

**UTTARAKHAND TECHNICAL UNIVERSITY,
DEHRADUN**



M TECH (MANUFACTURING PROCESS)

Programme

COURSE CODE	COURSE TITLE	CREDITS	L	T	P	EXAMINATION DURATION (Hrs.)		EVALUATION SCHEME				UNIV. EXAM	TOTAL
						THEORY	PRACTICAL	SESSIONAL			ESE		
								CT	ATTD.	TA		TOTAL	
I Year													
I Semester													
MMPT-100	Advanced Mathematics	4	3	1	0	3	-	30	10	10	50	100	150
MMPT-101	Modeling and Simulation	4	3	1	0	3	-	30	10	10	50	100	150
MMPT-102	Computer Aided Engineering	4	3	1	2	3	-	30	10	10	50	100	150
MMPT-103	Industrial Engineering & Management	4	3	1	0	3	-	30	10	10	50	100	150
MMPT-11X	Elective 1	4	3	1	0	3	-	30	10	10	50	100	150
Total		20	15	5	2						250	500	750
II Semester													
MMPT-201	Advanced Manufacturing Process	4	3	1	2	3	-	30	10	10	50	100	150
MMPT-202	Finite Element Methods	4	3	1	0	3	-	30	10	10	50	100	150
MMPT-203	Advance Optimization Techniques	4	3	1	0	3	-	30	10	10	50	100	150
MMPT-22X	Elective 2	4	3	1	0	3	-	30	10	10	50	100	150
MMPT-23X	Elective 3	4	3	1	0	3	-	30	10	10	50	100	150
Total		20	15	5	2						250	500	750
II Year													
III Semester													
MMPT-34X	Elective 4	4	3	1	0	3	-	30	10	10	50	100	150
MMPT-35X	Elective 5	4	3	1	0	3	-	30	10	10	50	100	150
MMPS-301	Seminar & Term Paper	3									100		100
MMPP-302	Project	3									100	100	200
MMPD-301	Dissertation	6									200		200
Total		20									500	300	800
IV Semester													
MMPD-401	Dissertation	24									250	250	500
Total		24									250	250	500

List of Elective Subjects

M. TECH. (MANUFACTURING PROCESS)

Elective 1

MMPT-111 Advanced Welding Process
MMPT-112 Composite Materials & Manufacturing

Elective 2

MMPT-221 Diagnostic Maintenance and Monitoring
MMPT-222 Product Design and Development
MMPT-223 Reliability Engineering

Elective 3

MMPT-231 Total Quality Management
MMPT-232 Non-Traditional Machining Processes
MMPT-233 Metal Forming Analysis

Elective 4

MMPT-341 Safety Engineering
MMPT-342 Flexible Manufacturing Systems
MMPT-343 Rapid Prototyping

Elective 5

MMPT-351 Casting and Forging Design
MMPT-352 Tool and Cutter Design

MMPT-100	Advanced Mathematics	L	T	P
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3	1	0
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Unit 1

Newton Raphson and iterative methods for finding roots of a non-linear equation; Cholesky LU-decomposition; Jacobi and Gauss-Seidel method for a System of linear Equations

Unit 2

Numerical differentiation; Gaussian Quadrature; Solution of first and second order differential equations using Euler, modified Euler and Runge-Kutta methods.

Unit 3

Finite difference approximations to two point boundary value problems; Numerical solution of parabolic and elliptic differential equations using finite difference approach; Method of weighted residuals; Collection method of least squares and Galerkin's method; numerical solution of ordinary and partial differential equations using these methods.

Unit 4

Concept of probability; random variable distributions; Some special distributions such as Binomial, Poisson, Negative Binomial, Geometric, Uniform, Normal, Exponential, Weibull. Moments; moment generating functions

Unit 5

Samplings Techniques; Sampling distributions; point and interval estimation; Testing of hypothesis; analysis of variance; Concept of design of experiments; Bi-variate distributions; independence; correlation and regression.

Recommended Books

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, 'Numerical Methods for Scientific and Engineering Computations', New Age International Publishers.
2. S .S. Sastry,' Introductory Methods of Numerical Analysis', Prentice-Hall of India
3. S.C. Gupta and V.K. Kapoor, 'Fundamentals of Mathematical Analysis', Sultan Chand and Sons Publishers.
4. M. K. Jain,' Numerical Solution of Differential Equations', John Wiley, New York,
5. Erwin Kreyszig, ' Introduction to Mathematical Statistics *Principles and Methods*', John Wiley & Sons, New York

MMPT-101	Modeling & Simulation	L	T	P
		3	1	0

Unit – 1

Introduction of Modeling: Concept of system, continuous and discrete systems, types of models, time advance mechanisms, components and organizations of a discrete event simulation models, steps in simulation study.

