

ORDINANCE No. V (42A) (B7)
Master of Technology (M.Tech)
Production Engineering.
(Syllabus Effective From 2023-24)



**SUBHARTI INSTITUTE OF TECHNOLOGY AND
ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
(FACULTY OF ENGINEERING AND TECHNOLOGY)**

Swami Vivekanand Subharti University Meerut, Uttar Pradesh
(Established under the UP Act No. 29 of 2008 & approved under Section 2 (f) of UGC Act, 1956)

Sanjay
(HOD-ME)



SWAMI VIVEKANAND SUBHARTI UNIVERSITY, MEERUT



EVALUATION SCHEME & SYLLABUS

M.TECH.(PRODUCTION ENGINEERING)

W.E.F.SESSION 2023-24

SUBHARTI INSTITUTE OF TECHNOLOGY AND ENGINEERING

Subhartipuram, NH-58 Delhi-Haridwar

Bypass Road, Meerut-250005 (UP)

www.subharti.org

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**SWAMIVIVEKANANDSUBHARTIUNIVERSITY,MEERUTS
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DY&EVALUATIONScheme**

M.Tech II Year/III Semester(Production Engineering)

w.e.f academic Session2023-24

SEMESTERIII														
S. No	CourseCode	Course Name	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	MMP-351	Dissertation	PROJ	0	0	26	-	-	-	200	-	300	500	13
2	MMP-352	Seminar-II	PROJ	0	0	6	-	-	-	100	-	-	100	3
TOTAL												600	16	

M.Tech II Year/ IV Semester (Production Engineering)

w.e.f academic Session 2023-24

SEMESTERIV														
S. No	Course Code	Course Name	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	MMP-451	Dissertation	PROJ	0	0	32	-	-	-	200	-	400	600	16
TOTAL												600	16	

M.TECH.(PE)TOTALCREDITS- 75

Syllabi of M.Tech (Production Engineering) First Semester Subjects

Subject Name: Advanced Manufacturing Process

Subject Code: MMP-101

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the factors influencing tool wear and the criteria for determining tool life using Taylor's tool life equation.
- To explore the processes involved in the preparation, consolidation, and sintering of ceramic materials and composites.
- To study various surface treatment methods, including cleaning, coating, and advanced deposition techniques like CVD, thermal spraying, and electroforming.
- To examine non-traditional machining processes such as AJM, USM, WJM, and WEDM with emphasis on process capabilities and parametric analysis.
- To understand the principles, equipment, and process parameters involved in advanced machining processes like Laser Beam, Plasma Arc, Electron Beam, and Electrochemical Machining.

Outcomes:

- Students will be able to evaluate cutting tool performance based on wear mechanisms such as crater and flank wear, enhancing machinability analysis.
- Students will acquire knowledge of the various ceramic processing techniques, including powder preparation, hot compaction, and sintering, along with the application of MMCs, CMCs, and reinforced plastics.
- Students will be able to select appropriate surface treatment techniques based on coating economics and performance requirements for different industrial applications.
- Students will be able to analyze and compare the material removal rates and surface finish in various non-traditional machining methods for enhanced manufacturing efficiency.
- Students will gain expertise in optimizing process parameters and assessing the performance of these advanced machining techniques for diverse material applications.

Unit I

Tool Failure and Tool Life

Tool Failure, form stability, wear of cutting tools, crater wear and flank wear, criterion of wear, tool life, machinability, Taylor's tool life equation.

Unit II

Processing of ceramics :

Applications characteristics, classification Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

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Subject Name: Computer Aided Manufacturing

Subject Code: MMP- 102

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the fundamentals of APT programming and its application in 2D machining.
- To learn about different types of tooling systems and their application in CNC machining.
- To explore the structure and necessity of post processors in CNC operations.
- To understand the components and functioning of microcontrollers and PLCs in CNC machines.
- To gain knowledge of computer-aided process planning and inspection techniques like CMM and AI in CAD.

Outcomes:

- Students will be able to write and implement NC programs using CAD/CAM systems and generate automatic tool paths.
- Students will be able to select and apply the appropriate tooling systems for various CNC operations, including modular fixturing and coolant-fed tools.
- Students will be able to design and implement DAPP-based post processors for efficient CNC communication and machining processes.
- Students will be able to program and apply microcontrollers and PLCs for automation in CNC machines, utilizing timers, counters, and interrupts.
- Students will be able to apply computer-aided process planning and inspection methods to enhance quality control and testing in manufacturing processes.

UNIT I

Computer-Aided Programming:

General information, APT programming, Examples Apt programming probkms (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors .Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT II

Tooling for CNC Machines:

Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding.

UNIT III:

Subject Name: Research Methodology & IPR

Subject Code: METC-101

L T P : 2-0-0

Credit : 02

Objectives:

- To understand the meaning, objective, and significance of research, along with various types and steps involved in defining a research problem.
- To explore various research designs, methods, and the steps involved in the research process, including conducting a literature survey.
- To comprehend the methods of data collection, sampling techniques, and ethical considerations in research.
- To learn statistical techniques, hypothesis testing, and the use of data processing software like SPSS.
- To understand different types of research reports and familiarize oneself with referencing styles, journal indexing, and issues of intellectual property and plagiarism.

