

Kalinga University Atal Nagar (C.G.)



SCHEME OF EXAMINATION & SYLLABUS

of

M.Tech Mechanical (Production Technology)

UNDER

Faculty of Engineering and Technology

w.e.f. Session 2021-22

Kalinga University, Raipur
Master of Technology (M.Tech) Mechanical
(Production Technology)
(2 yrs Programme) w.e.f 2021-22 Session

M.Tech in Production Engineering						
Semester - I						
Code No.	Paper	Lecture	T/P (Tutorial/Practical)	End Semester Exam	Internal Marks	Total Marks
MEPE101	Advanced Manufacturing Engineering	3	1	100	50	150
MEPE102	CAD/CAM Applications	3	1	100	50	150
MEPE103	Production & Materials Management	3	1	100	50	150
MEPE104	Maintenance Engineering	3	1	100	50	150
Refer Below Elective – I		3	1	100	50	150
MEPE105A	Applied Fuzzy logic & Fuzzy Sets					
MEPE105B	Finite Element Methods					
MEPE105C	Accounting & Management Control					
MEPE106-P	Advanced Manufacturing Engineering Lab		5	30	20	50
MEPE107-P	CAD/CAM Applications Lab		5	30	20	50
	Total	15	15	560	290	850
Semester - II						
Code No.	Paper	Lecture	T/P (Tutorial/Practical)	End Semester Exam	Internal Marks	Total Marks