Unit – 2

Statistical Models in Simulation: Discrete, continuous, Poisson and empirical distributions, Output data analysis for a single system – types of simulation with regard to output analysis, statistical analysis for terminating simulations; comparing alternative system configurations, statistical procedures for comparing real world observations with simulation output data, generation of arriving processes.

Unit-3

Monte Carlo Simulation : Introduction to Monte Carlo simulation, random number generators, and inventory control simulations, Fixed period and fixed quantity system, simulation of queuing problems, applications in queuing models and inventory models.

Unit-4

Simulation of Manufacturing and Material Handling Systems : Introduction, objective of simulation in manufacturing, modeling system randomness, sources of randomness, machine down-times, calendar time and busy time approach, models of material handling systems.

Unit-5

Verification and Validation of Simulation Models: Introduction, guideline for determining the level of model details, verification of simulation commuter programs, techniques for increasing model validity and credibility; Use of simulation package to solve problems related to simulation of queuing systems, simulation of material handling and manufacturing systems.

Suggested Books:

1. Banks, J. and Carson, J.S., “Discreet Event System Simulation”, 5th Ed. Prentice Hall.
2. Averill, M.L. and Kelton, W.D., “Simulation Modeling and Analysis”, 3rd Ed., McGraw Hill.
3. Schwarzenbach, J. and Gill K.F., “System Modeling and Control”, 5th Ed., Edward Arnold.
4. Carrie, A., “Simulation of Manufacturing Systems”, John Wiley and Sons.
5. Viswannadham, N. and Narahari, Y., “Performance Modeling of Automated Manufacturing System”, Prentice Hall.

MMPT-102	Computer Aided Engineering	L	T	P
		3	1	0

Course Contents

Unit-I

Computer Aided Design (CAD)

Interaction devices and techniques, geometrical transformations, viewing in three dimensions, modeling and object hierarchy, raster algorithms, display, representation of 3D shapes, introduction to cading & rendering of surfaces and solids, hidden lines, edge and surface removal. **(15 Hours)**

Unit-II

Finite Element Method

Modeling, shape functions, finite element equations, boundary conditions, quadratic shape functions, linear, triangular elements, numerical integration, softwares. **(10 Hours)**

Unit-III

Computer Aided Manufacturing

Review of NC part programming, APT programming, computerized numerical control, adaptive control system. Industrial robots, Computer integrated Manufacturing Systems, DNC System, the manufacturing cell, flexible manufacturing systems, computer managing system, Enterprises Resource Planning (ERP), factory of the future.

Material handling and storage systems, group technology, quality control and automated inspection. Computer networks for manufacturing, hierarchy, local area network, manufacturing automation protocol. **(17 Hours)**

Books Recommended

1. Chandrupatla & Belegandu, Introduction to Finite Elements in Engineering, PHI.
2. Yoram Koren, Computer Control of Manufacturing System, Mcgraw Hill.
3. Mikell P. Grover, Automation, Production systems and Computer Integrated Manufacturing, PHI.
4. Ramamurthi, Computer Aided Mechanical Design & Analysis, TMH.
5. P. Radhakrishnan, 'CAD/CAM/CIM', New Age

MMPT-103	Industrial Engineering and Management	L	T	P
		3	1	0

Course Contents

UNIT – 1

PRODUCTIVITY: Definition of productivity, individual enterprises, task of management Productivity of materials, land, building, machine and power. Measurement of productivity, factors affecting the productivity, productivity improvement programmes, wages and incentives (simple numerical problems) **7Hours**

UNIT - 2

WORK STUDY AND TIME STUDY: Definition, objective and scope of work study. Human factors in work study. Work study and management, work study and supervision, work study and worker. Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating & standard Rating, standard performance, scale of rating, factors of affecting rate of working, allowances and standard time determination. Predetermined motion time study – Method time measurement (MTM). **13 Hours**

UNIT - 3

Ergonomics: Introduction, areas of study under ergonomics, system approach to ergonomics model, man-machine system. Components of man-machine system and their functions – work capabilities of industrial worker, study of development of stress in human body and their consequences. computer based ergonomics. **6 Hours**

Unit -4

Principles of Management; History, Operations, Organization; Concept of manufacturing and Operations management; engineering productivity, efficiency utilization, difference between Products and services, interrelationship of profitability and productivity, productivity in relation to material. **8 Hours**

UNIT – 5

Operations Strategy; Competitiveness with Operations; Competing on cost, quality, flexibility, speed, Productivity, efficiency & effectiveness. **8 Hours**

