

BHARTI UNIVERSITY DURG (C.G.)

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**SCHEME OF EXAMINATION
&
DETAILED SYLLABUS
FOR
MASTER OF TECHNOLOGY
IN
PRODUCTION ENGINEERING
UNDER
FACULTY OF MECHANICAL ENGINEERING
Session 2021-22
(Approved by Board of Studies)**

Effective from Oct 2021

BHARTI UNIVERSITY DURG (C.G.)

Scheme of Teaching & Examination

M.Tech. Mechanical Engg.(Production Engineering) I Semester

S. No.	Board of Study	Subject Code	Subject	Periods per Week			Scheme of Examination			Total Marks
				L	T	P	Theory / Practical			
							ESE	CT	TA	
1	Mech. Engg.	MT02111	Advanced Manufacturing Engineering	3	1	-	70	10	20	100
2	Mech. Engg	MT02112	CAD/CAM Applications	3	1	-	70	10	20	100
3	Mech. Engg	MT02113	Production & Materials Management	3	1	-	70	10	20	100
4	Mech. Engg	MT02114	Maintenance Engineering	3	1	-	70	10	20	100
5	Refer Table –I		Elective-1	3	1	-	70	10	20	100
6	Mech. Engg	MT02116	Advanced Manufacturing Engineering Lab	-	-	3	70	-	30	100
7	Mech. Engg	MT02117	CAD/CAM Applications Lab	-	-	3	70	-	30	100
Total				15	5	6	490	50	160	700

L- Lecture

T- Tutorial

P- Practical

ESE- End Semester Exam

CT- Class Test

TA- Teacher's Assessment

Table-I

ELECTIVE-I (MT0215)			
S.No.	Board of Study	Subject Code	Subject
1	Mech. Engg.	MT02115(1)	Applied Fuzzy logic & Fuzzy Sets
2	Mech. Engg	MT02115(2)	Finite Element Methods
3	Mech. Engg	MT02115(3)	Accounting & Management Control
4	Mech. Engg	MT02115(4)	Advanced Metrology And Computer Aided Inspection

Note (1) – 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session .

Note (2) – Choice of elective course once made for an examination cannot be changed in future examinations.

Semester: M. Tech. I

Branch: Mechanical Engineering

Subject: Advanced Manufacturing Engineering

Code: MT02111

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Competitive Aspects of Manufacturing Processes

Selection of Material, product, design and quality of material, substitution of material, selection of manufacturing process, process capabilities, manufacturing considerations. Heat treatment of steel, Designation of steel.

UNIT – II

Casting

Alloys: Ferrous, Non ferrous, properties, processes – Ingot, shapes, expendable mould – permanent pattern, expendable mould – expendable pattern, permanent, centrifugal, melting practices, design considerations, quality assurance, foundry mechanization.

UNIT – III

Bulk Deformation Process

Rolling - Classification, products, processing sequence, mill types, mill line equipments, accessories for flat and shape rolling, variables, load, torque, power calculations, rolling mill controls, defects – causes and remedies.

Forging - Types, tools and dies, equipment, recent trend in forging, design considerations, defects, causes and remedies.

Press working - Material properties – Form abilities, yield point phenomenon, Anisotropy, metals, shearing process – types, forces, finish blanking, equipments, bending-stresses and spring back, methods, flanging and necking, special processes – spinning, bulging, peen forming, stretch forming, deep drawing dies, design considerations in metal working.

Extrusion - Process, tooling, analysis and variables. Wire and tube drawing - Operations and Analysis.

UNIT - IV

Joining Process

Welding – Solid state bonding – cold, diffusion, forge friction, liquid state – Joint, weld ability, weld quality, material, resistance, arc, thermal, high energy beam. Liquid solid – brazing soldering. Recent development in welding – under water, high pressure vessel etc. Inspection & testing of welded joints.

Adhesive bonding – Types of adhesive, adhesive systems, surface preparation, application, design, process capability, welding of plastics, thermal cutting.

UNIT – V

Advanced Machining Processes

Nontraditional machining – Processes, Process parameters and comparative study of AJM, ECM USM, EDM, LBM, EBM, PAM processes.

Rapid Prototyping – Processes, process parameters, capability and products, application of various methods.

Fabrication of Microelectronic devices – Process sequence, basic techniques, thick and thin film techniques, application.

Text Books:

1. Manufacturing Engineering Technology – S. Kalpakjian & S.C. Schemid – Pearson Education - New Delhi
2. Introduction to Manufacturing Processes – J.A. Schey – McGraw Hill, New York

Reference Books:

1. Manufacturing Science – A. Ghosh & A. Mallik – Affiliated East West Press, Delhi
2. Mechanical Metallurgy – G.E. Dieter – McGraw Hill, New York
3. Principles of Manufacturing Material and Processes – J.S. Cambell – TMH, New Delhi

Semester: M. Tech. I

Branch: Mechanical Engineering

Subject: CAD/CAM Applications

Code: MT02112

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. :70

Minimum number of class test to be conducted: 02

UNIT– I

CAD/CAM Software

Graphics Standards, Basic definitions, Software modules, Applications of software in CAD/CAM.

Wire Frame models

Wire Frame entities, Curve representation, Parametric representation of Analytical curves. Parametric representation of synthetic curves. Curve manipulations, Design & Engineering applications.

UNIT– II

Surface and Solid Modelling

Surface model, Surface Representation, Parametric Representation of Analytic and Synthetic Surfaces, Surface Manipulations.

Solid Models, Solid entities, Solid Representation, Fundamentals of Solid Modelling, Half spaces, Boundary Representation, Constructive Solid Geometry, Sweep Representation, Analytic Solid Modelling.

UNIT – III

Modelling Analysis

Geometric Transformations, Mechanical Assembly, Mass Property Calculations, Finite Element Modelling and Analysis.

UNIT - IV

NC Machining

NC, CNC & DNC, NC programming, NC programming languages, Generation of Tool path,

Verification of Tool path.

Prismatic Machining

Facing, pocketing, profile contouring, curve following, point to point transition path.

UNIT - V

Three axes surface machining

Sweep roughing operation, sweeping operation, Iso-parametric machine operation, spiral milling operation.

Lathe Machining Techniques

Roughing, grooving, recessing, profile finishing, groove finishing, threading,

Multi-Axes Machining

Sweeping, contour driven operation, curve machining operation, iso parametric machining operation, axes drilling operation. Numerical Control- Advanced

Text Books:

1. CAD/CAM Theory & Practice – Ibrahim Zeid – Tata McGraw Hill Pub.
2. Computer Aided Design and Manufacturing – M. P. Groover and E.W. Zimmers, Prentice Hall, India

Reference Books:

1. CAD/CAM/CIM – P. Radhakrishnan and S. Subramanyam, New Age International
2. Mathematical elements of computer graphics – David F. Rogers and J. Alan Adams, Mc Graw Hill.

