

1st Semester

MTH – 501 STATISTICS AND PROBABILITY

Collection & Tabulatory data. 2 Measures of central Tendency, Mean, Median, Mode. Dispersion, range, Deviation, Coefficient of Dispersion , Moments.

Probability:

Additive law of probability, Compound events, Use of multinomial Expansion, theorem. Probability density function.

Probability Distribution, Binomial, Poisson's and Normal weibill, experimental etc.

Sampling:

Simple Sampling, Sampling distribution the sampling of variables, estimation, distribution, chi-square distribution.

Interpolation:

Newton's Forward and Back ward interpolation formula, central difference interpolation formulae, Interpolation with unequal intervals.

Numerical Differentiation Numerical integration Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, weddlesrule .

Solution of Algebraic and Transcendental Equations, Method of false position, Newton Rap son method, Bisection method.

References:

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| 1. Engineering Reliability Fundamental and Application | R. Rama Kumar |
| 2. Mechanical Survival | J.H. Bampas – Smith |
| 3. Mathematical Statistic | M. Ray |
| 4. Mathematical Statistic | Fruend |

MT- 502 MAINTENANCE MANAGEMENT: POLICIES, STRATEGIES & OPTIONS

Introduction

Maintenance, Need of Maintenance Management, Maintenance Policies, Strategies and options in Maintenance management. Maintenance forms/actions and their inter relationships, Brief descriptions of various Maintenance actions.

Maintenance Organisations:

Prerequisites, factors determining effectiveness of a Maintenance organization, objectives of organization design, types of organization.

Maintenance Planning and Control:

Establishing a Maintenance Plan-Preliminary considerations, Systematic method of Maintenance Plan and schedule planning and schedule of Plant shut downs, Maintenance practices on production machines- Lathe, Drilling, Milling, Welding, Shaper Use of computer in maintenance, Machine Reconditioning.

Evaluation of Maintenance Management:

Need for evaluation a to z objectives, criterion of evaluation.

Spare Parts Management:

Capacity utilization, cost reduction approach to spares, reliability and quality of spares, spare parts procurement, inventory control of spare parts.

References:

1. Maintenance Management Policies, Strategies and Options: July 27–29 , 2000, Lecture notes MACT, Bhopal.
2. Maintenance & Spare Parts Management. :P. Gopal Krishnan & A.K. Banerji
3. Hand Book of Reliability Engineering & Management :W. Grant Ireson and Clyde F – McGraw Hill

4. Maintenance Planning & Control:Anthony Kelley – East West Press.
5. System Reliability & Maintenance Management : Balbir S. Dhillon.
6. Industrial Maintenance Management : S.K. Shrivastava

MT – 503 LUBRICATION MANAGEMENT AND PRACTICES

Introduction, historical background, lubrication- an important function of maintenance, purpose of lubrication, classification of lubricants, characteristics of lubricating oils - viscosity, viscosity index, flash point and fire point, pour point and cloud point, carbon residue, resistance to oxidation. Thermal stability, resistance to foaming & emulsification, additives-detergents, antifoam, antirust/anticorrosion inhibitors, antioxidants, extreme pressure additives, pour point depressants, emulsifying agents, emulsion breakers, oiliness additives & viscosity improvers, categories of lubricating oils - turbine grade oils, hydraulic oils, automotive engine oils, gear oils, machine oils, spindle oils & refrigeration oils, selection of lubricating oils, lubricating greases, categories of greases-soap base greases-calcium soap greases, sodium soap greases, lithium soap greases & non-soap base greases, characteristics of greases-penetration or consistency, drop point, heat stability, oxidation stability, selection of lubricating greases, greasing practices, testing of lubricants, test standards, lubrication methods, characteristics of lubricating devices and systems, planned lubrication, lubrication survey, standardization of lubricants, organising planned lubrication, lubricant storage and handling and control of lubrication costs.

References:

1. CRC Hand Book of Lubrication and Tribology Vol. I – Vol. III CRC Press Inc.USA,1994
2. Basic Lubrication Theory :A Cameron

MT-504 THEORY OF TRIBO ELEMENTS

I. Introduction to Tribology:

Back ground , engineering surface, laws of friction, sliding & rolling, dry and lubricated friction, lubricated friction. Wear, its types, abrasive, adhesive, corrosive, erosive, fretting, fatigue & cavitation wear, practical examples, wear reduction measures, prevention of wear,

II. Lubrication Principle :

Principle of lubrication, lubrication regimes, boundary lubrication, Hydrodynamic and Hydrostatic lubrication, Elasto hydrodynamic lubrication, types of lubricants, solid, liquid, semi solid and gaseous lubricants, lubricant additives.

III. Tribo Elements - I - Bearings :

Bearings types, journal bearings, important parameters for better performance, special additives, rolling element bearings, their types and important parameters in their selection.