RECOMMENDED BOOKS:

1. ILO, Introduction to work study - III Revised Edition, 1981
2. Motion and Time study - Ralph M Barnes; John Wiley, 8th Edition, 1985.
3. H.S Shan, Work Study & Ergonomics', Dhanpat Rai & Co.
4. Marvin E. Mundel- Motion and Time study, PHI, 1st edition
5. S.N. Chary, 'Production and Operations Management', TMH

MMPT-111	Advanced Welding Processes	L	T	P
		3	1	0

Elective -1

Course Contents

Unit-I

(8 Hours)

Solid State Welding Processes

Friction and friction stir welding, ultrasonic welding, adhesive bonding, diffusion bonding, explosion welding- basic principle, process variables, weld characteristics advantages, limitations and applications.

Unit-II

(8 Hours)

High Energy Beam Welding Processes

Electron Beam Welding (EBW), basic principle, equipment details, process characteristics, process variables, advantages, limitations and applications.

Laser Beam Welding (LBW), principle of operation, different laser mediums, advantages, limitations and applications.

Unit-III

(8 Hours)

Electro Slag and Electro Gas Welding

Principle of operation; equipment details; process variations; advantages, limitations and applications

Unit-IV

(8 Hours)

Thermit Welding

Basic principle, thermit mixtures, applications.

Thermal Cutting

Oxy-Acetylene cutting-basic principle, metal powder cutting, chemical flux cutting, oxygen lancing; Arc cutting- brief introduction to oxygen arc cutting, air arc cutting, plasma arc cutting, metal arc cutting and gouging; advantages, limitations and applications of various techniques.

Unit-V

(8 Hours)

Underwater Welding

Introduction to wet and dry under water welding & cutting

Welding in space

Introduction, welding techniques, difficulties and advantages

Books recommended

1. S.V. Nadkarni, "Modern Arc Welding Technology", Oxford & IBH.
2. H.B. Cary, "Modern Arc Welding Technology", Englewood Cliffs, Prentice Hall.
3. R.S. Parmar, 'Welding Technology', Part 1 & 2
4. O.P. Khanna, 'Welding Technology'
5. R. Little, "Welding Technology, TMH.

MMPT-112	Composite Materials & Manufacturing	L	T	P
		3	1	0

Elective -1

Course Contents

Unit-I (10 Hours)

Introduction: General introduction to composites; historical background; concept of matrix and reinforcement and particulates.

Matrix and reinforcement: Types of matrix and reinforcement, volume fraction and weight fraction Fiber architecture fiber packing arrangements, whiskers

Unit-II (10 Hours)

Fabrication methods of polymer composites: Liquid resin impregnated routes, pressurized consolidation of resin pre-pegs, consolidation of resin molding compounds, injection molding of thermoplastics, hot press molding of thermoplastics

Fabrication of ceramic composites: Powder based routes, reactive processing, layered ceramic composites, carbon/carbon composites

Unit-III (10 Hours)

Fabrication routes of metal matrix composites: Squeeze infiltration, stir casting, spray deposition, powder blending and consolidation, diffusion bonding of foils, PVD

Testing and characterization: Different tests like internal stress measurement by diffraction, metallographic preparation etc with special emphasis to metal matrix composites

Unit-IV (10 Hours)

Secondary processing and application of composites: Secondary processing like machining, joining, extrusion of composites; Application and case studies

Recommended Books:

- 1 S. C. Sharma, ' Composite Materials'', Narosa Publishers
2. R.K. Everret & R.J. Arsenault, ' Metal matrix composite', Academic Press
3. W. Clyne & P. J. Withers, ' Introduction to Metal Matrix Composite', Cambridge

MMPT-201	Advanced Manufacturing Processes	L	T	P
		3	1	0

Course Contents

Unit-1

Advanced Machining Theory and Practises: Review of orthogonal cutting – mechanisms of chip formation, shear angle relations, theoretical determination of cutting forces, analysis of turning, drilling, and milling operations, mechanics of grinding, dynamometry, thermal aspects of machining, tool wear and extended tool life equation, machinability, economics of machining. **(14)**

Unit-2

Advanced Machining Processes: Introduction, process principle, material removal mechanism, parametric analysis, and applications of processes such as ultrasonic machining (USM), abrasive jet machining (AJM), water jet machining (WJM), abrasive water jet machining (AWJM), electrochemical machining (ECM), electro discharge machining (EDM), electron beam machining (EBM), and laser beam machining (LBM) processes. **(14)**

