COURSE STRUCTURE & SYLLABUS OF
MASTER OF TECHNOLOGY (M.TECH)

In

Mechanical

Course Structure

First Year

First Semester

Paper Code	**Subject**	**Marks**	**Credits**
MFM1	Machine Vibration Analysis	100	4
MFM2	Advanced Mechanics of Solids	100	4
MFM3	Concurrent Engineering	100	3
MFM4	Management of Technology	100	3
MFM5-L	Lab Practice I	50	2

Syllabus

MFM1 MACHINE VIBRATION ANALYSIS

1. OSCILLATORY MOTION

Harmonic Motion, Periodic Motion, Vibration Terminology.

2. FREE VIBRATION

Vibration Model, Equations of Motion – Natural Frequency, Energy Method, Rayleigh Method : Effective Mass, Principle of Virtual Work, Viscously Damped Free Vibration, Logarithmic Decrement, Coulomb Damping.

3. HARMONICALLY EXCITED VIBRATION

Forced Harmonic Vibration, Rotating Unbalance, Rotor Unbalance, Whirling of Rotating Shafts, Support Motion, Vibration Isolation, Energy Dissipated by Damping, Equivalent Viscous Damping, Structural Damping, Sharpness of Resonance, Vibration Measuring Instruments.

4. INTRODUCTION TO MULTI-DEGREE OF FREEDOM SYSTEMS

Normal Mode Vibration, Co-ordinate Coupling, Forced Harmonic Vibration, Digital Computation, Vibration Absorber, Centrifugal Pendulum Vibration Absorber, Vibration Damper.

5. PROPERTIES OF VIBRATING SYSTEMS

Flexibility Matrix, Stiffness Matrix, Stiffness of Beam Elements, Eigenvalues and Eigenvectors, Orthogonal Properties of the Eigenvectors, Repeated Roots, Modal Matrix P, Modal Damping in Forced Vibration, Normal Mode Summation.

6. LAGRANGE'S EQUATION

Generalized Co-ordinates, Virtual work, Lagrange's Equation, Kinetic Energy, Potential Energy, and Generalized Force.

7. NORMAL MODE VIBRATION OF CONTINUOUS SYSTEMS

Vibrating String, Longitudinal Vibration of Rods, Torsional Vibration of Rods, Euler Equation for Beams, Effect of Rotary Inertia and Shear Deformation.

8. APPROXIMATE NUMERICAL METHODS

Rayleigh Method, Dunkerley's Equation, Rayleigh-Ritz Method, Method of Matrix Iteration, Calculation of Higher Modes.

9. NUMERICAL PROCEDURES FOR LUMPED MASS SYSTEMS

Holzer Method, Digital Computer Program for the Torsional System, Myklestad's Method for Beams, Coupled Flexure- Torsion Vibration, Transfer Matrices, Systems with Damping, Geared System, Branched Systems, Transfer Matrices for Beams, Difference Equation.

Reference Books:

1. Theory of Vibrations with Applications: W T Thomson CBS Publishers Delhi
2. Mechanical Vibrations : S S Rao Addison-Wesley Publishing Co.
3. Fundamentals of Vibration : Leonard Meirovitch , McGraw Hill International Edison.
4. Principles of Vibration Control : Asok Kumar Mallik, Affiliated East-West Press.
5. Mechanical Vibrations A H Church ,John Wiley & Sons Inc
6. Mechanical Vibrations J P Den Hartog ,McGraw Hill.
7. Mechanical Vibration Analysis : Srinivasan ,McGraw Hill.
8. Mechanical Vibrations : G K Groover.
9. Vibration and Noise for Engineers: Kewal Pujara , Dhanpat Rai & co.

MFM2 ADVANCED MECHANICS OF SOLIDS

1. ANALYSIS OF STRESS

Introduction, The State of Stress at a point, Normal and Shear Components, Rectangular Stress Components, Principal Stresses, Recapitulation, The State of Pure Shear, The Plane State of Stress.

2. ANALYSIS OF STRAIN

Introduction, Deformations, Deformation in the Neighbourhood of a Point, Change in Length of a Linear Element, Change in Length of a Linear Element – Linear Components, Rectangular Strain Components, The State of Strain at a point, Plane State of Strain, Compatibility Conditions, Strain Deviator and its Invariants.

3. STRESS – STRAIN RELATIONS FOR LINEARLY ELASTIC SOLIDS

Introduction, Generalised Statement of Hooke's Law, Stress-Strain Relations for Isotropic Materials, Modulus of Rigidity, Bulk Modulus, young's Modulus and Poisson's Ratio, Relations between the Elastic Constants, Displacement Equations of Equilibrium.

4. THEORIES OF FAILURE & IDEALLY PLASTIC SOLIDS

Maximum Principal Stress Theory, Maximum Shearing Stress theory, maximum elastic strain theory, Significance of Theories of Failure, Factors of Safety, Stress Space & Strain Space, Plastic Flow.

5. ELASTIC STABILITY

Euler's Buckling Load, Beam Column, Equation (All Cases)

Reference Books:

1. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, New Delhi
2. William Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series, McGraw-Hill International Edition.
3. Srinath L.N, Advanced Mechanics of Solids, Tata McGraw-Hill Publishing Co., New Delhi,

MFM3 CONCURRENT ENGINEERING

1. INTRODUCTION TO PRODUCT DESIGN : ASIMOW'S MODEL

Definition of Product Design, Design by Evolution, Design by Innovation, Essential Factors of Product Design, Production-Consumption Cycle, Flow and Value Addition in the Production-Consumption Cycle, The Morphology of Design (The Seven Phases), Primary Design Phases and Flowcharting – The 25 Steps, Role of Allowance, Process Capability, and Tolerance in Detailed Design and Assembly, Summary of Detailed Design Phase.

2. PRODUCT DESIGN PRACTICE AND INDUSTRY

Introduction, Product Strategies, Time to Market, Analysis of the Product, The Three S's, Standardization, Renard Series (Preferred Numbers), Simplification, The Designer and His Role, The Designer : Myth and Reality, The Industrial Design Organization, Basic Design Considerations, Problems faced by Industrial Designer, Procedure adopted by Industrial Designer, Types of Models designer by Industrial Designers, What the Designer contributes, Roles of Aesthetics in Product design, Functional Design Practice

3. STRENGTH CONSIDERATION IN PRODUCT DESIGN

Principal Stress Trajectories (Force-Flow Lines), Balanced Design, Criteria and Objectives of Design, Material Toughness: Resilience, Designing for Uniform Strength, Tension vis-à-vis Compression

4. DESIGN FOR STIFFNESS AND RIGIDITY

Pure Struts and Pure Columns, Structure involving both Tension and Compression members,, Mapping of Principal Stress, Buckling and Instability, Theory of Long Columns, Hollow Columns, Plastic Design, Practical Ideas for material Saving in design, Ribs, Corrugations, Laminates and Membranes

5. PRODUCTION PROCESSES

Introduction, Primary Processes, Machining Processes, Non-traditional Machining Processes.

6. DESIGN FOR PRODUCTION – METAL PARTS

Producibility Requirements in the Design of the Machine Components, Forging Design, Pressed Components Design, Casting Design, Design for Machining Ease, The Role of Process Engineer, Ease of Location and Clamping, Some Additional Aspects of Production Design, Die Casting and Special Castings, Design of Powder Metallurgical Parts, Expanded Metals and Wire Forms

7. OPTIMIZATION IN DESIGN

Introduction, Siddal's Classification of Design Approaches, Optimization by Differential Calculus, Lagrange Multipliers, Linear Programming (Simplex Method), Geometric Programming, Johnson's Method of Optimum Design

8. ECONOMIC FACTORS INFLUENCING DESIGN

Product Value, Design for Safety, Reliability and Environmental Considerations, Manufacturing Operations in Relation to Design, Economic Analysis, Profit and Competitiveness, Break-even Analysis, Economics of a New Product Design (Samuel Eilon Model)

9. HUMAN ENGINEERING CONSIDERATIONS IN PRODUCT DESIGN

Introduction, Human Being as Applicator of Forces, Anthropometry: Man as Occupant of Space, the Design of Control, the Design of Displays, Man/Machine Information Exchange.

10. VALUE ENGINEERING AND PRODUCT DESIGN

Introduction, Historical Perspective, What is Value? Nature and Measurement of Value, Maximum Value, Normal Degree of Value, Importance of Value, The Value Analysis job plan, Creativity, Steps to Problem – solving and Value Analysis, Value Analysis Tests, Value Engineering Idea Generation Check list, Cost reduction through Value Engineering Case Study on Tap Switch Control Assembly, Material and Process Selection in Value Engineering.

11. ROLE OF COMPUTER IN PRODUCT DESIGN, MANUFACTURING AND MANAGEMENT

CAD/CAM: Some Definitions, Product Cycle and CAD/CAM, Role of Computer in Manufacturing, Role of Computer in Design Process, Creation of a Manufacturing Database,

Computer Integrated Manufacturing, Communication Networks, Group Technology, Production Flow Analysis (PFA), Computer Aided Process Planning (CAPP), Material Requirement Planning (MRP), Moving Towards Total Automation: Role of Artificial Intelligence, Flexible Manufacturing Systems, Just-In-Time (JIT) Manufacturing

12. MODERN APPROACHES TO PRODUCT DESIGN

Concurrent Design, Quality Function Development (QFD), Rapid Prototyping

13. QUALITY ASSURANCE IN PRODUCT DESIGN AND MANUFACTURING

Evolution of Quality Concepts and Applications, Quality and Design Spiral, Theory of Sampling Inspection, Control Charts and In-process Monitoring of Quality, Quality of Performance: Reliability and Allied Topics Taguchi Method of Robust Design of Products, Six-Sigma Quality Concepts.