MEPE201	Machine Tools Engineering	3	1	100	50	150
MEPE202	Robotics	3	1	100	50	150
MEPE203	Quality Control & Reliability Engineering	3	1	100	50	150
MEPE204	Measurement system Analysis	3	1	100	50	150
Refer Below Elective – II		3	1	100	50	150
MEPE205A	Mechatronics					
MEPE205B	Productivity Management					
MEPE205C	Advances in Material					

	Processing					
MEPE206-P	Machine Tools Engineering Lab		5	30	20	50
MEPE207-P	Robotics Lab		5	30	20	50
	Total	15	15	560	290	850

Semester - III

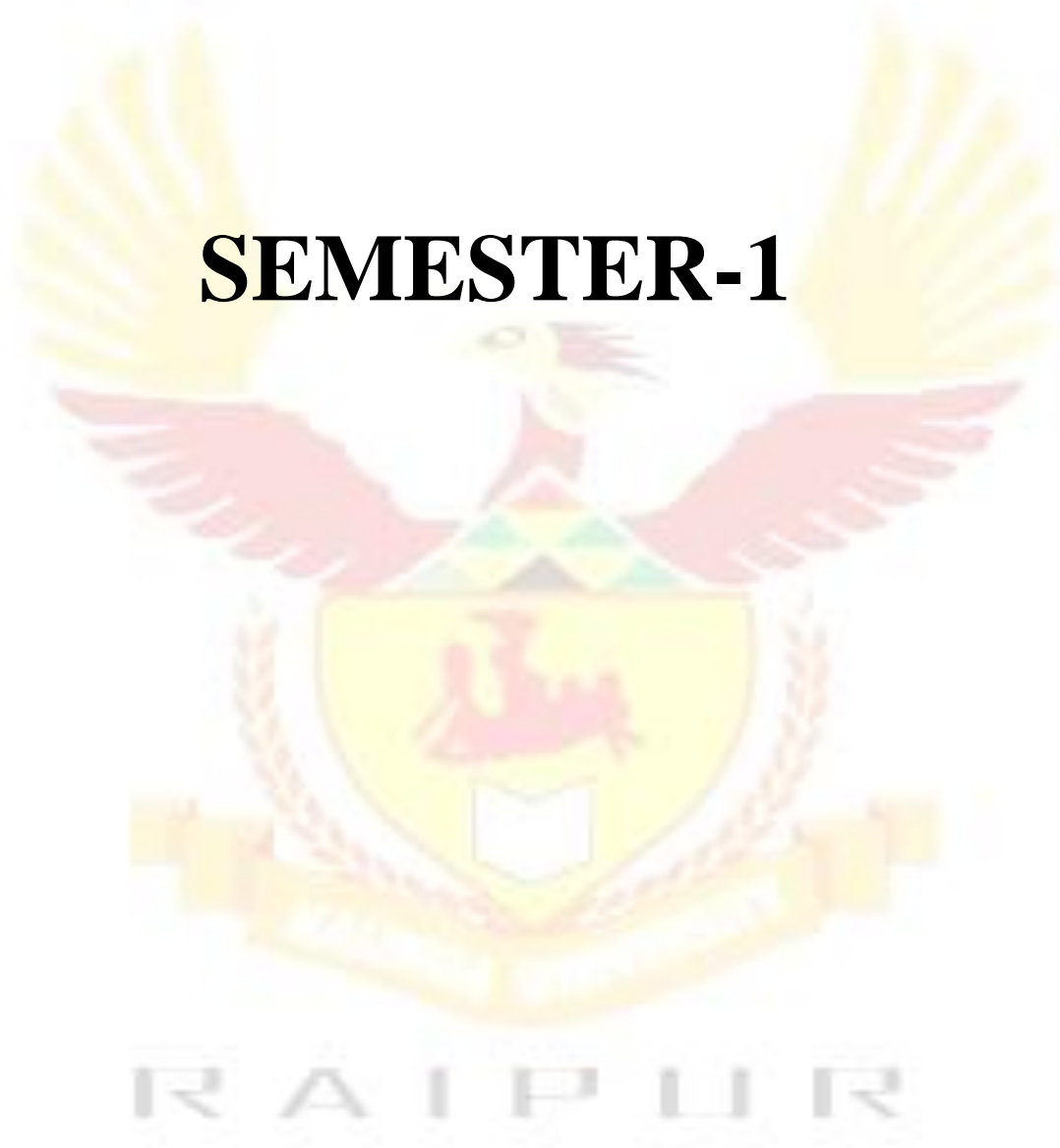
Code No.	Paper	Lecture	T/P (Tutorial/Practical)	End Semester Exam	Internal Marks	Total Marks
MEPE301	Computer Integrated Manufacturing	3	1	100	50	150
MEPE302	Communication & Research Methodology	3	1	100	50	150
Refer Below Elective – III		3	1	100	50	150
MEPE303A	Optimization Techniques					
MEPE303B	Advanced Machine Tools					
MEPE303C	Product Engineering					
MEPE304	Preliminary Work on Dissertation			100	50	150
MEPE305	Seminar Based on Dissertation			100	50	150
	Total					750