Unit-3

Advanced Casting Processes: Permanent mould casting, continuous casting, squeeze casting, vacuum mould casting, shell moulding, gating system design. **(6)**

Unit-4

Rapid prototyping (RP): Process chain in RP, layering techniques, steriolithography, fused deposition modeling, laminated object manufacturing, repetitive masking and depositing. **(4)**

Unit-5

Advanced Metal Forming Processes: Details of high energy rate forming (HERF) process, electro-magnetic forming, explosive forming, electro-hydraulic forming, stretch forming, contour roll forming. **(4)**

Suggested Books:

1. Bhattacharya, A., "Metal Cutting : Theory and Practices", New Central Book Agency
2. P.L. Jain, 'Principles of Foundary Technology', McGraw Hill
3. Ghosh, A. and Mallik, A.K., "Manufacturing Science", Affiliated East-West Press.
4. P. C. Pandey, 'Modern Machining Processes', TMH
5. Jain, V.K., "Advanced Machining Processes", Allied Publishers

MMPT-202	Finite Element Methods	L	T	P
		3	1	0

Course Contents:

Unit-1 (8 Hours)

INTRODUCTION

Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method, Ritz method

Unit-2 (8 hours)

ONE DIMENSIONAL PROBLEMS

Finite element modeling – Coordinates and shape functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions, Application stop lane trusses

Unit-3 (8 Hours)

TWO DIMENSIONAL CONTINUUM

Introduction – Finite element modelling – Scalar valued problem – Poisson equation – Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation – Temperature effects

Unit-4 (8 Hours)

AXISYMMETRIC CONTINUUM

Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures– Rotating discs

Unit-5. (8 Hours)

ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM

The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

Recommended Books:-

1. Chandrupatla T.R., and Belegundu A.D., “Introduction to Finite Elements in Engineering”, Pearson Education
2. David V Hutton, “Fundamentals of Finite Element Analysis”, 2004. McGraw-Hill Int. Ed.
3. J.N. Reddy, : *An Introduction to the Finite Element Method*, McGraw-Hill Education .
4. S. S. Bhavakatti, ' Finite Element Analysis', New Age Publishers

MMPT-203	Advanced Optimization Techniques	L	T	P
		3	1	0

Course Contents

Unit-I

(10 Hours)

Linear programming: Modelling of linear programming problem – a few examples; Solution of linear programming problem – simplex method, two-phase method, Sensitivity analysis – graphical approach

Unit-II

(10 Hours)

Non-linear programming: Convex and non-convex search space, Kuhn-Tucker conditions, Hessian matrix; Transformation of constrained optimization problems into unconstrained ones – penalty function approach; Direct search – variable elimination method, random search method

Unit-III

(10 Hours)

Integer Programming: Modelling of integer programming problem – a few examples; Solution of integer programming problem – branch & bound algorithm, cutting-plane algorithm; Case Study.

Unit-IV

(05 Hours)

Heuristic Models: Limitations of traditional optimization approaches to solve real world problems, Population based optimization techniques, Simple genetic algorithms – introduction, representation of variables.

Unit-V

(05 Hours)

Fitness function in genetic algorithms, genetic operators – reproduction, crossover, mutation; Advantages and limitations of population based optimization techniques over the point-to-point based ones

Recommended Books:

1. Taha, H. A., 'Operations Research', PHI
2. Deb, K., 'Optimization of Engineering Design', PHI
3. D.S. Hira, P. K. Gupta, 'Operations Research', S. Chand
4. Rao, 'Optimization Techniques', New Age international

MMPT-221	Diagnostic Maintenance and Monitoring	L	T	P
		3	1	0

Elective 2

Course Contents:

Unit-I

Introduction to maintenance techniques, maintenance Strategies, Classifications (Plant maintenance, Running Maintenance, Shut Down, Emergency corrective, curative, Breakdown, preventive predictive, Reliability, Total productive Maintenance, Guidelines for selecting best strategy

Unit-II

Fault Tree analysis, Methodology for tree development, Family tree definitions in symbols. Fault Tree construction, fault tree simplification, fault tree evaluation, common cause failure, Probability evaluation in fault trees, Simulation approach
Wear analysis through Thermo-graphy and Ferro-graphy

Unit-III

Various Techniques of condition Monitoring, condition based Maintenance, visual monitoring, performance monitoring, war debris monitoring, Decision elements in condition based maintenance detection, diagnosis, Prescription, Benefits of condition maintenance

Unit-IV

Vibration Analysis; Typical defects in gears and bearings; vibration characteristics; Monitoring methods; time domain, spectral and cepstral methods; Machine condition indicators; defect severity index