Semester: M. Tech. I

Branch: Mechanical Engineering

Subject: Production & Materials Management

Code: MT02113

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Production System & Advanced Forecasting Method

Generalized Model of production system, design, optimization & control of production system.
PPC – Production Planning, integrated part of corporate planning process, Integrative nature of production plans, centralized and decentralized production planning.

Advanced Forecasting – Principles, SWOT analysis, and 7S approach, Advanced Techniques – multi item forecasting, slow item forecasting.

UNIT - II

Capacity Planning

Measurement measures, estimating future capacity needs, factors influencing, factors favouring over capacity and under capacity, MPS.

Production Control Functions

Loading, sequencing, assignment models

High Volume Production System

Detroit type automation, automated flow lines, transfer mechanism, buffer storage, control function, automation for machining operation, Design and fabrication considerations.

UNIT – III

Inventory Management

Inventory models and safety stocks – Relevant costs, behaviour of costs in relation to level of inventory, optimal order quantity, EOQ, EBQ, Joint cycle for multiple products, model with purchase discounts, approaches to determine buffer stock, fixed order period models.

ABC and other classification of Materials selective management control, VED analysis,

combination of ABC and VED analysis, purpose classification.

Material requirement planning (MRP – I) – Concepts, structure, working output reports, classes of users.

UNIT – IV

Material Management

Spare parts Management – Characteristics, codification concept, stocking, policy analysis, Maintenance or breakdown capital, insurance, rotatable spares.

Other aspects of Material Management

Codification, characteristics, standardization, material handling, stores management.

UNIT – V

Physical Distribution Management

Transportation problem, Route scheduling problem, logistics management.

Material Management

An integrated view, Adaptability considerations, inventory – a part of production strategy, organization, effectiveness, a multi level interactive process.

Text Books:

1. Production and Operation Management – S.N. Chary – TMH, Delhi
2. Production Planning & Inventory Control – Seetharama L. Narasimham – Dennis W. Mc.
3. Automation, Production System and CIM – M.P. Groover – PHI, Delhi

Reference Books:

1. Industrial Engineering & Production Management – Martand Telsang – S. Chand & Company -Delhi
2. Production & Operation Management – Adam and Elbert – PHI, Delhi
3. Handbook of Material Management – Gopal Krishnan – PHI, Delhi
4. Industrial Engineering & Management – G. Nadha Muni Reddy – Newage International, Delhi

Semester: M. Tech. I

Branch: Mechanical Engineering

Subject: Maintenance Engineering

Code: MT02114

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam: 70

Minimum number of class test to be conducted: 02

UNIT- I

Maintenance, Reliability and Maintainability – Objectives, Productivity, reliability, redundancy maintainability, quality circle in maintenance, maintenance job and technologies.

Defect/Failure Analysis

Defect Generation, failure types, and failure analysis, defect reporting and recording and breakdown analysis.

UNIT - II

Maintenance Systems and Condition Monitoring

Planned, & Unplanned, Corrective opportunistic, Preventive, Predictive, Condition Based Maintenance, Design-out Maintenance, On-line & Off-line Monitoring, Visual, Temperature & Leakage Monitoring, Crack & Thickness Monitoring, Vibration Monitoring – selection of condition monitoring techniques, benefits.

UNIT- III

Maintenance Planning and Scheduling and CMMS

Job Planning & Scheduling, Short-term & long term plans, Capital Repair, Renovation, Codification Cataloguing; Maintenance Operation Liasons work permit job monitoring, maintenance records and documentation, selection and scope of computerization. Equipment classification, Material Management Module, Standardization Rationalization, Process planning.

UNIT - IV

Total Productive Maintenance & Concept of Maintenance

Terotechnology, scope and Concept of TPM, Basic System of TPM, Productivity Circle, TPM vis- a-vis TQM; 5-Zero Concept, Reliability Based Maintenance, Evaluation of RBM

programmes; Value Engineering in Maintenance, Productivity Measurement, Maintenance Audit.

Maintenance Organization

Formal & Informal Organization, Line & Staff Organization; Centralized. & Decentralized Organization, External Maintenance Services; Captive Shop facilities.

UNIT- V

Maintenance Budget and Cost-Control

Maintenance cost behaviour, cost factors influencing Maintenance, Budgeting of Maintenance Cost, Cost Controls, Budgetary Control.

Training of Maintenance Personnel

Profile and need of Maintenance, Objectives & Ten Commandments of training, Categories of training; Modes of training and developments, training sources, agencies, institutions, Planning & designing of training programmes.

Text Books:

1. Industrial Maintenance Management – S.K. Shrivastava – S. Chand & Compay – New Delhi
2. Integrated Maintenance Management concept to computerization – B. N. Saha – S. B. A. Publication, New Delhi

Reference books:

1. Maintenance Planning, Control and Documentation – E.N. White
2. Industrial Maintenance – H.P. Garg – S. Chand Publication
3. Maintenance Planning & Control – A. Kelly – Affiliated East West Press, New Delhi
4. Reliability Engg. – LS. Srinath– Affiliated East West Press, New Delhi

Semester: M. Tech. I

Branch: Mechanical Engineering Subject:

Applied Fuzzy logic & Fuzzy Sets

Code: MT02115 (1)

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT - I

Classification of sets and Fuzzy sets

Basic concepts of classical set and Fuzzy set, Basic operations & properties of classical & Fuzzy sets, Basic concepts of classical relation & Fuzzy relation.

UNIT - II

Membership Function & Fuzzy Arithmetic, Numbers, Vectors and the Extension Principle.

Features of the Membership Function, Standard Forms and Boundaries, Fuzzification, Membership value Assignments, Extension Principle, Fuzzy Transform, Fuzzy Numbers, Approximate Methods of Extension, Fuzzy Vectors.

UNIT - III

Classical Logic, Fuzzy Logic & Fuzzy Rule Based Systems.

Classical Predicate logic, Fuzzy Logic, Approximate Reasoning, Fuzzy Tautologies, Contradictions, Equivalence & Logical Proofs, Natural Language, Linguistic Hedges, Rule-Based Systems.

UNIT - IV

Fuzzy Non linear Simulation & Fuzzy Decision Making

Fuzzy Relational Equations, Partitioning, Non linear simulation using Fuzzy Rule-Based systems, Fuzzy Synthetic Evaluation, Fuzzy ordering, Preference & Consensus, Fuzzy Bayesian Decision method.

UNIT - V

Fuzzy Control system & Fuzzy Optimization

Simple Fuzzy logic controllers, Industrial Applications, Fuzzy Optimization, Fuzzy One Dimensional Optimization, Fuzzy maximum & minimum.