Reference Books:

1. Concurrent Engineering Kusiak John Wiley
2. Concurrent Engineering Menon Chapman & hall

MFM4 : MANAGEMENT OF TECHNOLOGY

1. NATURE OF ORGANIZATION

Introduction, objectives, the need for corporate objectives, the mission statement, managing by objectives, the legal establishment of organizations, companies, franchising, strategies for survival, strategic marketing, simultaneous engineering , manufacturing strategies

2. FUNCTIONS OF ORGANIZATION

Introduction, objectives, purchasing, the role of the purchasing function, organization of the purchasing function, activities in purchasing, management activities in the operations area, organization of manufacturing, market research, customers and markets, sales, finance, organization of the finance department, Activities of the finance department, product development, Activities of the product development function, organization of the product development function, research , quality, quality systems, management activities in the quality function, organization of the quality function, personnel, manpower planning, employee appraisal, recruitment and selection, company operation and the role of engineers.

3. PRODUCT DEVELOPMENT

Introduction, objectives, customer and product development, product life cycles and gap analysis, gap analysis , the ideal product development process, managing the product development process, models of the process, pugh, pahl and beitz, company structure for product development, research, development, engineering and manufacturing (rdem), project approach, matrix, finance and product development, management techniques in product development, identifying customer needs, product design specification (pds), decision making, drawings and drawing management, drawing in practice, the drawing office, preparation, drawing release, drawing modification, design reviews, intellectual property rights, trade marks.

4. OPERATIONS MANAGEMENT

Introduction, objectives, organization of manufacturing, job production, batch production, flow production, group technology, production planning and control, part specifications., product data, economic batch quantity, the schedules, materials management, purchasing, centralization and decentralization of purchase department, purchasing procedure, stores, material requirement planning (mrp), terms used in material requirements planning.,

dependent demand, lumpy demand, lead time, how mrp uses lead time information, master production schedule (mps), bill of material (bom) file, inventory status file., output of mrp, benefits of mrp, drawbacks of mrp, just in time (jit) in production system, push system vs pull system, kanban and pull system, calculation for number of kanban, an analogy to jit, requirements for implementing jit, preliminaries to jit production, jit production process, evaluation of jit production.

5. QUALTIY MANANGEMETN

Introduction, objectives, inspection and test, quality control, quality assurance and iso 9000, total quality management (tqm), what is quality, dimensions of quality, total quality management (tqm), quality gurus, deming's approach to tqm, joseph m. Juran, principal objectives of tqm principal objectives of tqm, management in tqm, elements of tqm, Customer satisfaction evalution, seven qc tools for improvement, implementation of tqm, iso 9000, iso 9000 vs tqm, standards indian standard institution, bis publications.

6. PROJECT PLANNING AND MANAGEMENT .

Introduction, objectives, projects and management, network analysis, finding the critical path, project float, gantt charts, resource analysis, planning under uncertainty

7. PERSONNEL MANAGEMENT.

Introduction, objectives, structure of organizations, methods of company organization, deployment of personnel, factors that affect company organization, product and manufacturing system, functions and expertise, definition of personnel management, principles of personnel management , functions of personnel management, recruitment and selection of employees manpower planning, types of manpower planning, steps in manpower planning, procedure of appointing an employee in a factory, training and development, organisation of training programme, principles of training, method of training operating employees, methods of traning foreman and supervisors, methods of training executives or managerial executive development, appraisal of employees, the aims of an appraisal scheme, formal appraisal schemes, the appraisal form, the appraisal interview, two- interview appraisals, the implications of an appraisal system, motivation, human needs, moslow's theory of motivation, leadership introduction, different styles of leadership are as follows.

8. TEAM WORKING AND CREATIVITY

Introduction, objectives, overview, team working, holistic teams, group dynamics, the needs of the group, meeting these needs –group dynamics, norms, group culture, managing the creative process., planning innovation, planning techniques for the innovative process, problem solving, brainstorming., decision making, start with objectives

9. COMMUNICATION SKILL

Introduction, objective, communication in the workplace, the purpose of a communication system., communication methods and aids., information gathering, sources of information, assimilation and organizing information ,written communication, factor affecting written communication, preparation of creative writing, specific writing techniques, using a computer for written communication, oral communications, factors that affect oral communications, active listening, oral presentations, making the presentation, interviews, negotiations, the telephone, managing meetings

10. THE VOCATION OF ENGINEERING MANAGEMENT.

Introduction, objectives, the cu100 project at oxford lasers ltd, cutomer requirements, recruitment, the design report, detailed design and manufacture, problems and delays, disconnection safety, testing, epilogue, the cu 100 project debrief, communication skills.

Reference Books:

1. Strategic Technology Management – Betz. F. – McGraw-Hill.
2. Management of Technology – Tarek Khalli -, McGraw-Hill.
3. Strategic Management of Technological Innovation – Schilling – McGraw-Hill, 2nd ed.
4. Managing Technology and Innovation for Competitive Advantage – V K Narayanan -Pearson Education Asia
5. Strategic Management of Technology & Innovation – Burgelman, R.A., M.A.
6. Madique, and S.C. Wheelwright -. Irwin.
7. Handbook Of Technology Management – Gaynor – Mcgraw Hill
8. Managing New Technology Development – Souder, W.C. and C.M. Crawford -McGraw-Hill.
9. Managing Technological Innovation – Twiss, B. -. Pitman.
10. Bringing New technology To Market – Kathleen R Allen – Prentice Hall India
11. Management Of New Technologies For Global Competitiveness — Christian N Madu – Jaico Publishing House

COURSE STRUCTURE & SYLLABUS OF
MASTER OF TECHNOLOGY (M.TECH)

In

Mechanical

Course Structure

First Year

Second Semester

Paper Code	Subject	Marks	Credits
MFM5	Applied Elasticity	100	4
MFM6	Finite Elements Methods in Engineering	100	4
MFM7	Mechanical Estimating & Costing	100	3
MFM8	Materials Mgmt .& Materials Handling	100	3
MFM9-L	Lab Practice II	50	2

Syllabus

MFM5 APPLIED ELASTICITY

1. BASIC EQUATIONS OF ELASTICITY

Introduction, The State of Stress at a Point, The State of Strain at a Point, Basic Equations of Elasticity, Methods of Solution of Elasticity Problems, Plane Stress, Plane Strain, Spherical Co-ordinates, Computer Program for Principal Stresses and Principal Planes.

2. TWO-DIMENSIONAL PROBLEMS IN CARTESIAN CO-ORDINATES

Introduction, Airy's Stress Function – Polynomials : Bending of a cantilever loaded at the end ; Bending of a beam by uniform load, Direct method for determining Airy polynomial : Cantilever having Udl and concentrated load of the free end; Simply supported rectangular beam under a triangular load, Fourier Series, Complex Potentials, Cauchy Integral Method , Fourier Transform Method, Real Potential Methods.

3. TWO-DIMENSIONAL PROBLEMS IN POLAR CO-ORDINATES

Basic equations, Biharmonic equation, Solution of Biharmonic Equation for Axial Symmetry, General Solution of Biharmonic Equation, Saint Venant's Principle, Thick Cylinder, Rotating Disc on cylinder, Stress-concentration due to a Circular Hole in a Stressed Plate (Kirsch Problem), Saint Venant's Principle, Bending of a Curved Bar by a Force at the End.

4. TORSION OF PRISMATIC BARS

Introduction, St. Venant's Theory, Torsion of Hollow Cross-sections, Torsion of thin-walled tubes, Torsion of Hollow Bars, Analogous Methods, Torsion of Bars of Variable Diameter.

5. BENDING OF PRISMATIC BASE

Introduction, Simple Bending, Unsymmetrical Bending, Shear Centre, Solution of Bending of Bars by Harmonic Functions, Solution of Bending Problems by Soap-Film Method.

6. BENDING OF PLATES

Introduction, Cylindrical Bending of Rectangular Plates, Slope and Curvatures, Lagrange Equilibrium Equation, Determination of Bending and Twisting Moments on any plane, Membrane Analogy for Bending of a Plate, Symmetrical Bending of a Circular Plate, Navier's Solution for simply supported Rectangular Plates, Combined Bending and Stretching of Rectangular Plates.

7. THIN SHELLS

Introduction, the Equilibrium Equations, Membrane Theory of Shells, Geometry of Shells of Revolution.

12. NUMERICAL AND ENERGY METHODS

Rayleigh's Method, Rayleigh – Ritz Method, Finite Difference Method, Finite Element Method.

13. HERTZ'S CONTACT STRESSES

Introduction, Pressure between Two-Bodies in contact, Pressure between two-Spherical Bodies in contact, Contact Pressure between two parallel cylinders, Stresses along the load axis, Stresses for two Bodies in line contact Exercises.