Unit-V

Diagnostic maintenance: Application of diagnostic maintenance to Industrial Machine & plants. Case studies

Recommended Books:

1. Kelly, 'Diagnostic maintenance & condition Monitoring', Butterworth & Co.
2. Krishan G,' Maintenance and spare parts management', Prentice Hall
3. Higgins,' Maintenance Engineering handbook', McGraw Hill
4. Nielsel Benjamin,' Engineering Maintenance Management', Maries
5. Tomer Elandy and Hans Boden,' Noise and Vibrations', MWL laboratory for Sound and Vibration, Stockholm, Sweden

MMPT-222	Product Design and Development	L	T	P
		3	1	0

Elective 2

Course Contents

Unit-I

(10 Hours)

Stages in design process: Introduction to various stages of the design process: Formulation of problem, Generation of alternatives, Evaluation, Guided Redesign. Case study

Product life cycle: New product introduction: early introduction, increased product life. Life cycle management tools: System integration, QFD, House of quality, Pugh's method, Pahl and Beitz method, Case studies

Unit-II

(10 Hours)

Value engineering: Introduction, nature and measurement of value, Value analysis job plan, Creativity and techniques of creativity, Value analysis test, Case studies

Concurrent/ reverse engineering: Introduction, basic principles, components, benefits of concurrent engineering. Concept of reverse engineering

Unit-III

(8 Hours)

Material selection: Materials in design, The evolution of engineering materials, Design tools and material data, Function, material, shape and process, Material selection strategy, attribute limits, selection process, computer aided material selection, Case studies

Process selection: Introduction, Process classification: shaping, joining and finishing, Systematic process selection, Ranking, process cost, Computer – aided process selection

Unit-IV

(8 Hours)

Design for manufacture and assembly: Design for Manufacture and Assembly (DFMA), Reasons for not implementing DFMA, Advantages of DFMA with case studies, Design features and requirements with regard to assembly, production, Design for Manufacture in relation to any two manufacturing processes: machining and injection molding, Need, objectives

Design for 'X': Introduction, Design for: Safety, packaging and storage, quality, reliability, energy conservation, environment, aesthetics, ergonomics, maintenance, recyclability and disposal, Case studies.

Unit-V

(4 Hours)

Patents, liability and ethics: Introduction, Protecting your design: patents, copyright, basic tools of design protection. Liability issues in product design. Ethical considerations, Examples/ case studies

(12 Hrs)

Recommended Books:

1. Karl T. Ulrich, Steven D. Eppinger, 'Product Design & Development', McGraw Hill
2. John M. Usher, Utpal Roy and H. R. Parasaei, 'Integrated Product and Process Development', Tata McGraw Hill
3. G. Boothroyd, P. Dewhurst and W. Knight, 'Product Design for Manufacture and Assembly', Marcel Dekker
4. A. K. Chitale and R. C. Gupta, 'Product Design and Manufacture', PHI
5. Mahmoud M. Farag, 'Selection of Materials and Manufacturing Processes for Engineering Design', Prentice Hall

MMPT-223	Reliability Engineering	L	T	P
		3	1	0

Elective 2

Course Contents

Unit 1 (8)

Fundamental concepts:-Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , PDF, cdf, safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Areas of reliability, Quality and reliability assurance rules, product liability, Importance of Reliability

Unit 2 (8)

Probability theory:-Set theory, laws of probability, total probability theorem, probability distributions binomial, normal, Poisson , lognormal, Weibull , exponential, standard deviation, variance, skewness coefficient , Chebyshev inequality, central limit theorem.

Unit 3 (8)

System reliability and modelling: Series, parallel, mixed configuration, k- out of m systems;, complex systems- enumeration method, conditional probability method, cut set and tie set method, Redundancy, element redundancy, unit redundancy, standby redundancy- types of stand by redundancy, parallel components single redundancy, multiple redundancy. Markov analysis.

Unit 4 (8)

System reliability Analysis: Reliability allocation or apportionment, Reliability apportionment techniques – equal apportionment, AGREE, ARINC, feasibility of objectives apportionment, dynamic programming apportionment, Reliability block diagrams and models, Reliability predictions from predicted unreliability, minimum effort method.

Unit 5 (8)

Failure Mode, Effects and Criticality Analysis- Failure mode effects analysis, FMECA examples, RPN, Ishikawa diagram for failure representation , fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, minimal cut set method, Delphi methods, Monte carlo evaluation.