Text Books:

1. Fuzzy Logic with Engineering Applications – Timothy. J. Ross – McGraw Hill Publications
2. Fuzzy sets & Fuzzy Logic, Theory & Applications – G.J. Klir, Boyuan – Prentice Hall of India

Reference Books:

1. Fuzzy set Theory and its application – By H.J. Zimmermann, Allied Publishers, LTD
2. Fuzzy sets uncertainty and Information – By G.J. Klir and T.A. Folger, Prentice Hall
3. Mathematical Principles of Fuzzy logic – By Novak, Kluwer Academic Publishers.
4. Fuzzy Logic and Soft computing – By Chen, Kluwer Academic Publishers

Semester: M. Tech. I

Branch: Mechanical Engineering

Subject: Finite Element Methods

Code: MT02115 (2)

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. :70

Minimum number of class test to be conducted: 02

UNIT – I

General Concept

Introduction, Finite Element method Advantages and Disadvantages, Historical background, Review of Basic Concepts of Elasticity, Solution of Differential equation. Principle of minimum potential energy.

UNIT – II

Formulation and variation method.

Boundary value problems. Approximation Method of solution. Review of variational calculus, Eigen value problems, weighted Integral and weak formulation. Rayleigh Reitz Method, Method of weighted residually.

UNIT – III

Element shape function

Basic steps of finite element analysis. One dimensional Element, Model Boundary value problem, Finite Element Error Analysis. Convergence of solution, accuracy of solution, natural coordinates, numerical integration.

UNIT – IV

Problem in Solid Mechanics

Formulation of problem, Axial, Torsional and Flexural, Deformation of Beams. Axisymmetric problem of plane stress and plane strain. Free vibration beam and staff.

UNIT – V

Plane Elasticity

Assumption of Plane Elasticity, Weak formulation, Finite Element Model Analysis, Virtual work statement, Displacement field education. Interpolation function.

Text Books:

1. Introduction of Finite Element – J.N. Reddy – TMH
2. Applied Finite Element Analysis – J. Larry – John Wiley and Sons Pub.

Reference Books:

1. Finite Element Analysis – Krishnamurty C.S. – TMH
2. Finite Element Method for Engineers – K.H. Hubner and E.A. Thornton – John Wiley and Sons Pub.

Semester: M. Tech. I

Branch: Mechanical Engineering

Subject: Accounting & Management Control

Code: MT02115 (3)

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Introduction to Financial Accounting

Basic accounting concepts & conventions, Preparation of Financial Statements/ Trial Balance, (Balance Sheets, Trading & Profit & loss A/c & Adjustments), Depreciation.

UNIT – II

Introduction to Cost Accounting

Cost Classification, Allocation and absorption, Preparation of Cost Sheet.

UNIT – III

Variance Analysis & Budgetary Control

Cost Analysis for decision making, Direct Costing, Break Even Analysis (CVP Analysis), Cost Analysis for Control (Variance Analysis), Budgetary Control & Preparation of Budgets(Cash Budget, & Other Types of Budget.)

UNIT – IV

Cash Flow & Fund Flow Analysis

Preparation of Cash Flow & Fund Flow Statement, Responsibility Accounting (Cost Centre, Profit Centre, Budget Centre) and Transfer Pricing.

UNIT – V

Working Capital Management

Concept need & influencing factors, Estimation of Working Capital, General idea of Control of Service Organizations & Control of Multi National Companies.

Text Books:

1. Bhattacharya, S.K. & Dearden John – Accounting for Management – PHI
2. Financial Management – Prasanna Chandra – TMH, New Delhi
3. Management Accounting – Sharma & Gupta – Kalyani Publications, New Delhi

Reference books:

1. Financial Accounting – S.M. Shukla – Sahitya Bhawan Publications, Agra
2. Cost & Management Accounting – Khan & Jain – TMH, Delhi
3. Cost & Management Accounting – M.N. Arora – Vikas Publications, New Delhi
4. Financial Management – I.M. Pandey – Vikas Publications, New Delhi
5. Modern Accountancy – Haneef & Mukherjee – TMH, Delhi

Semester: M. Tech. I

Branch: Mechanical Engineering

Subject: Advanced Metrology and Computer Aided Inspection

Code: MT02115 (4)

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Advanced Metrology

Measurement standards and systems, Gauging principles, machine tool accuracy and performance testing, computer assisted sensor systems for machine testing.

UNIT – II

Inspection principles and practices

Inspection fundamentals, inspection procedure, inspection accuracy, Type I and Type II inspection errors, error sources, sampling theory, uncertainty analysis, automated inspection, offline and online/in-process inspection, quantitative analysis of inspection, measurement standards and systems.

UNIT – III

Co-ordinate Measuring Machine (CMM)

Co-ordinate Metrology, CMM Basics, CMM Construction, CMM operation and programming, accessory elements, probing systems, probe and stylus, non contact sensors, probe calibration, error compensation of co-ordinate measuring machines, algorithms and sampling methods used in data analysis, thermal and environmental effects, compensation of probing errors. CMM Software, scanning, reverse engineering applications, performance evaluation of co-ordinate measuring machines.

UNIT – IV

Advanced surface metrology

Constituents of surface texture, stylus, optical, atomic force microscope and other advanced methods of measuring surface texture, two and three dimensional measurement of surfaces.,

separation of form, waviness and roughness, random process analysis techniques, use of transforms for filtering, numerical evaluation of surface texture.

UNIT – V

Laser metrology and Machine vision

Laser metrology, laser interferometer, laser scanners, applications, non contact non optical inspection techniques, Machine Vision, sensing, low and higher level vision, image acquisition and digitization, cameras, CCD,CID, CPD etc., illumination, image processing and analysis, feature extraction, applications.

Text Books:

1. Mikell P Groover : Automation Production Systems and Computer - Integrated Manufacturing - Pearson Education
2. John A Bosch: Co-ordinate Measuring Machines and Systems - Marcel Dekker, Inc.
Vernon D: Machine Vision - Automated Visual Inspection and Robot Vision -Prentice Hall, International Ltd.

Reference Books:

1. Fu K S Gonzalez, R C and Lee C S G Robotics : Control Sensing Vision and Intelligence McGraw Hill International
2. Robinson S L and R K. Miller : Automated Inspection and Quality Assurance Marcel Dekker Inc. USA
3. ASME, Handbook of Industrial Metrology - Prentice Hall of India Ltd.
4. ISO Guide to the expression of Uncertainty in Measurement

Semester: M. Tech. I

Branch: Mechanical Engineering

Subject: Advanced Manufacturing Engineering -Lab

Code: MT02116

Total Practical Periods: 40

Total Marks in End Semester Exam. : 70

List of Experiments-

1. Inspection procedures, codes and standard
2. Magnetic Particle Testing
3. Die Penetrant Testing
4. Liquid Penetration Report
5. Eddy Current Testing
6. Ultrasonic Inspection
7. Radiography
8. Study of IS standards in molding material, sand testing
9. Study of IS Standard in welding (weld material, weld testing, welding symbol)
10. Design of gating and feeding system for simple casting
11. Industrial Visit of industries to study the various manufacturing processes.