Semester - IV

Code No.	Paper	Lecture	T/P (Tutorial/Practical)	End Semester Exam	Internal Marks	Total Marks
MEPE401	Dissertation			300	200	500
	Total			300	200	500

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SEMESTER-1



Advanced Manufacturing Engineering

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 – Formabilities, 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, weldability, 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

Non traditional 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 Micro electronic 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



CAD/CAM Applications

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, McGraw Hill.

Production & Materials Management

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

5. Elements of Production Planning & Control – Samuel Eilon – Universal Publishing Corporation, Bombay
6. Production & Operation management – S. Buffa – John Wiley & Sons – New York
7. Computer Aided Production Management – P.B. Mahapatra – PHI, Delhi



Maintenance Engineering

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, 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

Applied Fuzzy logic & Fuzzy Sets

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.

Finite Element Methods

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

Finite element formulation of three dimensional problems in stress analysis. Finite Element formulation of an incompressible fluid. Potential flow problems Bending of elastic plates. Introduction to non-linear problems and Finite Element analysis software.

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.

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Accounting & Management Control

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

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Advanced Manufacturing Engineering -Lab

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.



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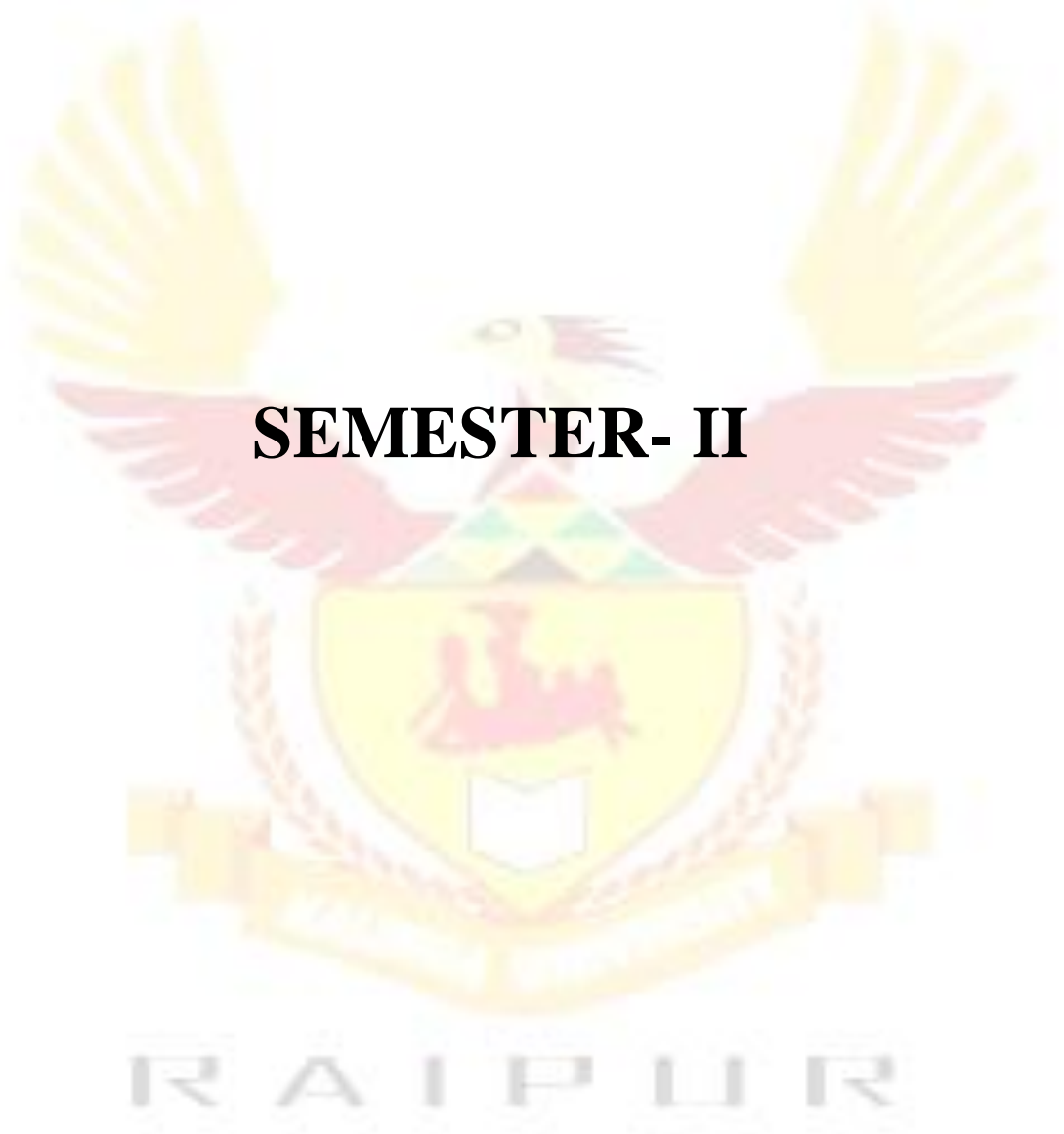
CAD/CAM Applications -Lab

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



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SEMESTER- II

Machine Tools Engineering

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 Braker. 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

Robotics

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

Robot Programming: Robot languages: AL, AML, RAIL, RPL, VAL, Demonstration of points in space: Continuous path (CP), Via points (VP), Programmed points (PP).

Robot Languages: Textual robot Languages, Generation, Robot language structures, Elements in function.

TEXT BOOKS

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

REFERENCE BOOKS

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

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Quality Control & Reliability Engineering

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:

4. Statistical Quality Control – M. Mahajan – Dhanpat Rai & Co. (P) Ltd.

5. Statistical Quality Control – R.C. Gupta – Khanna Publishers, Delhi

REFERENCE BOOKS

8. Fundamentals of Quality Control and Improvement – Amitava Mitra – Peterson Education Asia.

9. Quality Assurance Methods and Technologies – Kenneth L. Arnold, Michel Holler – McGrawHill Book Co.

10. Managing for total quality from Deming to Taguchi and SPC – N. Lugothesis Prentice – Hall of India.

11. Quality control and Industrial Statistics – Acheson J. Duncch – D.B. Taraporewala Sons & Co. Pvt. Ltd.

Measurement System Analysis

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, Rabinovich

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Mechatronics

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 Introduction – Chapman & Hall
2. Mechatronics , Intl. J. Pergamon Press.