14. STRESS CONCENTRATION PROBLEMS

Introduction, Stress-Concentration Factor, Fatigue Stress-Concentration Factors.

Reference Books:

1. Timoshenko.S and Goodier.J.N.," Theory of Elasticity", Mc Graw Hill Book Co., Newyork, 1988
2. Sadhu sing.," Theory of Elasticity", Khanna Publishers,New Delhi.1988
3. Advanced Strength and Applied Elasticity by Ugural and Fenster, PTR, Fourth Edition.

MFM6 FINITE ELEMENTS METHODS IN ENGINEERING

1. INTRODUCTION

Introduction. Historical Background. Design Considerations. Need of Finite Element Method. The Process Of Finite Element Method, Field And Boundary Conditions, Steps Involved In Fem, The Standard Discrete System , Transformation Of Co-Ordinates.

2. FINITE ELEMENTS OF ELASTIC CONTINUUM DISPLACEMENT APPROACH

Introduction, Direct Formulation Of Finite Element Characteristic, Generalized Nature Of Displacements, Strains, And Stresses, Generalization To The Whole Region--Internal Nodal Force Concept Abandoned, Displacement Approach As A Minimization Of Total Potential Energy, Convergence Criteria, Discretization Error And Convergence Rate, Displacement Functions With Discontinuity Between Elements--Non-Conforming Elements And The Patch Test, Bound On Strain Energy In A Displacement Formulation, Direct Minimization.

3. GENERALIZATION OF THE FINITE ELEMENT CONCEPTS WEIGHTED RESIDUAL AND VARIATIONAL APPROACHES

Introduction, Weighted Residual Methods, Approximation To Integral Formulations: The Weighted Residual Method, Virtual Work As The 'Weak Form' Of Equilibrium Equations For Analysis Of Solids Or Fluids, Variational Principles, Establishment Of Natural Variational Principles For Linear, Self-Adjoint Differential Equations, Maximum, Minimum, Or A Saddle Point, Constrained Variation Principles, Lagrange Multipliers And Adjoin Functions.

4. STRAIN PLANE STRESS AND PLANE

Introduction, Element Characteristics, Some Practical Applications, Special Treatment Of Plane Strain With An Incompressible Material.

5. AXI-SYMMETRIC STRESS ANALYSIS

Introduction, Element Characteristics, Some Illustrative Examples.

6. THREE – DIMENSIONAL STRESS ANALYSIS

Introduction, Tetrahedral Element Characteristics.

7. ELEMENT SHAPE FUNCTIONS SOME GENERAL FAMILIES OF C_0 CONTINUITY

Introduction, Two – Dimensional Elements, Completeness Of Polynomials, Rectangular Elements – Lagrange Family, Rectangular Elements – 'Serendipity' Family, Triangular Element Family, One-Dimensional Elopements, Three-Dimensional Elements, Other Simple Three-Dimensional Elements.

8. CURVED, ISOPARAMETRIC ELEMENTS AND NUMERICAL INTEGRATION

Introduction, Parametric Curvilinear Co-Ordinates, Geometrical Conformability Of Elements, Variation Of The Unknown Function With In Distorted, Curvilinear, Elements, Continuity Requirements, Transformations, Element Matrices, Area And Volume Co-Ordinates, Convergence Of Elements In Curvilinear Co-Ordinates, Numerical Integration.

9. SOME APPLICATIONS OF ISOPARAMETRIC ELEMENTS IN TWO- AND THREE-DIMENSIONAL STRESS ANALYSIS

Introduction, a Computational Advantage of Numerically Integrated Finite Elements.

Reference Books:

1. Finite Element Procedures , by Klaus Jurgen Bathi, Prentice Hall.
2. Concepts and Applications of Finite Element Analysis, by Cook, Malkus and Plesha, John Wiley.
3. The Finite Element Method by Zienkiewicz published by Mc Graw Hill.
4. An Introduction to Finite Element Method by J.N. Reddy published by Mc Graw Hill.

MFM7 MECHANICAL ESTIMATING & COSTING

1. ESTIMATING AND COSTING:

Estimating – Definition, Importance of Estimating, Aims, Functions, Organisation of Estimating Department, Qualities of Estimator, Functions of an Estimator, Estimating Procedure, Constituents of Estimation Costing –Definition, Aims of Costing, Difference between Estimating and Costing, Procedure for costing, Costing , Costing- Methods, Advantages of efficient costing, Classification of costs, Pricing determination , Questions.

2. ELEMENTS OF COSTS:

Elements of costs- Material, Labour costs, Expense, Direct, Indirect, Factory expenses, Administrative expense, Selling expenses and Distribution expenses, Components of cost. Overheads , Allocation of on-cost (overhead expenses) Percentage of Prime cost, Direct Labour cost, Direct material cost, Man-hour rate, Machine-hour rate, Combination of Man – hour and Machine-hour rate, Unit rate method; Examples of on-costs. Solved Examples, Questions.

3. MATERIAL COSTING:

Introduction, Cost of Materials, Control over Material cost, Waste Control, Valuation of Materials issued from Stores. Questions.

4. LABOUR COSTING:

Introduction, Objective of Labour Costing, Wages and Incentives. Work –study: Method Study (Motion Study), Time, Study, Allowance, Methods of Time Study, Job Evaluation, Merit Rating, Questions.

5. MATERIAL COST ECONOMICS:

Analyse Cost and Usage, Check Purchasing Practices, Use of Value Analysis, Simplification, Standardisation, Rationalisation, Up date old ideas, Make or Buy decisions. Questions.

6. INVENTORY CONTROL:

Inventory, Inventory Control, Quantity Standards, Inventory Build –up. Economic Ordering (Purchase)Quantity, Economic Lot(Manufacturing) or Batch Quantity, Examples, Questions.

7. INDIRECT EXPENSE AND DEPRECIATION:

Introduction, Factory Expense, Administrative Expense, Sales and Distribution Expense, Calculation of various overheads, Depreciation, Obsolescence, Methods of Calculating Depreciation, Interest on Capital , Idleness of machine, Idleness of workers, Repairs and Maintenance, Questions.

8. ESTIMATION OF MATERIAL SHOP:

Cutting speed , Feed , Depth of cut, Lathe operations-turning, knurling, facting , drilling boring, reaming, threading, tapping, Milling operations-cutting, facing, Grinding operations-surface grinding,cylindrical grinding, Shaping and Planning , Power consumption, Tool life, Questions.

9. ESTIMATION IN SHEET METAL SHOP:

Introduction, Operations in Sheet Metal Shop, Blank Layouts, Estimation of time, Capacity for Power process, Examples, Questions.

10. ESTIMATION IN FORGING SHOP:

Forging- Hand forging, Machine forging, Forging operations, Estimation procedure, Estimation of weight, loosed and time, Solved Problems, Questions.

11. ESTIMATION IN WELDING SHOP:

Welding, Types of welding joints, Estimation of welding costs, Gas cutting, Estimation of gas cutting cost, Electric welding, Estimation of Arc welding cost, Factors affecting welding cost, Solved Problems, Questions.

12. FORECASTING:

Introduction, Sales forecasting, Types of forecasting, Methods used for forecasting, Examples, Elements of a good forecasting method, Procedure for making forecast, Questions.

13. LAUNCHING AN INDUSTRY:

(Entrepreneurship), Entrepreneur, Entrepreneurship, Planning a new enterprise, Project reports, Small Scale Industries, Organizations for assistance . Financial Assistance. Market Survey. Industrial Areas, Industrial Estates, Facilities to S.S.I. Ancillary industries. Model Scheme. Questions.

14. PROJECT PLANNING:

Introduction, Market survey, Project capacity, Selection of site, Plant layout, Product Design and development. Material Requirement, Operation Planning, Machine loading, Subcontract considerations, Equipment requirement, Organizational layout and staff requirement , Material Handling , Budget and Budgetary control, Cost calculations, Arranging Finance, Critical Reports on Feasibility, Questions.

15. BREAK-EVEN ANALYSIS AND EQUIPMENT REPLACEMENT ANALYSIS:

Break-even Analysis (cost, volume profit analysis). Introduction, Assumptions, Limitations, Break-even point theory, Mathematical method, Graphical method, Examples, Equipment Replacement Analysis, Introduction, Reasons of equipment replacement ,Equipment Replacement Policy, Guidelines for replacement Analysis, Method of replacement studies, Pay Back period method, Total life average method, Present value method, Rate of return method, MAPI, method, Hire purchase, Questions.

16. FINANCIAL MANAGEMENT:

Introduction, Profit, Theories of profit, Utilization of profit, Increasing profit, Interest , Annuities, Kinds of Annuities , Pricing, Financial Management, Functions, Funds requirement, Types of Capital,Capitalisation, Sources of Funds, Financial Ratio Analysis, Capital Investment Decisions, Management of Assets, Important Terms , Questions.

17. BUDGET AND BUDGETORY CONTROL:

Budget, Budgeting , Budget classifications, Budgetory Control, Securing , flexibility of Budgeting , Limitations of the budget, Questions.