Semester: M. Tech. I

Branch: Mechanical Engineering

Subject: CAD/CAM Applications Lab

Code: MT02117

Total Practical Periods: 40

Total Marks in End Semester Exam.: 70

List of Experiments-

1. Making of casting using extrusion method in Pro-E.
2. Making of casting using removal method in Pro-E
3. Assembly of different machine components (Wheel-shaft assembly) in Pro-E
4. Impairing motion to Assembled components.
5. Working with Basic feature of ANSYS Software

BHARTI UNIVERSITY DURG (C.G.)

Scheme of Teaching & Examination

M.Tech. Mechanical Engg. (Production Engineering) Semester-II

S. No.	Board of Study	Subject Code	Subject	Periods per Week			Scheme of Examination			Total Marks
							Theory / Practical			
				L	T	P	ESE	CT	TA	
1	Mech. Engg.	MT02121	Machine Tools Engineering	3	1	-	70	10	20	100
2	Mech. Engg	MT02122	Robotics	3	1	-	70	10	20	100
3	Mech. Engg	MT02123	Quality Control & Reliability Engineering	3	1	-	70	10	20	100
4	Mech. Engg	MT02124	Measurement system Analysis	3	1	-	70	10	20	100
5	Refer Table –I		Refer Table –I	3	1	-	70	10	20	100
6	Mech. Engg	MT02126	Machine Tools Engineering Lab	-	-	3	70	-	30	100
7	Mech. Engg	MT02127	Robotics Lab	-	-	3	70	-	30	100
Total				15	5	6	490	50	160	700

L- Lecture

T- Tutorial

P- Practical

ESE- End Semester Exam

CT- Class Test

TA- Teacher's Assessment

Table-I

ELECTIVE I (MT02125)			
S.No.	Board of Study	Subject Code	Subject
1	Mech. Engg.	MT02125(1)	Mechatronics
2	Mech. Engg	MT02125(2)	Productivity Management
3	Mech. Engg	MT02125(3)	Advances in Material Processing
4	Mech. Engg	MT02125(4)	Management of Organizational Behaviour

Note (1) – 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session .

Note (2) – Choice of elective course once made for an examination cannot be changed in future examinations.

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Machine Tools Engineering

Code: MT02121

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Cutting Tool Design

Design of Single Point Tool, Tool angle specification systems and their interrelationship, Design of form Tool, Design of indexable insert and its specification system, Design of Chip Breaker.

Design of Twist drill, milling cutter, broach, reamer and taps.

Cutting Tool Material

Characteristics of tool material, advances in cutting tool material, role of coating.

UNIT –II

Mechanics of Machining Processes

Chip formation, Orthogonal cutting, Oblique cutting, mechanics of turning, milling and drilling process, machinery with controlled contact tools.

Machinability and Economics of Machining

Machinability, evaluation of Machinability, mechanism of tool failure, tool wear mechanism, tool life and tool life equation, factors affecting Machinability surface finish and surface integrity.

Economics of machining, cost of turning operation, optimum cutting speed for minimum cost and maximum rate of production.

UNIT – III

Design of Machine Tool Structure

Function and requirement, design criteria, material, static and dynamic stiffness, profile of machine tool structure, design procedure.

Design of – Beds, columns, housing, bases and tables, cross rails, arms, saddles, carriage and Rams. Model Technique in design of Machine Tool structure.

Design of Guide ways

Function, Design criterion and calculations for slideways, guide way operating under liquid friction condition.

UNIT – IV

Design of spindle and spindle supports

Function of spindle unit and requirement, material, effect of machine tool compliance on machining accuracy, Design calculations of spindles, antifriction bearing and sliding bearing.

Kinematics of Machine Tool

Aim of speed and feed rate regulation, stepped regulation of speed, classification of speed and feed boxes, design of speed box & feed box, stepless regulation of speed and feed rates.

UNIT – V

Jig & Fixtures

Element of Jig & Fixtures, Principle of location, principle of clamping, locating and clamping devices. Design principle of drilling Jig and drill bushes. Design considerations and design of Milling fixtures, Lathe fixtures, grinding fixtures, broaching fixtures, indexing jig and fixture. Design problem on Jig & Fixture.

Text Books:

1. Tool Design – Cyril Donaldson, George H. Lecain, VC Goold – TMH, New Delhi
2. Machine Tool Design and Numerical Control – N.K. Mehta – TMH, New Delhi
3. Jig & Fixture – P.H. Joshi – TMH, New Delhi

Reference books:

1. Principle of Metal Cutting – G.C. Sen, A. Bhattacharya – New Central Book Agency – Calcutta
2. Principle of Machine Tool - G.C. Sen, A. Bhattacharya – New Central Book Agency – Calcutta
3. Production Engineering – P.C. Sharma – S. Chand & Company, New Delhi
4. Metal Cutting and Machine Tool – B.L. Juneja, G.S. Shekhar, Niting Seth – New Age, New Delhi

5. Production Engineering & Science – Dr. P.C. Pandey, Dr. C.K. Singh – Standard Publishers, Delhi
6. Production Technology – R.K. Jain – Khanna Publishers – New Delhi

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Robotics

Code: MT02122

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. :70

Minimum number of class test to be conducted: 02

UNIT – I

Robotics

Concepts in Robotics - Advances and applications of robotics in Robots, Resolution, Accuracy and Repeatability, Point, Continuous part system control loops, types of manipulators, wrist & Grippers.

UNIT – II

Kinematics Analysis of Robotics

Geometry based direct kinematics, Co-ordinate and vector transformation using matrix, Denant – Hartenberg Convention, application of DH notation, Inverse Kinematics.

UNIT– III

Dynamics

Elementary treatment of Lagrange – Euler, Newton – Euler formulations, Generalized D' Alembert equations of motion.

UNIT- IV

Control & Trajectory Planning

Drives, Control of Trajectory: Hydraulic system stepper motor, Direct current servomotors, A-C servomotors, adaptive control, interpolators, trajectory planning, resolved motion rate control method.

UNIT – V

Robotic Sensors

Vision system, Range, proximity, touch, force and torque sensors, Assembly-Aid devices,

Robot programming, Artificial intelligence.