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Productivity Management

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

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

REFERENCE BOOKS

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

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Advances in Material Processing

UNIT – I

Introduction to Advance Material

Composites, Ceramic, Polymer, Super alloy, Refractory metal and alloy, Low melting alloy, precious metal, shape memory 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, plasm 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 Inspction 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

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

REFERENCE BOOKS

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

Machine Tools Engineering -Lab

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



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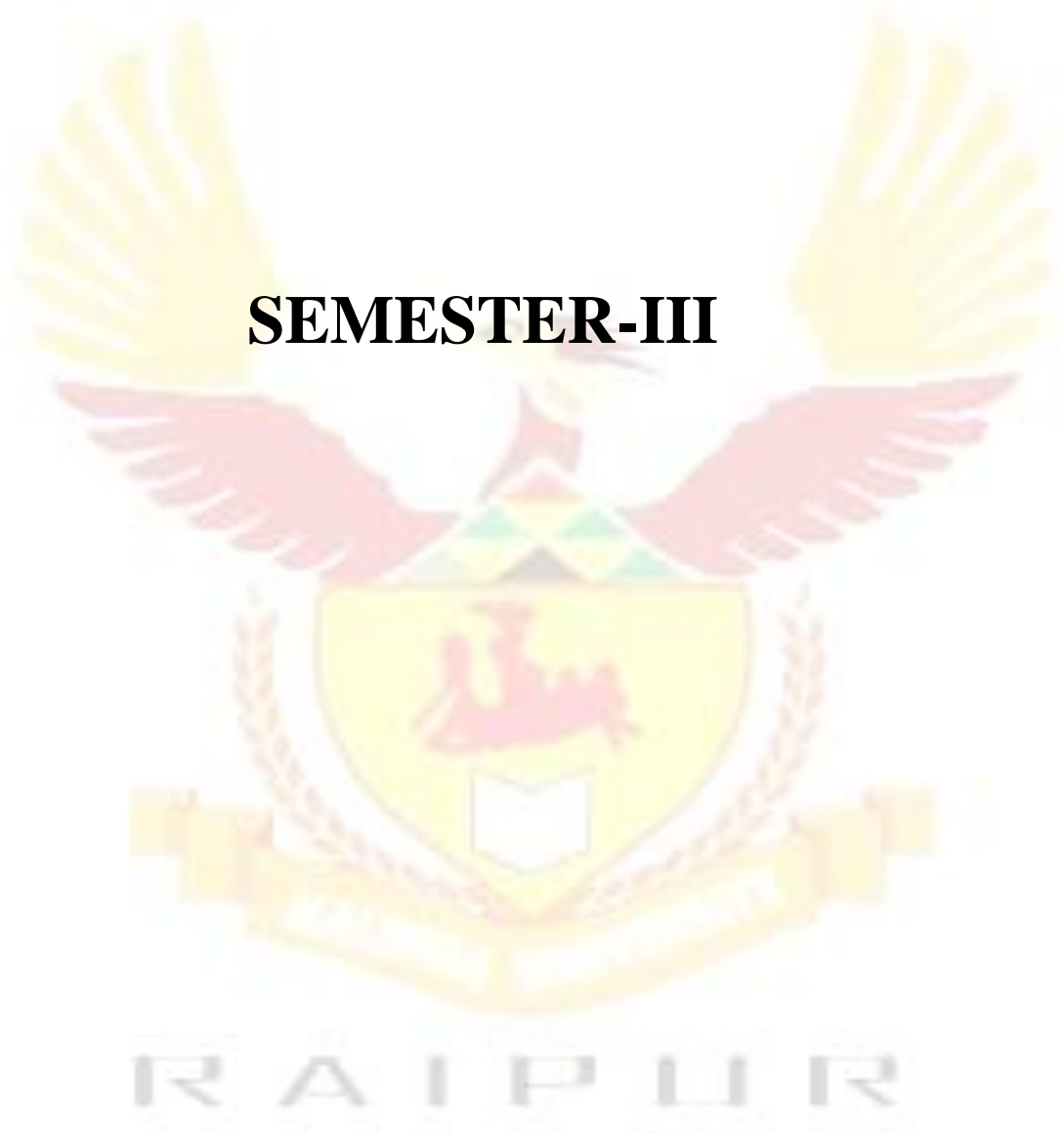
Robotics -Lab

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.



SEMESTER-III



Computer Integrated manufacturing

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, control 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
3. Modelling and Analysis of Manufacturing Systems – R.G. Askin & C.R. Standriage – John Wiley & Sons, New York

Communication and Research Methodology

Unit 1

Concepts of Communications: Definition, Forms of Communication, Objectives of Communication, Characteristics of Communication, Process of Communication, Communication, Roadblocks, Role of Verbal and Non-verbal Symbols in Communication, Barriers to Effective Communication, Overcoming Communication Barriers.