BOOKS RECOMMENDED:

1. L.S. Srinath, Concepts of Reliability Engg., Affiliated East-West Press (P) Ltd., 1985.
2. A.K. Govil, Reliability Engineering, Tata McGraw-Hill Publishing Co. Ltd., 1983.
3. E. Balagurusmy, Reliability Engineering, Tata McGraw-Hill Publishing Co. Ltd., 1984.
4. B.S. Dhillon, C. Singh, Engineering Reliability, John Wiley & Sons, 1980.
5. P.D.T. Conon, Practical Reliability Engg., John Wiley & Sons, 1985.
6. A.Birolini , Reliability Engineering, Theory and Practice, Third Edition, Springer,1999

MMPT-231	Total Quality Management	L	T	P
		3	1	0

Elective 3

Course Contents

UNIT 1 (8)

Introduction, Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation

UNIT 2 (8)

TQM Principles, Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT 3 (8)

Statistical Process Control (SPC), The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools

UNIT 4 (8)

TQM tools, Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA

UNIT 5 (8)

Quality systems, Need for ISO (9)000 and Other Quality Systems, ISO (9)000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS (9)000, ISO 14000 – Concept, Requirements and Benefits

RECOMMENDED BOOKS:

1. Dale H.Besterfield, et al., Total Quality Management, Pearson Education Asia, 1999, (Indian reprint 2002).
2. James R.Evans & William M.Lindsay, The Management and Control of Quality, (5 th Edition), South-Western (Thomson Learning), 2002 .
3. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
4. Oakland.J.S. “Total Quality Management Butterworth”, Hcinemann Ltd., Oxford. 1989
5. Narayana V. and Sreenivasan, N.S.,’Quality Management – Concepts and Tasks’, New Age International 1996.
6. Zeiri,“Total Quality Management for Engineers”, Wood Head Publishers, 1991

MMPT-232	Non Traditional Machining Processes	L	T	P
		3	1	0

Elective 3

Course Contents:

Unit-I (10 Hours)

Overview of mechanical removal processes: Introduction, Classification of various modern machining processes. Considerations in process selection, Working principle, selection of processes, Material removal rate, Horn design, process capabilities, applications & limitations of the Ultrasonic machining (USM)

Unit-II (10 Hours)

Abrasives water-jet processes: Working principles, mechanism of material removal study and selection of process parameters, machining characteristics, applications & limitations of the following processes, Abrasive jet Machining (AJM), Water jet machining (WJM), Abrasive Flow Machining Process (AFM), Abrasive water jet Machining (AWJM)

Unit-III (10 Hours)

Electro chemical processes: Principle of operation, mechanism of material removal, study of equipment and selection of process parameters, process capabilities, tool design applications & limitations of the following processes, chemical machining (CM), Electro chemical machining (ECM). Electrochemical Honing, Electrochemical de-burring, Electro stream and shaped Tube Electrolytic Machining

Unit-IV (10 Hours)

Thermal metal removal processes: Thermal energy methods of material processing by Electric Discharge machining (EDM), Electron Beam machining (EBM), Ion-beam machining (IBM), and Laser Beam machining (LBM), .Introduction to new concept of High Speed Machining, Ultra-Precision Machining and hard turning

Recommended Books:

1. P.K. Mishra, ' Non Conventional Machining', Narosa
2. Pandey and Shan, ' Modern Machining Methods', TMH
3. Mc Geough, ' Principles of Electrochemical Machining', Chapman & Hall
4. Arata. A, ' Plasma, Electron and Laser Beam Technology', ASM
5. George Chryssolouris, ' Laser Machining-Theory & Practice', Springer

MMPT-233	Metal Forming and Analysis	L	T	P
		3	1	0

Elective 3

Course Contents

Unit-I (10 Hours)

Introduction: Stress-strain relations in elastic and plastic deformations, yield criteria for ductile metals, work hardening and anisotropy in yielding. Flow curves, elements of theory of plasticity, application of theory of plasticity for solving metal forming problems using slab method, upper and lower bound methods, slip line field theory, extremism principles, and effect of temperature and strain rate in metal working

Drawing: Drawing of a flat strip and round bar, determination of drawing load, drawing with wedge shaped dies, cylindrical dies, cylindrical rod drawing with a conical die analysis of the processes and maximum possible reduction

Unit-II (10 Hours)

Tube making: Tube making and deep drawing: introduction, plug drawing with a conical die, load determination, tandem drawing of tubes on a mandrel, tube sinking, concept of tube production by rolling and extrusion methods

Extrusion: Extrusion: round bar extrusion through a conical die, flat strip extrusion through dies of constant angles, impact extrusion, and hot extrusion of steels

Unit-III (10 Hours)

Rolling: Rolling of flat slabs and strip: Cold rolling and hot rolling, roll-pressure determination, rolling with no external tensions, rolling with front and back tensions