Applications of Robot

Handling, loading, unloading, welding, painting, assembly, Machining, Manufacturing, Work-cell, Installation of Robots.

Text Books:

1. Robotics & Control – R.K. Mittal, I.J. Nagrath – TMH – New Delhi
2. Fu K.S., Gonzalez R.C. and Lee C.S.G., Robotics : Control sensing vision and intelligence, Mc Graw Hill

Reference Books:

1. M.P. Groover, M. Weiss, P.N. Nagal and N.G. Odrey, Industrial Robotics, McGraw Hill International Deduction
2. Shimon Y. Nof (Editor), hand book of industrial robotics, John Wiley and Sons
3. D.T. Pham, Expert – System in Engineering, Springer Verlag
4. Anthony C, Mc Donald, Robot Technology, theory , design and applications, Prentice Hall, New Jersey
5. Yoren Koren, Robotes for Engineers.
6. K.S. Fu, R.C. Gonzaler C.S.G. Lee, Robotes (Control, sensing vision& intelligence)

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Quality Control & Reliability Engineering

Code: MT02123

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Introduction to Quality Control and Total Quality System

Philosophy and fundamental of quality control, Some philosophies and their impact on quality, comparison of philosophies, Quality management practices, Tools and standards, Management commitment, Total quality management, performance standards, six sigma quality, Quality function deployment, QFD process, Innovative Adoption and performance evaluation – Bench marking, Quality auditing, Vendor rating, Tools for continuous improvement, International standards and quality awards.

UNIT – II

Fundamentals of Statistical concepts and Techniques in Quality Control and Improvement

Descriptive statistics describing product or process characteristics – Data collection, measurement scales, measure of central tendencies, measure of dispersion, measure of skewness and Kurtosis.

Probability distribution – discrete distributions (Hyper geometric, Binomial, Poisson), continuous distributions (Normal, exponential, Weibull). Approximate to some probability distribution.

Inferential statistics drawing conclusion on product and process quality – sampling distribution, Hypothesis testing, Analysis of Variance.

Graphical methods of data presentation and quality improvement – Frequency distributions and histogram, Run chart, Pareto diagram, Cause - Effect diagram, Box plot etc.

Tolerances of Assemblies and component – Tolerance limits on interacting components, tolerance limits on mating parts.

UNIT – III

Statistical Process Control using control charts

Causes of variation, Statistical basis for control charts, analysis of patterns in control charts, maintenance of control charts.

Control chart for variables – selection of characteristics for investigation, preliminary decisions, various control charts. Control charts for Attributes – Advantages and Disadvantages, preliminary decisions, and various attribute charts.

Process Capability analysis – Benefits, process capability indices, process capability analysis procedure.

UNIT – IV

Acceptance Sampling

Sampling plans for attributes - Advantages and Disadvantages of sampling, evaluation of sampling plans, various sampling plans.

Sampling plan for variables- Advantages, disadvantages, variable sampling plans.

UNIT – V

Reliability Engineering

Reliability, life cycle curve, probability distribution in modelling reliability, system reliability, Redundancy, Reliability allocation, Reliability and life testing plans.

Experimental design, Taguchi method, quality control in service sector.

Text Books:

1. Statistical Quality Control – M. Mahajan – Dhanpat Rai & Co. (P) Ltd.
2. Statistical Quality Control – R.C. Gupta – Khanna Publishers, Delhi

Reference Books:

1. Fundamentals of Quality Control and Improvement – Amitava Mitra – Peterson Education Asia.
2. Quality Assurance Methods and Technologies – Kenneth L. Arnold, Michel Holler – McGrawHill Book Co.

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Measurement System Analysis

Code: MT02124

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Analysis of Measurement System

Classification of measurement, analysis of experimental data, types of measurement errors, uncertainty, uncertainty analysis, proposition of uncertainty, curve fitting.

UNIT – II

Static Characteristics

Static Performance Characteristics, linearity, static sensitivity, repeatability, hysteresis effect, resolution, readability, span, Thevenin Theorem, Theory of validation, multiple regression analysis, measurement with linear equality and inequality.

UNIT – III

Dynamic Characteristic

Zero order Instrument, first order instrument, ramp response, frequency response equation, second order Instrument with over damping, critical damping and under damping.

UNIT - IV

Data Analysis

Data acquisition and processing, types and configuration of DAS signal conditions, analog to digital conversion, digital to analog conversion, mechanical transmission, electric transmission, pneumatic transmission system.

UNIT – V

Theory of Calibration

Types of calibration, estimation of measuring instruments in verification, rejection and

acceptance. Calculation of number of standards. Calibration standard, master calibration schedule.

Text Books:

1. Measurement System – Ernest ‘O’ Doebline- McGraw Hill, Delhi
2. Experimental Methods for Engineering – Holman. J.P. – TMH, Delhi

Reference Books:

1. Mechanical Measurement – Backwith, Buck and Narangani – Narosa Publications, Delhi
2. Engineering Experimentation – Doebelin
3. Measurement Errors and Uncertainty – Semyan G, Rabinovic

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Mechatronics

Code: MT02125 (1)

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. :70

Minimum number of class test to be conducted: 02

UNIT – I

Introduction

Introduction to Mechatronics, Systems, Mechatronics in Products, Measurement Systems, Control Systems, Traditional design and Mechatronics Design.

UNIT– II

Sensors and Transducers

Performance Technology, Displacement, Position and Proximity, Velocity and Motion, Fluid Pressure, Temperature Sensors, Light Sensors, Selection of Sensors, Signal processing, Servo systems.

UNIT – III

Microprocessors in Mechatronics

Architecture, Pin configuration, Instruction set, Programming of Microprocessors using 8085 instructions, Interfacing input and output devices, Interfacing D/A converters and A/D converters, Applications, Temperature control, Stepper motor control, Traffic light controller.

UNIT– IV

Programmable Logic Controllers

Basic structure, Input/Output processing, Programming, Mnemonics Timers, Internal relays and counters, Data handling, Analog input / output – Selection of PLC.

UNIT – V

Design and Mechatronics

Designing – Possible design solutions – Case studies of Mechatronic systems.

Text Books:

1. Mechatronics – HMT Ltd., Tata Mc. Graw Hill, New Delhi
2. Machine Design for mobile and Industrial applicators – G. W. Kurtz, J. K. Scheller, D. W. Claar, SAE

Reference Books:

1. Computer Automation in Manufacturing – T. O. Boucher – An Introuduction – Chappman & Hall
2. Mechatronics , Intl. J. Pergamon Press.

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Productivity Management

Code: MT02125 (2)

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Productivity

Output, different inputs and productivity measures, partial and indirect measures, multi-factor productivity, efficiency and effectiveness, quantity orientation, productivity and quality, measures to increase productivity.