IV. Tribo Elements - II – Gears:

Gears, gear types, gear drives, gear loces and reduction gears, selection of gear drives, gear lubrication and maintenance, gear failures. Chains for power transmission, types, service factors, maintenance and lubrication of chains.

V. Tribo Elements - III - Seals :

Metallic and elastomeric seals, non contacting seals for rotating shafts, radial lip seals, mechanical face seals, selection of seal types for rotating shaft application. Seal failure, its analysis. Practical consideration in use of seals.

References:

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| 1. Basic Lubrication Theory | : | A Cameron |
| 2. Friction and Lubrication in Mechanical Design | : | A.A. Seireg |
| 3. CRC Hand book of lubrication – Vol. II | : | Ed. E.Richard Booser |
| 4. Hand Book of fluid sealing | : | Ed-R.V. Brink |

MT – 511 MAINTENANCE AUDIT

A Methodology for auditing the industrial maintenance function.

The purpose and procedures of such auditing.

An outline with examples of a full audit, a snapshot audit and a fingerprint audit.

Information gathering strategy.

Information gathering techniques: models, questionnaires, survey forms.

An outline of an aide-memoire based on the audit methodology.

Methods of interviewing.

Analysis of data: the analysis procedure, identification of problem areas, developing improved organisations and systems.

Reporting: the report structure, the audit section, the proposal section.

A major part of the course will be devoted to the discussion and analysis of actual audit reports. This will include use of audit data to identify problems, their causes and solutions.

References:

1. GIP Quality Audit Manual : Milton A. Anderson
2. ISO 14000 EMS Audit Hand book :Gregory P Johnson

MT – 512 RISK ANALYSIS AND SAFETY

Risk management and analysis during operation.

Risk analysis and management during system procurement and installation.

Role of maintenance and inspection in risk management.

Risk minimization through operation and maintenance feed back in design.

Strategies for safety of equipment and personnel and emerging trends in design of power plants to reduce fire risk.

Risk and hazards in chemical industries.

Risk and safety assessment in defence equipment.

Risk management in EHV transmission systems.

Risk man & Risk management in steel cord conveyors.

Introduction, safety legislation, causes of accidents, role of maintenance in plant safety, Industrial hazards and controls of Mechanical hazards and electrical hazards. Toxic, physical and five hazards. Organising safety programme, safety, policies, the safety organization. Safety message, safety training, safety audits and controls, safety in manual material handling, safety in lifting heavy loads. Safety in chemical handling

References:

1. Risk Analysis and Security Survey : John F. Border
2. Fundamentals of Risk Analysis and Risk Management :Vlasta Molar

MT –513 CONCURRENT ENGINEERING

Introduction to Concurrent Engineering, Fundamentals of CE, Need and basic principles of CE, Benefits of implementation of CE, Introduction to various integrating mechanisms, forming of CE team.

Teamwork: Interfacing of manufacturing and design, selection of key techniques and methodologies, selection of CE tools.

Quality by design: Quality Function Deployment methodology, Taguchi methods of robust design, Design for manufacturability: Virtual manufacturing, , Introduction to Value Engineering, Value Engineering analysis and techniques, Design for assembly : Introduction to various DFA technologies.

Rapid Prototyping: Need and use of RP, various RP technologies, Design for Reliability: Reliability fundamentals and design for reliability principles, Design for Serviceability: Factors affecting serviceability, serviceability evaluation, Design for Maintainability and Economics.

References: -

- 1.) John. R. Hartley, Susmu Okamoto. "Concurrent Engineering, shortening lead times, raising quality & lowering costs".
- 2.) Don Clausing, "Total quality development, a step by step guide to world class concurrent engineering".
- 3.) Thomas A. Salomone, " Concurrent engineering, what every engineer should know about series".

MT-514 MAINTENANCE OF AGRICULTURAL AND EARTH MOVING MACHINERY

Maintenance scheduling, predictive and preventive maintenance, machine health monitoring systems, spare parts – inventory and maintenance.

Fault diagnosis, rectification servicing and repairs of various components/systems of agricultural equipments and earth moving machinery, fault diagnosis and manuals.

Special problems associated with heavy earth moving equipments and their solutions.

Planning and design

References:

1. Hand book of Maintenance: Lindley R. Higgins

MT – 515 MAINTENANCE AWARENESS IN DESIGN

Design activity: design modules, what makes for good design, design levels. Systems engineering.

M+R parameters that can be usefully used in design. Design reviews.

Design evaluation. Creative design.

Design detail. Design contractual agreements.

Decision analysis. Ergonomic considerations.

Industrial case studies.

References:

1. Parking Structures Planning ,Design ,Construction, Maintenance and Repair : A.P.Chrest,Mary S. Smith
2. Asset Maintenance Management Aguide to developing strategy and improving performance: A.Wilson