18. CONTRACTING:

Introduction, objectives, essentials of a contract , Basic elements of contracts, Document in contract, Duties and rights of seller and buyer, Terms used in purchase contracts, Contracts for construction works, objectives , essential features, terms used , specifications, Contract, Packaging, Types of contracts, Preparation of Tender document. Notice Inviting Tenders, Definitions, Clauses (conditions) of contract. Enlistment or Registration of Contractors, Prequalification of contractors, Tendering, Tender evaluation, Negotiations, Acceptance of

Tender and selection of supplier/contractor. Placement of order. Settlement of disputes. Arbitration , Indian Contract Act, 1872.

Reference Books:

1. Sinha.B.P., “Mechanical Estimating and Costing”, Tata McGraw-Hill, Publishing Co., 1995
2. Phillip.F Ostwalal and Jairo Munez, “Manufacturing Processes and systems”, John Wiley, 9th Edition, 1998
3. Russell.R.S and Tailor, B.W, “Operations Management”, PHI, 4th Edition, 2003.
4. Chitale.A.V. and Gupta.R.C., “Product Design and Manufacturing”, PHI , 2nd Edition, 2002.

MFM8 MATERIALS MANAGEMENT AND MATERIALS HANDLING

PART I

1. INTRODUCTION TO MATERIALS MANAGEMENT

Evolution, Introduction, Importance, Definitions, Scope, Objectives, Functions, Materials Management as a science. Integrated materials management approach, Characteristics. Questions.

2. ORGANISATION OF MATERIALS MANAGEMENT

Introduction, Aims. Types of organizational structures, Organisational chart : Inter-relationship. Manpower planning, Manpower planning for materials management, Training. Organisational aspects : Principles of management, functions of management, principles of organization. Motivation. Questions.

3. MATERIALS PLANNING AND BUDGETING

Introduction. Materials planning : Factors, Techniques. Materials Requirement and Capacity Requirement Planning, Spare parts planning. Manufacturing Resource Planning (MRP II). JIT Production Planning, Strategic Materials Planning, Materials control, Budgeting : Budget and budgetary control, Material budget, Purchase budget, Questions.

4. PURCHASING

Introduction. Importance of good purchasing System. Functions. Organisation for purchasing. Duties of purchase manager. Relations with other departments, objectives of purchasing. Purchasing Decision, Methods of purchasing. Purchasing policy, Whether to purchase or manufacture. Bill of materials. Purchasing parameters. Purchasing role in new product development. Questions.

5. INSPECTION AND QUALITY CONTROL

Introduction. Definitions, Inspection : Functions, Kinds of inspection. Quality control. Factors affecting quality control. Areas of quality control. Quality assurance. Causes of quality failures. Quality loss. Objectives, Functions of quality control. Product quality analysis. I.S.I., Statistical Quality Control (SQC). Control charts. Total Quality Management. Life testing. Reliability. Questions.

6. I.S.O. 9000 SERIES

Introduction. Characteristics. Areas covered in I.S.O. 9000 Series. Salient features of I.S.O. 9000 series : I.S.O. 9000; I.S.O. 9001; I.S.O. 9002; I.S.O. 9003; I.S.O. 9004.

7. MATERIALS INFORMATION SYSTEM AND DECISION-MAKING

Introduction; Management information System (M.I.S.); Characteristics of good M.I.S.; Objectives of M.I.S. Information needs. Computer *v/s* manual systems. Materials Information System : Aims and objects, Level of information, Application, Advantages. Materials Information Flow : Internal information, External information, Source of materials information.

Decision-making : Introduction, Definitions, Characteristics. Classification. Procedure of Decision Making. Decisions under-certainty. Decisions under uncertainty. Questions.

8. COST REDUCTION IN MATERIALS FUNCTIONS

Introduction. Cost control *v/s* cost reduction; Materials cost reduction techniques : Standardisation, Simplification (Variety Reduction), Value Engineering (Value analysis), Materials Codification System. Questions.

Valuation of materials issued from stores. Storage and handling equipments. Steps for reducing handling costs. Protection of stores. Security Good house keeping, Transportation. Inter-relationship. Physical Verification (Stock-Taking) Codification. Questions.

9. INVENTORY MANAGEMENT

Inventory. Need for inventory, Inventory Management. Types of Inventory. Symptoms of poor inventory management. Systems approach for inventory management.

Inventory control : Need, Functions. Quantity Standards in inventory control, Advantages of inventory control. Inventory Build-up. Economic Ordering Quantity. Selective Control Techniques. Questions.

10. COMPUTERISATION AND PERFORMANCE EVALUATION

Introduction. Importance. Classification. Elements of a Computer Data Processing System. Computer requirements. Central Processing Unit. Output devices. Programming.

Management planning for computerization. Computer based information system. Conversion of manual of computer based M.I.S. Information. Storage and Retrievals-Data Bank. Application of Computer in Materials management. Evaluating Performance of Materials Functions. Questions.

PART II

Plant Layout And Materials Handling

11. PLANT LOCATION.

Introduction, General location, selection of a particular site, Locational Economics, Selection of site in an Urban Area, Selection of site in a Rural area, Techniques for selecting best location. Location for an industrial plant. Procedure for selecting a site.

12. PLANT LAYOUT:

Introduction, Definitions, Factors affecting layout, Objectives of plant layout. Organisation set-up for layout department. Relationship with other departments, Advantages of scientific layout. Layout services. Objectives of plant layout and materials handling. Inter-relationship between plant layout and materials handlings. Types of relay out problems. Symptoms of good layout, bad layout. Characteristics of good layout. Principles of plant layout. Top management policies affecting layout. Major considerations for layout. Factors Influencing layout . Types of layout.

13. MATERIAL FLOW:

Introduction, Advantages of planned material flow. Flow pattern. Designing a material flow pattern. Criteria for designing (or planning) material flow. Analysis of low: Operation process chart, Flow process chart, Flow diagram, Man – Machine chart, Multi-product process chart, Form-To (Travel) chart. Motion Economy,

14. SPACE PLANNING AND AREA ALLOCATION:

Introduction, Activity centres. Factors for space planning, Determination of space requirements: Offices, Receiving and storage. Production. Characteristics of materials handling at work –place. Work area planning, Principles of Motion- Economy. Design of work place layout, Tool room and Tool crib. Parking. Warehousing . Space planning for warehousing.

Area allocation. Factors considered for area allocation; Expansion, Flexibility. Use of all levels. Inter-building handling, Point of use storage, Aisles. Procedure for area allocation. Plot plan. Special services for employees . Office layout. Factory Services in the layout.

15. INTRODUCTION OF MATERIALS HANDLING:

Introduction , Definition, System concept, Steps in analysis materials handling problems. Objectives of material handling : Reduction in cost, Increase in capacity , Improvement in working conditions, Improved customer service. Activity areas of material handling. Functions of material handling. Relationship with other departments. Disadvantages of materials handling departments in an organization. Principle of Material handling. Unit load concept. Pallets, skids and containers. Designing the unit load system.

16. DESIGNING OF MATERIAL HANDLING SYSTEMS:

Introduction, Systems concept. System Design. Procedure for engineering a system. Factors considered in Materials handling problems. Designing the handling system. Materials handling and Plant layout . Computerized plant layout . Computers in materials handling. Mechanization Guidelines.

17. WORK –STUDY:

Introduction. Method Study. Procedure. Aims, Micro motion Study. Time Study. Procedure for time study. Performance rating . Allowances. Methods of times study. Number of cycles to be timed. Uses of Time Study Data for Wage Incentives. Determining Standard data . Work – Sampling .

18. MATERIAL HANDLING EQUIPMENT:

Introduction. Selection of materials handling devices . Types of materials handling equipment . Conveying equipment (conveyors): Belt conveyors, Roller conveyor, Chain conveyor, Elevating conveyors (Bucket conveyors) Cage Elevators, Escalators.

Tractionless Type Conveyors: Gravity type conveyors, Chute, Screw or Spiral conveyors, Conveying by hydraulic means, Pneumatic Conveyors, Vibrating and Oscillating Conveyors.

Hoisting Equipment: Hoisting machines: Jacks, Pulleys, Winch, Worm-wheel hoists, Elevators, Power hoist, Monorails, Hydraulic lift, Cranes; Derrick, Mobile, Hydraulic, Overhead and geantry, Traveller (or Goliath), Jib, and Tower cranes.

Transport equipment: Non-powered equipment. Powered equipment: Tractors and Trollies, Trailers , Narrow gauge rail road, Platform lift truck, Crane truck, Fork lift truck.
Containers of Supports: Bulk handling equipment. Feeding equipment. Handling of construction materials. Warehousing equipment.

Components of Hoisting Equipment: Flexible Hoisting Appliances: Welded load chains , Roller chains, Hemp ropes, Steel wire ropes, Pulleys and Pulley Systems. Load handling attachments; Hooks, Electric lifting magnets, Grabs, Arresting gear, Drives of Hoisting Gear; Hand drive and operating levers, Power drives.Bulk Transport Equipment (Hauling Equipment): Dump trucks. Rail wagons. Aerial Transport ; Cableways, Ropeways.