UNIT – II

Modern Tools and Techniques for Productivity Improvement

Job Redesign, human resource, Development Business Process Engineering, Bench Marking, Just-in-Time Production, Single Unit Production and Conveyance, Yo-I-Don and standardization, Kanban Production Information System.

UNIT – III

Operation Strategy

Operations Decision, priorities, components of production strategy, framework for manufacturing, types, developing and implementing, focussed operations, strategic management process, interfaces between operations and marketing function, Porter's five forces Models, Meaningful differentiation, flexibility, comparison, Traditional Vs New approach, cost leadership, operation strategies.

UNIT – IV

Performance Measurement

Principles, Indicators, key success factors, performance measurement system issues, Design and Implementation of performance measurement system.

UNIT – V

Technology Management

Technical issues and Implications, Technology Development and Acquisition, Technology Absorption and Diffusion, Technology Environment, Technology Support System.

Text Books:

1. Production & Operation Management – S.N. Chary – TMH, Delhi
2. Productivity Engineering & Management – Sumanth David J. – TMH, Delhi

Reference Books:

1. Productivity Management- Concepts and Techniques – S.C. Sawhney – TMH, Delhi
2. Industrial Engineering & Production Management – Martand Telsang – S. Chand & Co., Delhi
3. Managing Productivity - Schaffen Robot – Jaico Publishing House, Bombay

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Advances in Material Processing

Code: MT02125 (3)

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Introduction to Advance Material

Composites, Ceramic, Polymer, Super alloy, Refractory metal and alloy, Low melting alloy, precious metal, shapememory alloy, amorphous alloy.

UNIT – II

Solidification Principle

Heat transfer in solidification, Nucleation and growth, Plane front solidification of alloy, Lateral segregation, cellular and dendritic growth, segregation, solidification process and cast structure, single crystal growth, grain refinement and eutectic modification.

UNIT – III

New Solidification Process

Rapid solidification process: conduction process and convection process, chill block melt spinning process, free flight melt spinning process, free jet melt spinning process, planer flow casting process, crucible melt extraction process, spray deposition process, plasma spray deposition process, ultrasonic gas atomization process.

Solidification of metal matrix Composite

Infiltration Casting process, dispersion process, spray casting process, reactive processing, Squeeze casting, semi mold metal forming process, Cosworth process, Improved low pressure casting process (LIP), Directional solidification processing.

UNIT – IV

Powder Metallurgy

Recent Advances in Powder Metallurgy: Hot Isostatic pressing, spark discharge sintering,

gravity sintering, Induction sintering, sinter HIP process, ceracon process, Ospney process, Metal Inspection molding, Designing the powder Metallurgy parts for production.

UNIT – V

Special Processing Methods

Hot machining, Unit head, Plasting tooling, Electroforming, surface cleaning and surface treatment, surface coating, surface coating for tooling.

Modern techniques for Material Studies

Optical Microscope, Electron Microscope, Chemical Analysis using atomic absorption, spectroscope, photoelectron spectroscope, magnetic resonance.

Text Books:

1. Fundamentals of solidification – W. Kurz and D.J. Fisher – Tans Tech. Publication
2. Rapidly solidified metals – T. R. Anantbraman C. Suryaharyan – Trans Tech. Publication

Reference Books:

1. Modern Ceramic Engineering – D. W. Richardson – Mareel Dekker Inc.
2. ASM Handbook Vol. 7 & 15 ASM Inst.

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Management of Organizational Behaviour

Code: MT02125 (4)

Total Theory Periods: 40

Total Tutorial Periods: 12

Total Marks in End Semester Exam. : 100

Minimum number of class test to be conducted: 02

UNIT– I

Fundamentals of Organizational behavior

Dynamics of people & Organization – Goals, forces, characteristics of O.B. field, nature of people, nature of organization, supportive approach, contingency approach, system approach, causes of human behaviour.

Models of Organizational Behavior - Elements of the system – Autocratic model, custodian model, supportivemodel, collegial model.

Managing Communication – Importance of communication, process, problems, barriers & solutions to overcomebarriers, types of communications.

Social System & Organization culture – Social equilibrium, effects of change, cultural diversity, role perception – conflict, ambiguity, characteristics of culture, measuring organization culture.

UNIT– II

Motivation & Reward System

Sources of motivation, Theories of motivation, Maslow's, Megregor's X & Y Theory, McClelland's theory, Herzebeegs Theory, Models – Expectancy model, comparison model, Money as means of rewarding, performance appraisal, 360° feedback program, Economic incentive systems.

UNIT– III

Leadership & Empowerment

Nature of leadership, behavioral approaches to leadership styles, personality, perception, dimensions of personality, learning & behavior reinforcement, empowerment, participative process, impact on managerial power & prerequisites.

UNIT– IV

Individual & Group behaviour & Conflict Management

Individual & interpersonal behaviour, nature of employee attitude, effects of attitude, Job satisfaction, reasons for group formation, types of group, factors contributing to group conveniences, Differentiation of groups, conflicts – nature, types of situation, causes, negotiation, levels of conflict, team building – concept, ingredients of effective team, the process skills useful in T. Build.

UNIT – V

Emerging aspects of organizational behavior

Organizational behavior across culture, managing interpersonal behavior, barriers to cultural adoption, overcoming barriers, cultural contingencies.

Text Books:

1. Organizational Behaviour – Human Behavior at work – John W. Newstrom and K. Davis. – TMH, Delhi
2. Organizational Behaviour – Concept Controversies and Applications – S. P. Robbins – Prentice Hall of India

Reference Books:

1. Organizational Behavior – Fred Luthans – Mc Graw Hill Irwin.
2. Organizational Designs for Excellence – Pradip N. Khandwalla – Tata Mc Graw Hill
3. Organizational Participation – Myth and Reality – Frank Herler , Eugen Pusic, George Strauss, Bernhard Wilpert.
4. Organizational Behaviour – M. N. Mishra – Vikas Publishing House Pvt. Ltd.

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Machine Tools Engineering -Lab

Code: MT02126

Total Practical Periods: 40

Total Marks in End Semester Exam. : 70

List of Experiments-

1. Design and Specification of Single point cutting Tool
2. Design and specification of indexable inserts and tool holders
3. Design of Chip breakers and tool shank
4. Practical application of turning operation
5. Form Tools
6. Design of Twist Drill and Practical application of drilling
7. Design of Milling cutter and practical application of milling
8. Practical application of grinders
9. Design for Limits, Fits and Tolerances
10. Design of Gear Hob

Semester: M. Tech. II

Branch: Mechanical Engineering

Subject: Robotics -Lab

Code: MT02127

Total Practical Periods: 40

Total Marks in End Semester Exam.:70

List of Experiments (In Basic Stamp V2 Software)-

1. Write a program for the forward movement of the hex crawler.
2. Write a program for the backward movement of the hex crawler.
3. Write a program for right rotation of the hex crawler.
4. Write a program for left rotation of the hex crawler.
5. Write a program for sensing an obstacle by the hex crawler.
6. Write a program for pick and place of an object.
7. Write a program for the tuning of the legs of hex crawler.
8. Write a program for setting the home position of the hex crawler.