Forging: Forging: Introduction, determination of plain strain compression load, weight friction condition, inclined platen, thin strip, load evaluation for forging a flat circular disc

Unit-IV (05 Hours)

Frictions lubrication: Friction and lubrication in metal working, introduction, influences of friction in metalworking processes, lubricants used for different metalworking processes

Unit-V (05 Hours)

Unconventional Forming: Introduction to unconventional forming processes like hydrostatic extrusion, hydro-forming of sheets and tubes, powder forming

Recommended Books:

1. G. B. Rowe, 'Principles of Industrial Metal working Processes', CBS
2. Ghosh & Malik, 'Manufacturing Science', East West
3. P. N. Rao, 'Foundry, forming and welding', TMH

MMPT-341	Safety Engineering	L	T	P
		3	1	0

Elective 4

Course Contents:

Unit- I

(8 Hours)

SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planing machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards.

Unit- II

(8 Hours)

PRINCIPLES OF MACHINE GUARDING

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening.

Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawing-shearing presses- forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.

Unit- III

(8 Hours)

SAFETY IN WELDING AND GAS CUTTING

Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.

Unit- IV

(8 Hours)

SAFETY IN COLD FORMING AND HOT WORKING OF METALS

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures.

Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

Unit- V

(8 Hours)

SAFETY IN FINISHING, INSPECTION AND TESTING

Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation.

Suggested References

1. "Accident Prevention Manual" – NSC, Chicago, 1982.
2. "Occupational Safety Manual" BHEL, Trichy, 1988.
3. "Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
4. "Safety in Industry" N.V. Krishnan Jaico Publishery House, 1996.
5. **Indian Boiler acts and Regulations, Government of India.**

MMPT-342	Flexible Manufacturing Systems	L	T	P
		3	1	0

Elective 4

Course Contents

Unit 1 (8)

MANUFACTURING IN A COMPETITIVE ENVIRONMENT

Automation of manufacturing process - Numerical control - Adaptive control - material handling and movement - Industrial robots - Sensor technology - flexible, fixturing - Design for assembly, disassembly and service.

Unit 2 GROUP TECHNOLOGY (8)

Part families - classification and coding - Production flow analysis - Machine cell design - Benefits.

Unit 3 (8)

FLEXIBLE MANUFACTURING SYSTEMS

Introduction - Components of FMS - Application work stations - Computer control and functions - Planning, scheduling and control of FMS - Scheduling - Knowledge based scheduling - Hierarchy of computer control -Supervisory computer.

Unit 4 (8)

COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS

System issues - Types of software - specification and selection - Trends - Application of simulation - software -Manufacturing data systems - data flow - CAD/CAM considerations - Planning FMS database.

Unit 5 (8)

JUST IN TIME

Characteristics of JIT - Pull method - quality -small lot sizes - work station loads - close supplier ties – flexible work force - line flow strategy - preventive maintenance - Kanban system - strategic implications -implementation issues - MRD JIT - Lean manufacture.

BOOKS RECOMMENDED:

1. “Automated Manufacturing Systems, Actuators, Controls, Sensors, and Robotics”, McGraw-Hill, 1995
2. "Automation, Production Systems, and Computer-Integrated Manufacturing", M.P. Groover, Prentice-Hall, 1987
3. "NC Machine Programming and Software Design", Chang and Melkanoff, Prentice-Hall, 1989.
4. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi, 1998.
5. Yorem Koren, "Computer Integrated Manufacturing Systems", McGraw Hill, 1983.

MMPT-343	Rapid Prototyping	L	T	P
		3	1	0

Elective 4

Course Contents

Unit 1: (10)

Definition & Concept of Rapid Prototyping processes, Need of RP in context of batch production, FMS and CIM and its application; Basic Principles of RP, Steps in RP, Process chain in RP in integrated CAD-CAM environment, Advantages of RP; Classifications of different RP techniques based on raw material, layering technique (2D or 3D) and energy sources.

Unit 2: (10)

Process Technology, Basic concept & process detail of RP process like Stereo-lithography (SL), Solid foil polymerization, Selective laser sintering, Selective powder binding, Ballistic particle manufacturing both 2D and 3D, Fused Deposition Modelling, Shape Melting, Laminated Object Manufacturing, Solid Ground Curing, Repetitive Masking and deposition, Beam Inference Solidification, Holographic Interference Solidification.

Unit 3: (10)

Special Topic on RP using metallic alloys Solid ground curing laminated object manufacturing, fused deposition modeling, three dimensional printing, ballistic particle manufacturing & vacuum casting. Their advantages, applications & limitation.