Reference Books:

1. Alan Mulemann, John Oakland, Keith Locker, 'Production and Operations Management' Macmillan India Ltd.
2. Datta A.K., Materials Management: Procedures, Text and Cases, Prentice Hall of India.
3. Everett E. Adam Jr & Ronald J. Ebert , Prpduction and Operations Management, Prentice Hall of India.
4. Gaither, Operations Management, Thomson Learning.
5. Gopalakrishnan, P. & Sundaresan, M., Materials Management: An Integrated Approach, Prentice Hall of India.
6. Joseph Monks, Operations Management, McGraw Hill.
7. Mohanty, 'Advanced Operations Management', Pearson Education.
8. Paneerselvam, 'Production and Operations Management', Prentice Hall of India.
9. Richard B. Chase, Nicholas J. Aquilano and F. Robert Jacobs, 'Production and Operations Management' Tata McGraw Hill.

COURSE STRUCTURE & SYLLABUS OF

MASTER OF TECHNOLOGY (M.TECH)

In

Mechanical Engineering

Course Structure

Second Year

Third Semester

Paper Code	**Subject**	**Marks**	**Credits**
MSM1	Jig and Fixtures Design	100	4
MSM2	Mechatronics	100	4
MSM3	Industrial Automation	100	3
MSM4	Quality Control and Reliability Engineering	100	3
MSM5-L	Lab Practice III	100	2

MSM1: JIG AND FIXTURES DESIGN

Section I BASIC TYPES AND FUNCTIONS OF JIGS AND FIXTURES

1. PURPOSE OF TOOL DESIGN

Objectives, Tool Design, Tool Design Objectives, Tool Design in Manufacturing,
Planning the Design, Challenges to the Tool Designer Requirements to become a Tool Designer

2. TYPES AND FUNCTIONS OF JIGS AND FIXTURES

Objectives, Jigs and Fixtures, Classes of Jigs, Types of Jigs, Types of Fixtures, Classification of Fixtures

3. SUPPORTING AND LOCATING'PRINCIPLES

Objectives, Referencing, Basic Rules for Locating, Planes of Movement, Locating the Work

4. **CLAMPING AND WORKHOLDING PRINCIPLES**

Objectives, Workholders, Basic Rules of Clamping, Types of Clamps, Non-Mechanical Clamping, Special Clamping Operations, Clamping Accessories

5. BASIC CONSTRUCTION PRINCIPLES

Objectives, Tool Bodies, Preformed Materials, Drill Bushings, Set Blocks, Fastening Devices

Section II CONSIDERATIONS OF DESIGN ECONOMICS

6. **DESIGN ECONOMICS**

Objectives, Considerations of Design Economics Design Economics, Design Economy: Economic Analysis, Comparative Analysis

7. DEVELOPING THE INITIAL DESIGN,

Objectives, Predesign Analysis, Designing Around the Human Element, Previous Machining Operations, Developing Tooling Alternatives

8. TOOL DRAWINGS

Objectives, Tool Drawings versus Production Drawings, Simplified Drawings, Making the Initial Drawing, Dimensioning Tool Drawings, Millimeter and Inch Dimensioning
Geometric Dimensioning and Tolerancing, Supplementary Symbols, Geometrically Dimensioned and Toleranced Tool Drawings, Computers in Tool Design

Section III DESIGNING AND CONSTRUCTING JIGS AND FIXTURES

9. TEMPLATE JIGS

Objectives, Template Jigs, Variations of Template Jigs, Design Procedures, Tool Design Application

10. VISE-HELD AND PLATE FIXTURES

Objectives, Vise-Held Fixtures, Designing a Vise-Held Fixture, Plate Fixtures, Designing a Plate Fixture, Calculating Cam Clamps, Tool Design Application Cam Design Application

11. PLATE JIGS

Objectives, Plate Jigs, Designing a Plate Jig, Designing a Table Jig, Designing a Sandwich Jig or a Leaf Jig, Tool Design Application

12. ANGLE-PLATE JIGS AND FIXTURES

Objectives, Variations and Applications, Designing an Angle-Plate Jig, Designing an Angle-Plate Fixture, Tool Design Application

13. CHANNEL AND BOX JIGS

Objectives, Channel Jigs, Designing a Channel Jig, Box Jigs, Designing a Box Jig Tool Design

14. VISE-JAW JIGS AND FIXTURES

Objectives, The Machine Vise, Locating Work in Vise-jaw Workholders, Designing a Vise-jaw Jig, Designing a Vise-jaw Fixture, Tool Design Application

Section IV SPECIALIZED WORKHOLDING TOPICS

15. POWER WORKHOLDING

Objectives, Types of Power- Workholding Systems, Basic Operation of Power- Workholding Systems, Benefits of Power Workholding

16. MODULAR WORKHOLDING

Objectives, Modular Fixturing Systems, Modular Fixturing Applications

17. WELDING AND INSPECTION TOOLING

Objectives, Tooling for Welding Operations, Modular Fixturing for Welding, Inspection Fixtures

18. LOW-COST JIGS AND FIXTURES

Objectives, Chucks and Chucking Accessories, Collets and Collet Accessories Vises and Vise Accessories, Specialty Clamps and Workholding Devices

19. TOOLING FOR NUMERICALLY CONTROLLED MACIDNES

Objectives, Introduction, Basic N/C Operation, The Cartesian Coordinate System Incremental and Absolute Programming, Types of N/C Systems, Tooling Requirements for Numerical Control, Types of Workholders

20. SETUP REDUCTION FOR WORKHOLDING

Objectives, Benefits of Setup Reduction, The Setup Reduction Process

21. TOOL MATERIALS

Objectives, Properties of Tool Materials, Ferrous Tool Materials, Nonferrous Tool Materials, Nonmetallic Tool Materials, Designing with Relation to Heat Treatment

Reference Books:

15. Kempster, "Jigs & Fixtures Design, The English Language Book Society", 1978
16. Joshi, P.H., "Jigs & Fixtures, Second Edition", Tata McGraw-Hill Publishing Company Limited,New Delhi 2004
17. Hiram E Grant, "Jigs and Fixture" Tata McGraw-Hill, New Delhi, 2003
18. "Fundamentals of Tool Design", CEEE Edition, ASTME, 1983
19. PSG College of Technology, Coimbatore - Design Data Handbook

MSM2: MECHATRONICS

1. INTRODUCTION

What is Mechatronics? , Scope of Mechatronics, Key Issue

2. INTRODUCTION TO MODERN CNC MACHINES AND MANUFACTURING SYSTEMS

Introduction, Advantages of CNC Machines, CNC Machining Centre Developments, Turning Centre Developments, Tool Monitoring on CNC Machines, Other CNC Developments, Advanced Manufacturing Systems, Benefits of an FMS, Trends in Adoption of FMSs

3. ELECTRONICS FOR MECHANICAL ENGINEERS

Introduction, Conductors, Insulators and Semiconductors ,Passive Components used in Electronics , Transformers , Semiconductors , Transistors , Silicon Controlled Rectifiers (SCR), Integrated Circuits (IC) , Digital Circuits

4. DESIGN OF MODERN CNC MACHINES AND MECHATRONIC ELEMENTS

Introduction, Machine Structure, Guide ways , Feed Drives , Spindle/Spindle Bearings ,Measuring Systems, Controls, Software and User Interface, Gauging, Tool Monitoring System

5. DRIVES AND ELECTRICALS

Drives, Spindle Drives , Feed Drives , DC Motors , Servo-principle , Drive Optimisation ,Drive Protection , Selection Criteria for AC Drives , Electric Elements , Wiring of Electrical Cabinets Power Supply for CNC Machines , Electrical Standard , Electrical Panel Cooling (Air Conditioning)

6. CNC SYSTEMS

Introduction, Configuration of the CNC System, Interfacing, Monitoring, Diagnostics, Machine Data, Compensations for Machine Accuracies, PLC Programming, Direct Numerical Control (DNC)

7. PROGRAMMING AND OPERATION OF CNC MACHINES

Introduction to Part Programming , Coordinate System ,Dimensioning ,Axes and Motion nomenclature ,Structure of a Part Program , Word Addressed Format , G02/G03 Circular Interpolation , Tool Compensation , Subroutines (Macros) , Canned Cycles (G81-G89),
Mirror Image, Parametric Programming (User Macros) and R-Parameters, G96 S... Constant Cutting Speed and G97 Constant Speed, Machining Cycles, Programming Example for Machining Centre, Programming Example for Turning Centre.

8. INDUSTRIAL DESIGN, AESTHETICS AND ERGONOMICS

Introduction, Elements of Product Design, Ergonomic Factors for Advanced Manufacturing Systems

9. INTRODUCTION TO COMPUTERS AND CAD/CAM

Introduction to Computers, CAD/CAM Systems,

Reference Books:

1. Microprocessor Architecture, Programming and Applications with 8085. By R.S.Gaonkar
2. Assembly Language Programming: By L.A. Laventhal
3. Mechatronics: By HMT
4. Mechatronics. By W. Bolton
5. Pneumatic Circuits and Low Cost Automation: By Fawcett J.R.
6. Engineering Applications of Pneumatics & Hydraulics: By Ian C Turner
7. Automation, Production Systems and CIM. By Mikell P Groovar.
8. Industrial Pneumatic Controls: By Z.J Lansky, Lawrence F Schrader, JR.

10. Mechatronics System Design : By Shetty and Kolk.
11. Computer graphics- Hearn & Baker
12. Computer graphics- Foley Van Dam
13. Mathematical elements for computer graphics - Roger & adams
14. Procedural Elements for computer graphics- Roger.
15. M/c Tool Design - N.K.Mehta.
16. N/C of M/C tools –Koren.