Nonverbal communication: Body Language, Gestures, Postures, Facial Expressions, Dress codes; the Cross Cultural Dimensions of Business Communication; Listening and Speaking, techniques of electing response, probing questions, Observation. Business and social etiquettes;

Listening Skills: Definition, Anatomy of poor Listening, Features of a good Listener, Role Play, Group Discussion and Interviews, Meetings: Ways and Means of conducting meetings effectively, Mock Meetings and Interviews

Unit 2

Reading and language skills: The reading process, purpose, different kinds of texts, reference material, scientific and technical texts, active and passive reading, strategies - vocabulary skills, eye reading and visual perception, prediction techniques, scanning skills, distinguishing facts and opinions, drawing inferences and conclusions, comprehension of technical material - scientific and technical texts, instructions and technical manuals, graphic information.

Forms of Communication in Written mode: Basics Body language of Business Letters and Memos, Tone of writing,

Enquiries, orders and replying to them, sales letters, Job applications and resume, E-mail: How to make smart e-mail, Writing Business Reports and Proposals, Practice for Writing.

Unit 3

Referencing and Writing skills: Business letters: Enquiries, Circulars, Quotations, Orders, Acknowledgments, Executions, Complaints, Claims and adjustments, Collection letter, Banking correspondence, Agency correspondence, Bad news and persuading letters, Sales letters, Job application letters - Biodata, Covering Letter, Interview Letters, Letter of Reference, Memos, minutes, Circulars & notices.

Types of Business Reports - Format, Choice of vocabulary, coherence and cohesion, paragraph writing, organization reports by individual, Report by committee.

Unit 4

Introduction to Research and Research Design: Nature and scope of research, information based decision making and source of knowledge. The research process; basic approaches and terminologies used in research. Defining research question and framing of hypotheses, preparing a research plan, qualitative and quantitative research designs, Experimentation, Observational studies, Exploring secondary data.

Measurement and Scaling, Data Source and Data Collection Field research: primary data collection from observations, surveys and experimentation. Measurement and scaling; commonly used scales in reliability and validity of scales. Designing instrument for data collection; testing the instrument, data collection process, Sampling methods and procedures and sample size decisions.

Unit 5

Data Analysis and Presentation Editing and coding of data, tabulation, graphic presentation of data, cross tabulation, Testing of hypotheses; type I and II errors, one tailed and two tailed tests of

significance, Parametric and nonparametric tests for Univariate and Bivariate data. Tests of association; simple linear regression and other non parametric tests.

Technical Writing: Technical Proposal writing: Definition, Purpose, types, characteristics, Elements of structure, style and appearance, evaluation, exercises, Research report writing, Proposal writing, referencing, forms of reports, bibliography, etc. Research paper, Dissertation, and Thesis, Instruction Manuals, Type of instructions, Writing Instructions, Technical Descriptions, Process descriptions, Guidelines for Writing Good Descriptions.

Text Books:

1. Lesikar, R. V. & Flatley, Basic Business Communication Skills for Empowering the Internet Generation. TMH.
2. Meenakshi Raman, Sangeeta Sharma, Technical Communications, Oxford Latest Edition.
3. D. K. Bhattacharyya, Research Methodology, Excel Books 2nd Edition.

Reference Books:

1. Bowman, J.P. & Branchaw, P.P. Business Communications, Process to Product Dryden Press, Chicago.
2. M Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill.
3. E. H. McGrath, Basic Managerial Skills, Prentice hall India
4. Sajitha, Technical Writing, Himalaya Latest Edition



Optimization Techniques

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

Non Traditional Optimization Algorithms: Genetics Algorithm-Working Principles, Similarities and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing- Working Principle Simple Problems.

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.

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Advanced Machine Tools

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

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

REFERENCE BOOKS

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

Product Engineering

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 BOOKS

1. Product Development – Chitale & Gupta
2. Product Development –



Preliminary work on Dissertation

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports.



MEPE305

Seminar Based on Dissertation

The student will deliver a seminar on the topic chosen by him and approved by Departmental committee for evaluation at the end of semester.



SEMESTER – IV

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MEPE401

Dissertation

The student will submit a detailed Project Report on the topic approved by Departmental committee in a specified format and will also deliver a Presentation on the topic chosen at the end of semester.