BHARTI UNIVERSITY DURG (C.G.)

M.Tech (Third Semester) Mechanical Engineering (Production Engg.)

S. No.	CODE	Board of Studies	SUBJECT	Periods per week			Scheme of Exam Theory / Practical			GRAND TOTAL
				L	T	P	ESE	CT	TA	
1	Mech. Engg.	MT02131	Computer Integrated Manufacturing	3	1	-	70	10	20	100
2	Refer Below		Elective – III	3	1	-	70	10	20	100
3	Mech. Engg.	MT02133	Preliminary work on Dissertation	-	-	28	140	-	60	200
4	Mech. Engg	MT02134	Seminar based on Dissertation	-	-	3	-	-	100	100
TOTAL				6	2	31	280	20	200	500

L – Lecture,

T – Tutorial

P – Practical,

ESE- End Semester Exam,

CT- Class Test,

TA – Teacher’s Assessment

Table - III

Elective - III			
S.No.	Board of Studies	Code	Subject
1	Mech. Engg.	MT02132(1)	Optimization Techniques
2	Mech. Engg.	MT02132(2)	Advanced Machine Tools
3	Mech. Engg.	MT02132(3)	Product Engineering
4	Mech. Engg.	MT02132(4)	Ergonomics

Note (1) – 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session.

Note (2) – Choice of elective course once made for an examination cannot be changed in future examination

Semester: M. Tech. III Sem.

Branch: Mechanical Engg. (Production)

Subject : Computer Integrated manufacturing Code: MT02131

Total Theory Periods: 40

Total Tutorial Periods: 10

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Introduction to CIM

Integration and rationalization, sequence of functions, elements, CIM Wheel, activities, Database Management system, CIM development and related standards, hardware and software, implementation, benefits, product development through CIM.

UNIT – II

Automated Process Planning

Computer Aided Process Planning (CAPP) – Process planning, structure, operation of CAPP Software. Group Technology – Part families, parts classification and coding systems, part design attributes, part manufacturing attributes, coding structure – operating classification system, MI Class system, code system.

Methods of CAPP – Variant process planning, generative process planning, process planning systems

– CAM, ICAPP, MIPLAN, MULTI CAPP, TIPPS.

UNIT – III

Planning of Resources for Manufacturing

Manufacturing Resources Planning (MRP-II) – Structure, Role of MRP – II in CIM System, major modules of software – Manufacturing applications – Business Plan, Production Plan, MPS, Engineering Applications – BOM, Standard Product Routing, job costing, standard product costing, capacity requirement planning (CRP)

Enterprise Resource Planning (ERP) - Modules in Software- Finance, Distribution, Manufacturing, service modules.

UNIT – IV

Robotics

Need, applications of industrial Robot and integration with CIM system.

Computer Aided Quality Control (CAQC)

Tools and techniques for quality control, objectives, inspection systems, contact methods.

UNIT – V

Flexible Manufacturing Systems

Elements, classification, operational aspects, planning and control, types, FMS, workstations, layout configuration, Material handling equipments, computer control systems, applications, benefits, evaluation criteria.

Material Handling and Storage

Storage system performance, automated storage, retrieval system, carousal storage system, WIP system, interfacing handling of storage with manufacturing.

Text Books:

1. Automation, Production System and CIM – M.P. Groover – PHI, Delhi
2. CAD/CAM/CIM – P. Radhakrishnan – New Age Publishers - Delhi

Reference Books:

1. Computer Aided Design and Manufacturing – Dr. Sadhu Singh – Khanna Publishers, Delhi
2. Performance Modelling of Automated Manufacturing System – N. Viswanathan, Y. Narhari – PHI

Semester:M. Tech. III Sem.

Branch: Mechanical Engg. (Production Engg.)

Subject :Optimization Techniques

Code : MT02132(1)

Total Theory Periods: 40

Total Tutorial Periods: 10

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT - I

Introduction to Optimization and Classical Optimization Techniques:

Basic Concepts and introduction of engineering optimization, single-variable optimization, Multivariable optimization with no constraints, equality constraints and inequality constraints.

UNIT - II

Linear Programming:

Basic concepts of Linear programming, Applications of Linear programming, standard forms of a Linear programming problems, solution of a system of linear simultaneous equations, Decomposition principle, Quadratic programming.

UNIT - III

Non Linear Programming:

Basic concepts of Non-linear programming, Uni-modal function, Elimination methods, Interpolation methods, classification of unconstrained minimization methods- Direct search methods, Indirect search methods, characteristics of a constrained problem-Direct methods, Indirect methods.

UNIT -IV

Geometric and Integer Programming:

Basic concepts of Geometric programming, Posynomial, unconstrained minimization problem, solution of an unconstrained geometric programming problem using differential calculus, Applications of geometric programming, Integer linear programming, Integer non linear programming.

UNIT - V

Special Optimization Techniques:

Separable programming, multi objective optimization, calculus of variations, optimal control theory.

Text Books:

1. Engineering Optimization Theory and Practice – S.S. Rao – New Age Publishers, Delhi
2. Optimization for Engineering Design, Algorithms & examples – K. Deb – Prentice Hall of India, Delhi

Reference Books:

1. Introduction to optimum Design – J.S. Arora – TMH, Delhi
2. Optimization methods for Engineering Design – R.L. Fox - Addison Wesley Pub.
3. Advances in optimization and Approximation – Ding Zhu Du - Kluwer Academic Publishers
4. An introduction to optimization – 2nd Edn. – Edwin K.P. Chong – Wiley publishers
5. Foundation of Mathematical optimization – Pallaschke – Kluwer Academic Publishers.

Semester: M. Tech. III Sem.

Branch: Mechanical Engg. (Production)

Subject : Advanced Machine Tools

Code: MT02132(2)

Total Theory Periods: 40

Total Tutorial Periods: 10

Total Marks in End Semester Exam. : 100

Minimum number of class test to be conducted: 02

UNIT – I

Accuracy of Machine Tools

Accuracy, Element of accuracy, errors in form and relative locations, accuracy of machine Tool, spindle rotation accuracy and its significance, test methods for radial spindle rotation error, displacement accuracy, influence of geometric accuracy of machine tools on work piece accuracy.