MSM3 : INDUSTRIAL AUTOMATION

1. INTRODUCTION

Production System Facilities, Manufacturing Support Systems, Automation in Production Systems, Manual Labor in Production Systems, Automation Principles and Strategies,

2. MANUFACTURING OPERATIONS

Manufacturing Industries and Products, Manufacturing Operations, Product/Production Relationships, Production Concepts and Mathematical Models, Costs of Manufacturing Operations

3. INTRODUCTION TO AUTOMATION

Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automation

4. INDUSTRIAL CONTROL SYSTEMS

Process Industries versus Discrete Manufacturing Industries, Continuous versus Discrete Control, Computer Process Control, Forms of Computer Process Control

5. SENSORS, ACTUATORS, AND OTHER CONTROL SYSTEM COMPONENTS

Sensors, Actuators, Analog-to-Digital Conversion, Digital-to-Analog Conversion, Input/Output Devices for Discrete Data

6. INDUSTRIAL ROBOTICS

Robot Anatomy and Related Attributes, Robot Control Systems , End Effectors , Sensors in Robotics, Industrial Robot Applications , Robot Programming ,Engineering Analysis of Industrial Robots

7. INTRODUCTION TO MATERIAL HANDLING

Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling

8. MATERIAL TRANSPORT SYSTEMS,

Industrial Trucks, Automated Guided Vehicle Systems, Monorails and Other Rail Guided Vehicles, Conveyor Systems, Cranes and Hoists , Analysis of Material Transport Systems .

9. AUTOMATIC DATA CAPTURE

Overview of Automatic Identification Methods, Bar Code Technology, Other ADC Technologies

10. FLEXIBLE MANUFACTURING SYSTEMS

What is an FMS? ,FMS Components ,FMS Applications and Benefits ,FMS Planning and Implementation lssues ,Quantitative Analysis of Flexible Manufacturing Systems

11. AUTOMATED ASSEMBLY SYSTEM

Fundamentals of Automated Assembly System, Design for Automated Assembly, Quantitative Analysis of Assembly System

12. PRODUCT DESIGN AND CAD/CAM IN THE PRODUCTION SYSTEMS

Product Design and CAD, CAD system Hardware, CAM, CAD/CAM, and CIM

13. PRODUCTION PLANNING AND CONTROL SYSTEMS

Aggregate Production Planning and the Master Production Schedule, Material Requirements Planning (MRP), Capacity Planning, Shop Floor Control, Inventory Control, Manufacturing Resource Planning (MRP II) , Just-In-Time Production Systems ,

14. LEAN PRODUCTION AND AGILE MANUFACTURING

Lean Production, Agile Manufacturing, Comparison of Lean and Agile

Reference Books:

1. Fundamentals of Process Control Theory, P. W. Murrill, ISA, (2000),

2. Process Measurement and Control: Introduction to Sensors, Communication, Adjustment, and Control, R. E. Fraser, Prentice Hall, (2001), .

3. Process Control Systems: Application, Design and Tuning, F. G. Shinskey, McGraw-Hill Professional, (1996), .

4. Control System Documentation: Applying Symbols and Identification, R. Mulley, ISA, (1994),

5. Chemical Engineering Volume 6: Chemical Engineering Design, R. K. Sinnott, Butterworth-Heinemann, (1999), .

6. Control Valve Primer: A User's Guide, H. D. Baumann, ISA, (1998), I

7. Control Valves: Practical Guides for Measurement and Control, G. Borden Jr., ISA, (1998),

8. Introduction to Programmable Logic Controllers, G. Dunning, Delmar Thomson Learning, (2002),

9. Programmable Controllers, T. A. Hughes, ISA, (2000), .

10. Programmable Logic Controllers, S. B. Morriss, Prentice hall, (2000),

11. Programmable Logic Controllers: Principles & Applications, J. W. Webb and R. A. Reis, Prentice Hall, (2002),

MSM4: QUALITY CONTROL AND RELIABILITY

1. QUALITY CONTROL IN PERSPECTIVE

Quality Of Design , Quality Of Conformance To Design, Quality Of Performance , Growth Of Quality Control., Illustrative Application: Quality Of Design, Quality Of Conformance To Design, Process Monitoring, Quality Of Conformance To Design : Acceptance Sampling, Quality Of Performance Reliability, Management Of Quality , Quality And Productivity,

2. FUNDAMENTALS OF STATISTIC AND PROBABILITY IN QUALITY CONTROL

Events Abd Probability, Laws Of Probability, Mutually Exclusive Events, Event Space, Distribution, And Frequency, Expectations And Moments , Some Distribution Useful In Qc Studies , Binomial Distribution, Poisson Distribution , Normal Distribution , Exponential And Weibull Distribution , Hierarchy Of Approximations, Probability Functions In Practice , Graphic Representation Of A Frequency Distribution , Estimates And Their Distributions, Hypothesis Testing

3. STATISTICAL CONTROL OF PROCESS

Illustrative Of Variability in Materials, Machines, and People, Statistical Inference of Process Variability, Variation over Time versus Natural Variation of the Process. , Basic Form Of The Control Chart , Use Of The Control Chart , Development Of A Control Chart, Causes For Investigation, Responsibilities For Chart Maintenance And Adjustment Action , Process Sampling

4. CONTROL CHARTS FOR VARIABLE QUALITY CHARACTERISTICS

Basics Of A Control Chart, Use Of Control Charts, Charts For Variable Quality Characteristics. Derivation Of Control Chart Factors. , Starting A Control Chart. Levels Of Significance, Process Not Stable During The Base Period, Process Not Stable During The Base Period

5. PROCESS CAPABILITY ANALYSIS

Determination Of Process Capability , Determination Of Process Capability : Using Sample Observation, Single – Range Method , Adjustment For Within – Study Trend , Design Specifications And Tolerances, Process Capability And Tolerances , Tolerances For Subassemblies , Setting Tolerances For Intermediate Steps In Production, Interference And Tolerance Of Fit.

6. QUALITY ASSURANCE METHODS AND STANDARDS

Product Quality Value Analysis, Classification Of Defects Procedure., Specification Of Inspection Method. , Setting Standard Quality Levels, Inclusion Of Quality Standards On The Engineering

Drawings, Classification Of Defects Of Complex Assemblies , Classification Of Demerits , Illustration Of Classification Of Demerits , Experimental Standard Quality Levels

7. BASIC CONCEPT OF RELIABILITY

Introduction, Reliability and Quality, Failures and Failure Modes, Causes of Failures and Unreliability, Maintainability and Availability, History of Reliability, Reliability Literature

8. DESIGN FOR RELIABILITY

Reliability Analysis, Mathematical Models and, Numerical Evaluations, Designing For Higher Reliability, Redundancy Techniques, Equipment Hierarchy, Reliability and Cost

9. RELIABILITY MATHEMATICS

Introduction, Random Experiments, Probability, Random Variable, Distribution Functions, Discrete Distributions, Continuous Distribution, Uniform Distribution, Numerical Characteristics of Random Variables, Laplace Transform

10. COMPONENT RELIABILITY AND HAZARD MODEL

Introduction, Component Reliability from Test Data, Mean Time to Failure (MTTF), Time Dependent Hazard Model, Stress-Dependent Hazard Model, Derivation Of Reliability Function Using Markov Model, Treatment Of Field Data

11. SYSTEM RELIABILITY MODELS

Introduction, System With Components In Series, System With Parallel Components, K-Out – Of –M –Systems, Non Series Parallel System, Systems With Mixed-Mode Failures, Fault –Tree Technique

12. REDUNDANCY TECHNIQUES IN SYSTEM DESIGN

Introduction, Component Versus Unit Redundancy, Weakest-Link Technique, Mixed Redundancy, Standby Redundancy, K-Out-Of-M Standby System, Redundancy Optization, Double Failure and Redundancy

13. MAINTAINABILITY AND AVAILABILITY

Introduction, Maintainability Function, Availability Function, Frequency of Failures, Two Unit Parallel System with Repair, K-Out – Of – M System, Preventive Maintenance

Reference Books:

1. John.S. Oakland. Statistical process control", Elsevier, 5th edition, 2005
2. Connor, P.D.T.O., " Practical Reliability Engineering", John Wiley, 1993
3. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
4. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
5. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997.
6. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
8. Danny Samson, "Manufacturing & Operations Strategy", Prentice Hall, 1991

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COURSE STRUCTURE & SYLLABUS OF
MASTER OF TECHNOLOGY (M.TECH)

In

Mechanical

Course Structure

Second Year

Fourth Semester

SPECIALIZATION 1

Specialization 1	**PRODUCTION TECHNOLOGY**	**Marks**	**Credits**
Paper Code	**Subject**		
MSPT 01	Metal Forming Technology	100	4
MSPT 02	Machine Tool Design	100	4
MSPT 03	CAD /CAM	100	4
MS 04	Project	300	12

SPECIALIZATION 1: PRODUCTION TECHNOLOGY

MSPT 01 : Metal Forming Technology

Plastic Deformation of Metals; Stress Strain Relationship; Slip Line Field ,Theory; Metal Forming Process; Drawing and Extrusion Process; Rolling; Forging; Sheet Metal Forming Process; Unconventional Forming Process; Numerical Control Of Machine Tools.