Unit 4: (10)

Programming in RP, Modelling, Slicing, Internal Hatching, Surface Skin Fills, Support Structure. Technology for Rapid Prototyping: Selection materials, Development of 3D model & transforming it to the RP machine, Supporting techniques & development of the workpiece, Post processing part removal, part cleaning, post curing, part finishing, machine accuracy & part accuracy. Some case studies & application of Auto industries, die industries, medical appliances, etc.

BOOKS RECOMMENDED:

1. Rapid prototyping & Manufacturing Fundamental of Stero-lithiography, by Paul F. Jacobs, SME Publications.
2. Rapid Prototyping by Amitabh Ghosh, East West Press Pvt. Ltd.
3. Rapid Prototyping, Principles and Application, by Chua C. K., Leong K. F. and Lim C. S., World scientific publishing Co. Pvt. Ltd., Singapore

MMPT-351	Casting and Forging Design	L	T	P
		3	1	0

Elective 5

Course Contents

Unit-1

Introduction; Solidification of pure metals & alloys; Solidification of actual castings; state of solidification; Chvorinov's rule

Unit-2

Rising and Gating System; Riser Design, NRL Method; Application of Geometrical Programming, Gating Systems and their Characteristics, Pattern Design, Casting Design Considerations, Recent Trends

Unit-3

Selection and Control of Melting Furnaces, Cupola Design, Recent Trends e.g. Low Pressure and Ferrous Die Casting, High Pressure Molding, Hot and Cold Box Molding, Ceramic Shell Molding, V-Process, Shaw Process, Anitoch Process etc., Internal Stresses, Defects and Surface Finish; Quality Control.

Unit-4

Introduction, Forging Process, Forge ability of Different Materials, Die Design and Die making, Hammer Dies, Impressioned Dies, Finishing Dies, Press Dies, Forging Dies, Laws Governing Forging Machine Die Design, Piercing, Stripping and Clipping Tools.

Unit-5

Different Kinds of Hammers, Forging Machines, Furnaces, Maintenance and Repair of Plants, Testing Inspection and Quality Control

Suggested Books:

- 1 J.C. Sharman, 'Drop, Press and Machine Forging', The Machinery Publishing Co. London
2. Forging Design Handbook
 1. Hein, R.W.; Loper, C.R. and Rosenthal, P.C., 'Principles of Metal Casting', Tata McGraw Hill
 2. "ASM Handbook, Vol 15, Casting", ASM International
 3. Jain, P.L., 'Principles of Foundry Technology', Tata McGraw Hill

MMPT-352	Tool and Cutter Design	L	T	P
		3	1	0

Elective 5

Course Contents

Unit-I (10 Hours)

Classification of cutting tools: Various machining operations and the tools required to carry out these operations: principle elements of various cutting tools; single point cutting tool geometry in ASA, ORS & NRS systems.

Tool Materials: Properties of cutting tool materials, development of cutting tool materials, composition, production process and application of different cutting tool materials viz. High carbon steel, HSS, carbides, Ceramics, CBN, UCON, diamond, etc.

Unit-II (10 Hours)

Design of Single point cutting tools: Cutting parameters of a lathe, different turning operations and cutting tools used for these operations. Classification of single point cutting tools: solid, carbide tipped tools, geometrical parameters of a single point cutting tool, design procedure of single point cutting tool, re-sharpening of single point cutting tools

Form Tools: Purpose and types, design procedure and their sharpening

Unit-III (10 Hours)

Drill design: Drilling operations, Cutting parameters of drilling operations, different drilling operations and cutting tools used for these operations, Types of drills, solid, carbide tipped drills, geometrical parameters of a twist drill, design procedure of a twist drill, re-sharpening of the twist drill.

Milling Cutter Design: Milling operations, milling cutting parameters, different milling operations and cutting tools for these operations, Types of milling cutters, solid, and carbide tipped cutter; geometrical parameters of a milling cutter, design procedure of a disc type milling cutter, re-sharpening of the cutters

Unit-IV (05 Hours)

Broach design: Broaching operation and its advantages, broaching cutting parameters, types of broaches, solid, and carbide tipped broaches; design procedure of a broach, re-sharpening of the broach.

Unit-V (05 Hours)

Hob design: Gear nomenclature, construction of involutes profile, hobbing operation and its advantages, geometrical parameters of a hob, design procedure of a hob

Recommended Books:

1. Donaldson, ' Tool Design', McGraw Hill
2. Prakash Joshi, ' Cutting tools', Wheeler Publishing
3. Arschinow & Alearoev, ' Metal Cutting theory & practice', Mir publication