UNIT – II

Accuracy of Numerically Controlled System

Errors due to Numerical interpolation, errors due to displacement measurement system, definition of accuracy of a numerical control system, periodic errors, errors due to velocity lags, transient response, slideway friction, feed drive stiffness, zero stability.

UNIT – III

Static Stiffness and its influence on machining accuracy

Static stiffness, nature of deformation of a machine tool, stiffness of lathe, compliance of work piece, errors due to variation of cutting force, errors due to variation of the total compliance.

Inaccuracies due to Thermal effects

Thermal effect, Heat sources, Heat dissipation, calculation of thermal field and deformations, Geometry of thermal deformations, method of decreasing thermal effects, Influence of forced vibration on accuracy, Influence of tool wear on accuracy.

UNIT – IV

Dynamics of Machine Tool

Machine Tool Elastic System, Dynamic characteristics of elements and system, Dynamic characteristics of equivalent elastic system, experimental determination.

Dynamic Characteristics of cutting process, stability analysis, forced vibration of machine tools, forced vibration due to perturbation of cutting process and perturbation of EES.

UNIT – V

Automatic drives for Machine Tools

Principle of automation, Automatic and semiautomatics, single spindle automatic screw machine, swiss type automatic machine, multiple spindle machine tool, automatic loading and feed of work piece.

Transfer Device in automatic machine tool system, classification, transfer bar mechanisms, rotary transfer devices, turn table for orientation.

Automatic in process gauging and gauging devices.

Text Books:

1. Precision Engineering in Manufacturing – R.L. Murty – New Age International, Delhi
2. Machine Tool Design and Numerical Control – N.K. Mehta – TMH, Delhi

Reference Book:

1. Principle of Machine Tool – Gopal Chandra Sen, Amitabha Bhattacharya – New Central Book Agency – Calcutta
2. Machine Tool Practices – Richar R. Kibbe, John E. Neely – PHI, New Delhi

Semester: M.Tech. III Sem.

Branch: Mechanical Engg. (Production Engg.)

Subject: Production Engg.

Code: MT02132(3)

Total Theory Periods: 40

Total Tutorial Periods: 10

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Product Development Process

An introduction to product Design, Modern Product Development, Theories and Methodologies in Design, Product Development Teams, Product Development Planning, Customer Satisfaction, Gathering Customer Needs, Organizing and Prioritising customer needs.

UNIT – II

Establishing Product Function

Why Functional Decomposition, Modelling Process, A simple Approach-Function Trees, Establishing System Functionality-Creating a function structure, Augmentation-From Simple function trees to complete models, aggregation revisited-Simplicity of Shooting Darts, A functional common basis, critique of functional Modelling Methods.

Product Tear Down and Experimentation

Tear down process, teardown methods, post teardown reporting, applications of product teardown.

Benchmarking and Establishing Engineering Specification

Background-Know your enemy to know yourself, a bench marking approach, support tools for benchmarking process, setting product specifications.

UNIT - III

Product Architecture

Product Architecture, Product Modularity-Background, Modular Design, Modular Design, Architecture- Based Development Teams.

Generating Concepts

Concept Generation Process, Basic Methods-Information Gathering and Brainstorming,

Advanced Methods-Direct Search, Morphological Analysis, Combination Solution Principles (Concept Variants) **Concept Selection**

Estimating Technical Feasibility, A Concept Selection Process, A Basic Method-Pugh Concept Selection Charts, Advanced Discussion-Measurement Theory, Advanced Method-Numerical Concept Scoring, A Critique of Design Evaluation Schemes.

UNIT – IV

Design for Manufacture and Assembly

Overview and Motivation, Basic Method-Design Guidelines, Advanced Method-Manufacturing Cost Analysis, Critique of Design for Assembly Methods,.Design for the Environment Why DFE? Environmental Objectives, Basic DFE Methods-Design Guidelines, Life Cycle Assessment, Techniques to Reduce Environmental Impact.

UNIT – V

Analytical and Numerical Model Solutions

Overview and Strategy, Basic Method: Spreadsheet Search, Fundamental Concepts in Optimisation, Advanced Topic: A Discussion of Analytical Formulations, Practical Optimisation, Product Applications. **Physical Properties**

Prototyping essentials, types of prototypes, uses of prototypes, rapid prototyping techniques, scale, dimensional analysis and similitude, basic method-physical prototype design and planning. Physical Models and Experimentation

Design of Experiments, Design of Experiments-Reduced Tests and Fractional Experiments, Statistical Analysis of Experiments, Product Applications of Physical Modelling and DOE.

Text Books:

1. Product Development – Otto & Wood

Reference Book:

1. Product Development – Chitale & Gupta

Semester: M. Tech III Sem.

Branch: Mechanical Engg. (Production Engg.)

Subject: Ergonomics

Code: MT02132(4)

Total Theory Periods: 40

Total Tutorial Periods: 10

Total Marks in End Semester Exam. : 70

Minimum number of class test to be conducted: 02

UNIT – I

Human factors in Production System

Characteristics, features of man-machine system, Human performance and performance reliability, the human sensory motor system, stimulus dimensions, human information processing, noise and theory of signal detection.

Displays

Quantitative and Qualitative visual displays, auditory displays, factual and factory displays.

UNIT – II

Method Study

Objectives, steps, human factor considerations, recording techniques, critical evaluation of method, learning curves.

UNIT – III

Control System

Special movements and conceptual relationship of stimuli and response, continuous control system, control functions, tools and related devices, design of work place and works components, applied anthropometry, activity analysis, motion economy, design of individual work place.

UNIT – IV

Human Performance

Performance under heat, cold, illumination, vibration, noise, pollution, static and dynamic condition, organizational factors, energy expenditure in physical work activity, shift, work, age, sex.

UNIT – V

Biomechanics

Concepts and principles, Bio-Engineering aspects of human motor activity, performance analysis of body, members in making specific movements.

Text Books:

1. Ergonomics – Murrel
2. Human Factors Engineering – Mc Comick & Sanders

Reference Books:

1. Work Study – ILO – Universal Publications, Bombay
2. Motion & Time Study – Barnes R.M. – John Wiley & Sons, New York

BHARTI UNIVERSITY DURG (C.G.)

SCHEME OF TEACHING AND EXAMINATION

M.TECH (Fourth Semester) Mechanical Engineering (Production Engg.)

S. No.	CODE	Board of Studies	SUBJECT	Periods per week			<u>Scheme of Exam</u> Theory/Practical			GRAND TOTAL
				L	T	P	ESE	CT	TA	
1	Mech. Engg.	MT02141	Dissertation + Seminar	6	-	34	350	-	150	500
			TOTAL	6	-	34	350	-	150	500

L – Lecture,
ESE- End Semester Exam,

T – Tutorial,
CT- Class Test,

P – Practical,
TA – Teacher's Assessment