Reference Books:

1. Kurt Lange “Handbook of Metal Forming”, Society of Manufacturing Engineers. Michigan, USA, 1988
2. Avitzur, “Metal Forming - Processes and Analysis”, Tata McGraw-Hill Co., New Delhi, 1977.

3. ASM Metals Handbook. Vol.14, “Forming and Forging”, Metals Park, Ohio, USA, 1990.
4. Taylor Altan, Soo I.K. Oh, Harold.L.Gegel. “Metal Forming: Fundamentals and Applications”, ASM, Metals Park, Ohio, USA, 1983.

MSPT 02 : Machine Tool Design

Metal Cutting; Machine Tools; Mechanism for Transmissions of Motions in Machine Tools; Mechanical Drives for Providing Rotational Movements; Strength and Rigidity of Machine Tool Structure; Analysis of Spindle Bearings, Slides and Guides; Automatic Drives for Machine Tools; Economics of Machine Tool Selection; Trends of Developments of Future Machine Tools.

Reference Books:

1. Machine Tools Design & Numerical Controls –N.K. Mehta, T.M.H. New Delhi.
2. Design of Machine Tools – S.K. Basu Allied Publishers.
3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.

MSPT 03 : CAD/CAM

Introduction; CAD/CAM Hardware; Computer Graphics; Geometric Modeling; CAD Standards; Introduction to Drafting Systems; Introduction to A Modeling Systems; CNC Hardware and Basics; CNC Tooling; CNC Programming; CNC Machine Tools and Control Systems; Computer Added Part Programming; Advanced Part Programming and Methods; Group Technology and Computer Added Process Planning; Micro Computer Based CAD/CAM; CAD/CAM Data Exchange; CAD/CAM Integration; Flexible Manufacturing System; Computer Integrated Manufacturing.

Reference Books:

1. CAD/CAM Theory and Practice / lbrahim Zeid / Mc Graw Hill international.
2. Mastering CAD/CAM / Ibrhim Zeid / Mc Graw lull international.
3. CAD/CAM / P.N.Rao / TMH.

MS 04 : PROJECT

Project Guidelines:

Thinking up a Project

You are expected to come up with your own idea for a project. A wide range of topics is acceptable so long as there is substantial computing content and project is predominantly of a practical, problem-solving nature. You might take up an interest which you already have in your stream of engineering. You may do your project in any reputed organization or a department. Every student is to take up a project individually. The project is a vehicle for you to demonstrate the required level of competence in your chosen field of Masters.

Start thinking about your project right in the beginning. If you want to do the project in industrial environment start your correspondence fairly early to find an organization, which is ready to accept you You must submit an outline of your project (two or three pages) to your guide within one month of start of the project work. This must include the Title, Objective, Methodology (main steps to carry out a project), expected output and organization where you intend to carry out the project.

Arranging a Guide

When you have an idea of your project, even a tentative one, approach a suitable person who has interest and expertise in that area. The Guide may be a person with M.E. / M.Tech with a five-year working experience or a B.E./ B.Tech having a working experience of fifteen years in relevant field.

Working with the Guide

The Guide's role is to provide support and encouragement to direct the student's attention to relevant literature, to provide technical assistance occasionally, to read and comment on the draft report and to give guidance on the standard and amount of work required. The Guide is not responsible to teach any new skills and language required for project work or for

arranging any literature or equipment. You are expected to meet at least once a month to your Guide. Rest you can workout your own arrangement. The students, who are content to carry out their work largely without supervision, should keep their Guide in touch with what they are doing. A student should not remain silent for months and then appear with a complete project work unknown to supervisor. In such circumstances, the Guide cannot be counted on to give an automatic seal of his approval. If a project produces a piece of software, the Guide would normally expect to see a demonstration of the software in action.

The main purpose of the report is to explain what you did in your project. The reader should be able to see clearly what you set out to do and what you achieved. It should describe the problem addresses and explain why you tackled it in the way you did. It should include your own assessment of how successful the project was.

Resist temptation to include pages of padding. If the project consists of developing an application in area with which a computer scientist would not be familiar – such as chemical testing, stock & shares – it might be necessary to include some explanatory company/ organization profile for whom you have done the work must not appear in chapters and must go to appendix part.

The work that is presented for examiners should be your own. The presentation of another person's work, design or program as though they are your own is a serious examination offence. Direct quotation form the work of others (published or un published) must always be clearly identified as such by being placed in quotation marks, it is essential that reader should be able to see where the other work ends and your begins.

Sometimes a project containing good work is marred by a report, which is turgid, obscure and simply ungrammatical. In such cases, it is very difficult to find out the work done during the project. An examiner cannot be kind enough to look properly on a project that is almost unreadable.

Some important points for carrying out a project

20. The organizations or companies offer you a placement for project work out of good will or to get some useful work done. Usually the companies do not provide you everything required by you. You must settle this right in the beginning of the project with the business that what will you get from them and what you have to arrange yourself.

21. Some times a complication arises due to the fact that some aspect of your project work is considered confidential by the company. If this is so, it is your responsibility to get whatever clearance is necessary from the organization right in the beginning as essential parts like system analysis and design, flow charts etc. can not be missing from a project report.

22. Make sure you allow enough time for writing report. It is strongly recommended that do some writing work as you carry out the project rather than leaving write up until the end. You must allow at least a month to finally write the report. There has to be enough time for the supervisor to read and comment on it and for student to make changes (sometimes extensive) on the basis of the comments. You may have to prepare two or three drafts before the final submission. Remember that it is mainly the project reports that get examined. An external supervisor receives a pile of project reports written by people who he does not know. If a project produced some software he even may not get time to see it running. In most cases he forms his judgment purely on the basis of the report. Please make your report as readable as possible content wise as well as presentation wise.

23. **Introduction:** This must contain background, any previous work done in the area of your project, your objective and other relevant material that may be helpful to further explain your project work.

24. **The existing system:** The study of the present system; problems in existing system.

25. **System design:** The proposed system; Any specific problem encountered at how you handled them.

26. **Implementation of the system:** Implementation issues and their justification.

27. **Conclusions:** Any shortcoming; your assessment of your work; comparison of your work with similar works; silent features of your work any feature modification. Real times applications of your project work.

References must be given at the end following any standard way of giving references.
For example:
Langdrof, 'Theory of Alternating Current Machinery" Tata McGraw Hill, July 2003.

Finally, your project work is your brainchild and nobody knows about it more than you. Be confident to explain your work at the time of viva and be honest to accept any short falls.

The Project Report Details

The report should be prepared with the Word Processing software. They should be printed on A4 size (Executive Bond) paper. A margin of 1.5 inches must be allowed on left hand side for binding. The pages should be numbered. The report should be typed in the 12-font size with vertical spacing of 1.5**. You must submit three copies of your Project Report in between 15.06.05 and 20.06.05 positively** alongwith **a brief Bio –Data of the Supervisor.**
A report should be hard bound (light green cover with golden print on the cover). The title of the project should be clearly visible on the cover.

The cover page should be as figures below. The first page should be title page containing the title, the candidates name, Enrolment Number, Name of Study Centre and University. Second page is a certificate from the supervisor. The 3rd page is for the acknowledgement. Fourth page gives the contents of the project report. Fifth page should be an abstract of the project followed by the chapters. You must ensure that all pages are legible. Where the project has produced software for a personal computer, you should include a CD inside the back cover of the report, along with instructions in the report how to run it.

Cover Page
Project Title
A Project Report

Submitted in partial fulfillment of the degree of Master of Technology

Supervisor's Name

Student's Name

Karnataka State Open University, Mysore.

(Year)

LOGO

COURSE STRUCTURE & SYLLABUS OF
MASTER OF TECHNOLOGY (M.TECH)

In

Mechanical

Course Structure

Second Year

Fourth Semester

SPECIALIZATION- 2

Specialization 2	**THERMAL ENGINEERING**	**Marks**	**Credits**
Paper Code	**Subject**		
MST 01	Advanced Thermodynamics	100	4
MST 02	Refrigeration and Air conditioning Technology	100	4
MST 03	Steam and Gas Turbines	100	4
MS 04	Project	300	12

SPECIALIZATION 2 : THERMAL ENGINEERING

MST 01 : Advanced Thermodynamics

Introduction; Laws of Thermodynamics; Entropy; Exergy Analysis; Maxwell Relations; Properties of Pure Substances; Properties of Gases and Gas Mixtures; Equilibrium and Stability;

Reference Books:

1. Kenneth Wark Jr., Advanced Thermodynamics for Engineers, McGraw-Hill Inc., 1995.
2. Bejan, A., Advanced Engineering Thermodynamics, John Wiley and Sons, 1988.
3. Holman, J.P., Thermodynamics, Fourth Edition, McGraw-Hill Inc., 1988.
4. Smith, J.M. and Van Ness., H.C., Introduction to Chemical Engineering Thermodynamics, Fourth Edition, McGraw-Hill Inc., 1987.
5. Sonntag, R.E., and Van Wylen, G, Introduction to Thermodynamics, Classical and Statistical, Third Edition, John Wiley and Sons, 1991.
6. Sears, F.W.and Salinger G.I., Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Third edition, Narosa Publishing House, New Delhi, 1993.
7. DeHotf,R.T. Thermodynamics in Materials Science, McGraw-Hill Inc.,1993.
8. Rao,Y.V.C., Postulational and Statistical Thermodynamics, Allied Publisher Limited,New Delhi,1994.

