (RCM): Introduction its place in Maintenance policies & Hierarchy aims of RCM, steps in RCM implementation, steps in RCM analysis, system selection, RCM effectiveness indicators. Maintenance informer and efficiency.

RCM tasks Proactive Maintenance, Preventive and Predictive tasks. Scheduled restoration and scheduled discard . The P-F interval and P-F curves, linear as non linear PF curves , Default actions, RCM Decision diagrams. Implementation of RCM.

Condition Based Maintenance: Machine signatures, various techniques of signature analysis, temperature noise, vibration and wear particle analysis, on line and off line techniques.

References:

1. Seichi Nakajima TPM development : Productorly Press 1989.
Programme
2. Total Productive Maintenance : Vikas Bhaduri
3. Industrial / Maintenance & Management : S.K.Shrivastava.
4. Introduction to TPM – Total. : S Nakafiurea Productivity
Productive Maintenance Press Coimbatore 1988
5. Hand book of Condition Monitoring : By BKN Rao.
6. Reliability Centred Maintenance : John Monbray
7. Maintenance Engineering Hand book : Lindly & Higgins
8. Maintenance and spare parts Management : Gopal Krishnan & Banerji
9. Maintenance Management : Niebel

MTH – 504- ADVANCED MATHEMATICS

Complex Variables:

Differentiation, analytic functions, Cauchy-Raimann equations, Conjugate functions and their application to two dimensional potential problems, Conformal transformation. Integration, Cauchy's theory, Zero's and poles residues, applications of residue theorem in integration.

Differential Equations:

Partial differential equations, solution by separation of variables. Diffusion equation. Heat flow in a bar

Wave Equation:

Vibration of strings, vibration of circular membranes..

Numerical Methods in Engineering:

Solution of Polynomial Equation: Newton Raphson, Graffes's Braistow methods for nearly equal roots.

Solution of Differential Equations: Runge –Kutta method for first and second order equations. Adam Bash forth methods for corrotor and predictor. Numerical methods for partial differential equations of parabolic and hyperbolic type. Applications

FEM:

Variational Functionals, Euler Lagranges equation, Variational forms, Ritz method, Glarkin's method, discretization. Finite elements method for one dimensional problems

Laplace Transforms:

Elementary Laplace Transforms and theorem, solution of linear differential equations with constant coefficients. Heavyside unit functions, Dirac delta function, their Laplace transforms and application to practical problems, Fourier integrals.

Books:

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| 1. Engineering Maths | - Shrivastava & Dhavan |
| 2. Engineering Maths | - B.S. Grewal |
| 3. Higher Engineering Mathematics | - Krezing |
| 4. Int J. of Maths and Mathematical Sciences | |

MT -561 BULK SOLIDS AND HANDLING

Nature of Bulk Solids, Flow of bulk solids-gases/solid flow in pipelines, Mechanical Handling-Screw Conveying, Belt Conveying, Bucket Elevators, Vibratory Conveyors, Components of Pneumatic Conveying Systems-Feeding devices, Pipeline, Engaging and Disengaging ,Devices,Pneumatic Conveying System Design,Operational Problems-Erosive Wear,Product Degradation,Moisture.

References:

1. Handbook of Pneumatic Conveying Vol. 1 2005 :D.Mills,Mark G.Jones,V.Agarwal
2. A Practical Guide to Pneumatic Conveying Problems :V.Agarwal

MT- 562 MAINTENANCE OF ELECTRICAL MACHINES

Principals and planning of maintenance, heating and ventilation of electrical machines, mechanical features of electric motors, lubrication system, possible faults, their causes and repairs in A.C. single phase induction motors and D.C. motors, transformers, installation and commissioning of transmission lines and distribution lines, under ground cables, switch gears, house installation maintenance, importance of earthing, its testing and maintenance, fire fighting equipments, batteries.

References:

1. Parameter Estimation,Condition Monitoring and Diagonosis of Electrical Machines : P.Vas

MT – 563 MAINTENANCE OF POWER PLANT MACHINERY

Introduction to various systems of power plant e.g., boilers, fuel and ash handling equipments, steam turbine, condenser and feed heaters etc. Operation and maintenance of piping, plant, stokers, oil burners. Boiler tube corrosion and its prevention, maintenance of furnace and boiler accessories and mountings. Emergency actions, Boiler regulation / inspection. Boiler operations and safety precautions.

Operation and maintenance of coal handling, oil handling and ash handling plants. Predictive and preventive maintenance of steam turbine and its components. Erosion of blades and its prevention. Lubrication of bearings, valves etc. Steam path deposits, vibration monitoring, performance monitoring. Planned overhauls, general purpose steam turbine maintenance and repair, maintenance overview. Maintenance scheduling methods of detection of leaking and its prevention in the condensers, Condenser fault systems and its causes. On load and off load cleaning of condenser tubes, Maintenance scheduling of cooling water plants, cooling towers etc.

References:

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| 1. Plant Service and Operation Handbook | - | A.L. Kohan |
| 2. Practical Machinery Management for Process plants Vol. – IV - Major Process Equipment maintenance and repairs. | - | H.P. Bloch & F.K. Geitner |
| 3. Maintenance Engineering hand Book | - | Lindley & Higgins |
| 4. Steam turbine -Operation & Maintenance | - | Kearton |

MT – 564 MECHATRONICS AND NDT IN MAINTENANCE ENGINEERING

Mechatronics:

Introduction, Mechatronic systems, closed and open loop measurement systems, The Mechatronics approach, Sensors microprocessors and transducers, displacement, position and proximity pickups. Mechanical and Electrical activation systems.

Measurement Systems: Measurement errors, modelling measurement systems, system Reliability, signal conditioning & processing, Data acquisition and processing systems, Data presentation.

Applied Instrumentation : Measurement of mechanical and process parameters. Measurement of force, torque, temperature, pressure and flow. Measurement of displacement velocity and acceleration. Measurement of noise and vibration.

Non Destructive Testing: Visual inspection, crack detection techniques like magnetic crack detection, dye penetrant, radio graphy, oil analysis, wear particle analysis, strain gauge technology, ultra sonic crack detection, Thermography.

Machine Health Monitoring: Signature analysis and their significance, machine signatures, temperature, vibration, wear particle and noise monitoring, acceptable standards, online and offline techniques, performance trending, potential failure (P-f) curves.

References:

1. Handbook of Condition Monitoring :BKN Rao
2. Non-Destructive Examination :K.G. Bowling
3. Non-Destructive Testing :R. Halmshaw
4. Mechatronics :W. Bolton
5. Mechanical Measurements :T.G. Beckwith, , R.D. Marangoni and J.H. Lienhard
6. Measurement and Instrumentation Systems :W. Bolton