MST 02: Refrigeration and Air Conditioning Technology

Introduction; Vapor Compression System; Vapor Absorption System; Electrolux Refrigeration System; Bell Coleman Refrigeration Cycle; Refrigerant; Properties of Moist Air; Psychometric Process; Air Conditioning system design; Duct Design; Cooling Tower; Cascade Refrigeration System.

Reference Books:

1. Kenneth Wark Jr., Advanced Thermodynamics for Engineers, McGraw-Hill Inc., 2001..
2. Bejan, A., Advanced Engineering Thermodynamics, John Wiley and Sons, 1998.
3. Holman, J.P., Thermodynamics, Fourth Ediction, McGraw-Hill Inc., 1998.
4. Smith, J.M and Van Ness., H.C., Introduction to chemical Engineering
5. Thermodynamics, Fourth Edition, McGraw-Hill Inc., 1987.
6. Sonntag, R.E., and Vann Wylen, G, Introduction to Thermodynamics, Classical and Statistical, third Edition, John Wiley and Sons, 1991.
7. Sears, F.W. and Salinger G.I., Thermodynamics, Kinetic Theory and Statistical Thermodynamics, third Edition, Narosa Publishing House, New Delhi, 1993.
8. DeHoft, R.T. Thermodynamics in Materials Science, McGraw-Hill Inc., 1993.
9. Rao, Y.V.C., Postulational and Statistical thermodynamics, Allied Publisher Limited, New Delhi, 1994.

MST 03 Steam and Gas Turbines

Introduction; Steam Nozzle; Steam Turbine; Impulse and Reaction Turbines; Governing of the Turbines; Compounding of Turbine; Multistage Turbines; Reheat and Regeneration of Steam Turbines; Open and Close Gas Turbine Cycle; Reheat Inter Cooling and Regeneration in Gas Turbine; Complex Cycles; Combined Cycles; Application of Steam and Gas Turbines;

Reference Books:

1. Gas turbine theory: Cohen & Rogers, Addison Weslay Longman Ltd.
2. Design of high efficiency turbomachinery and gas turbines, David Gordon Wilson, Theodosios Korakianitis, Prentice Hall International.
3. Turbomachinery : S.M. Yahya.
4. Turbine, Compressors and Fans, S.M. Yahya, Tata Mc Graw Hill.
5. Gas Turbine- Ganeshan, Tata Mc Graw Hill.

MS 04: PROJECT

Project Guidelines:

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Start thinking about your project right in the beginning. If you want to do the project in industrial environment start your correspondence fairly early to find an organization, which is ready to accept you You must submit an outline of your project (two or three pages) to your guide within one month of start of the project work. This must include the Title, Objective, Methodology (main steps to carry out a project), expected output and organization where you intend to carry out the project.

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The Guide's role is to provide support and encouragement to direct the student's attention to relevant literature, to provide technical assistance occasionally, to read and comment on the draft report and to give guidance on the standard and amount of work required. The Guide is

not responsible to teach any new skills and language required for project work or for arranging any literature or equipment. You are expected to meet at least once a month to your Guide. Rest you can workout your own arrangement. The students, who are content to carry out their work largely without supervision, should keep their Guide in touch with what they are doing. A student should not remain silent for months and then appear with a complete project work unknown to supervisor. In such circumstances, the Guide cannot be counted on to give an automatic seal of his approval. If a project produces a piece of software, the Guide would normally expect to see a demonstration of the software in action.

The main purpose of the report is to explain what you did in your project. The reader should be able to see clearly what you set out to do and what you achieved. It should describe the problem addresses and explain why you tackled it in the way you did. It should include your own assessment of how successful the project was.

Resist temptation to include pages of padding. If the project consists of developing an application in area with which a computer scientist would not be familiar – such as chemical testing, stock & shares – it might be necessary to include some explanatory company/ organization profile for whom you have done the work must not appear in chapters and must go to appendix part.

The work that is presented for examiners should be your own. The presentation of another person's work, design or program as though they are your own is a serious examination offence. Direct quotation form the work of others (published or un published) must always be clearly identified as such by being placed in quotation marks, it is essential that reader should be able to see where the other work ends and your begins.

Sometimes a project containing good work is marred by a report, which is turgid, obscure and simply ungrammatical. In such cases, it is very difficult to find out the work done during the project. An examiner cannot be kind enough to look properly on a project that is almost unreadable.

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2. Some times a complication arises due to the fact that some aspect of your project work is considered confidential by the company. If this is so, it is your responsibility to get whatever clearance is necessary from the organization right in the beginning as essential parts like system analysis and design, flow charts etc. can not be missing from a project report.

3. Make sure you allow enough time for writing report. It is strongly recommended that do some writing work as you carry out the project rather than leaving write up until the end. You must allow at least a month to finally write the report. There has to be enough time for the supervisor to read and comment on it and for student to make changes (sometimes extensive) on the basis of the comments. You may have to prepare two or three drafts before the final submission. Remember that it is mainly the project reports that get examined. An external supervisor receives a pile of project reports written by people who he does not know. If a project produced some software he even may not get time to see it running. In most cases he forms his judgment purely on the basis of the report. Please make your report as readable as possible content wise as well as presentation wise.

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For example:
Langdrof, 'Theory of Alternating Current Machinery" Tata McGraw Hill, July 2003.

Finally, your project work is your brainchild and nobody knows about it more than you. Be confident to explain your work at the time of viva and be honest to accept any short falls.

The Project Report Details

The report should be prepared with the Word Processing software. They should be printed on A4 size (Executive Bond) paper. A margin of 1.5 inches must be allowed on left hand side for binding. The pages should be numbered. The report should be typed in the 12-font size with vertical spacing of 1.5**. You must submit three copies of your Project Report in between 15.06.05 and 20.06.05 positively** alongwith **a brief Bio –Data of the Supervisor.**

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Cover Page
Project Title
A Project Report

Submitted in partial fulfillment of the degree of Master of Technology

Supervisor's Name

Student's Name

Karnatak LOGO niversity,

(Year)

COURSE STRUCTURE & SYLLABUS OF
MASTER OF TECHNOLOGY (M.TECH)

In

Mechanical

Course Structure

Second Year

Fourth Semester

SPECIALIZATION- 3

Specialization 3	**MECHANICAL DESIGN**	**Credits**
Paper Code	**Subject**	
MSMD 01	Thermal System Design	4
MSMD 02	Design of Machinery	4
MSMD 03	Mechanical Engineering Design	4
MS 04	Project	12

SPECIALIZATION 3: MECHANICAL DESIGN

MSMD 01: Thermal System Design

Introduction to thermal system; Geometric programming; Linear programming; Dynamic programming; Lagrange's interpolation; Search method; Simulation and Modeling; Curve fitting; Heat exchangers; Heat Exchangers; Fluid properties and basic equations; Heat transfer fundamentals.

Reference Books:

1. Stoecker, W., Design of Thermal Systems, McGraw-Hill
2. Burmeister, L.C., Elements of Thermal-Fluid System Design, Prentice Hall, 1998.
3. Jaluria, Y., Design and Optimisation of Thermal Systems, McGraw-Hill, 1998.
4. Janna, W.S., Design of Fluid Thermal Systems, PWS-Kent Publishing, 1993.

MSMD 02: Design of Machinery

Introduction; Kinematics Fundamentals; Graphical Linkage Synthesis; Position, Analysis; Analytical Linkage Synthesis; Velocity analysis ; Acceleration Analysis; Cam Design; Gear Trains; Dynamics Fundamentals.

Reference Books:

1. Design of Machinery, R. Norton, Fourth Edition, McGraw-Hill.
2. Norton R.L, “Design of Machinery”, Tata McGraw-Hill Book Co, 2004.
3. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
4. Ugural A.C, “Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
5. Spotts M.F., Shoup T.E “Design and Machine Elements” Pearson Education, 2004.

MSMD 03: Mechanical Engineering Design

Basic; Introduction; Stress; Deflection and Stiffness; Failure Prevention; Materials; Failure Resulting From Static Loading; Failure Resulting from Variables Loading; Design of Mechanical Elements; Welding and Design of Permanent Joints; Mechanical Springs; Journal Bearings; Spur and Helical Gears; Bevel and Worm Gears; clutches; Brakes; Coupling and Fly Wheels; Shafts; Belt; Chain Drives; Power Screw Pipes and Pipe Joints; Couplings; Cotter and Knuckle Joints.

Reference Books:

1. Robert L. Mott, Machine Elements in Mechanical Design, Pearson Prentice-Hall, Upper Saddle
2. River, NJ, Fourth Edition, 2003.
3. Juvinall R.C., Marshek K.M., Fundamentals of Machine Component Design, John Wiley & Sons, Inc., Third Edition, 2000
4. Earle J. H., Engineering Design Graphics, Addison Wesley, Eleventh Edition, 2004

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A Project Report

Submitted in partial fulfillment of the degree of Master of Technology

Supervisor's Name

Student's Name

Karnataka State Open University, Mysore.

LOGO