Outcomes:

- Learners will be able to identify and define clear research problems and understand the different types and objectives of research.
- Students will be able to select and apply an appropriate research design and conduct a thorough literature survey for their research projects
- Learners will be able to collect and classify data effectively while adhering to ethical research standards.
- Students will be able to analyze and interpret research data using appropriate statistical methods and tools.
- Learners will be proficient in writing and presenting research findings in various formats, ensuring proper referencing and adherence to intellectual property rights.

Unit 1:

Introduction:

Introduction to research and Problem. Definition Meaning, Objective and importance of research, Types of research, steps involved in research, defining research problem.

Unit 2:

Research Design

Research design, Methods of research design, research process and steps involved, Literature Survey.

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Subject Name: PRODUCTION ENGINEERING LAB

Subject Code: MMP-151

L T P : 0-0-4

Credit : 02

List of Experiments:

- 1 Study of the morphology of chips produced from different materials and machining processes.
- 2 Effect of tool geometry on chip flow direction in simulated orthogonal cutting conditions.
- 3 Study of cutting ratio/chip thickness ratio in simulated orthogonal cutting with different materials and tool geometry.
- 4 Evaluations of tool face temperature with thermocouple method.
- 5 Roughness of machined surface. Influence of tool geometry and feed rate.
- 6 Study of the construction and operating parameters of metal spinning Lathe.
- 7 Study of the water hammer equipment and hydrostatic extrusion setup.
- 8 Extrusion of cylindrical billets through dies of different included angles and exit diameters and their effect on extrusion pressure.
- 9 Practice and study of blanking and punching process and their characteristic features on mechanical press with existing dies.
- 10 Experiments on TIG and MIG welding to find out the mechanical properties of metals.
- 11 Hydraulic and Pneumatic circuits.
- 12 Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder.
- 13 Determination of cutting forces in turning.
- 14 Inspection of parts using tool makers' microscope, roughness and form tester.
- 15 Studies on PLC programming.

Subject Name: Advanced Manufacturing Lab-II

Subject Code: MMP-152

L T P : 0-0-4

Credit : 02

1. Exercises on Manual CNC Part programming using G& M codes.
2. Machining of parts on CNC Machines including preparation of part program, after simulation of tool path using suitable CAM software package.
3. Part Programming using CAM software like MASTERCAM
4. CNC programming on turning and Milling process
5. Experiments on micro-machining
6. Study and experimentation with CMM
7. Experiments with NDT techniques
8. Experiments with non conventional machining processes such as EDM, USM, Abrasive Machining etc...
9. Use of Surface roughness meter and related experiments
10. Use of 3D scanner and experiments

working, Cold working, Strain rate effect, Friction and lubrication, Deformation zone geometry, Workability, Residual stress.

UNIT IV

Analysis of metal forming processes (only limited portion), Forging: Load calculation inplane strain forging, Rolling: Forces & geometrical relationship in rolling, Rolling load and torque in cold rolling, Von-Karman work equation, Extrusion: Analysis of extrusion process, extrusion pressure, Drawing: Drawing load

TEXT BOOK(S):

1. Mechanical Metallurgy: By- Dieter, Mc Graw Hill Book Co.
2. Plasticity- Chakraborty- McGraw Hill.
3. Engineering Plasticity: BY- Johson & Mellor, Van Nostrand.
4. Metal working –Avitzur, Mc Graw Hill
5. Industrial Metal working- G.W. Rowe

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Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

UNIT III

Cellular Manufacturing

Group Technology (GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

UNIT IV

Flexible Manufacturing System (Fms) And Automated Guided Vehicle

SYSTEM (AGVS) ,Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT V

Industrial Robotics

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

TEXT BOOK:

1. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

Srinivas

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distribution; Binomial distribution; Geometric distribution, continuous distribution: Uniform distribution; Exponential distribution; Gamma distribution; Normal distribution; Weibull distribution; Triangular Distribution; Lognormal distribution, poisson process,

UNIT IV

Queueing Models: Characteristics of queuing systems, the calling population, system capacity, arrival process, service mechanism, queuing notations, long run measures of performance of queuing systems, server utilization in $G/G/1/\infty/\infty$ queues, server utilization in $G/G/C/\infty/\infty$ queues, server utilization and system performance, costs in queuing problems, Larkovian models.

UNIT V

Random Number Generation: Properties of random numbers, Pseudo random numbers, techniques of generating random numbers, tests of random numbers. Random Variate generation: Inverse transform technique, Direct transformation for the Normal and Lognormal distribution, Convolution Method, Acceptance rejection technique. Input Modelling And Validation: Steps in the development of model, data collection, distribution identification, Parameter estimation, Goodness of Fit Tests, selecting input models without data, verification and validation of simulation models.

Books:

1. Simulation Modelling and Analysis by Law and Kelton, Mc Graw Hill.
2. Simulation Model Design & execution by Fishwick, Prentice Hall.
3. Discrete event system simulation by Banks, Carson, Nelson and Nicol.

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Unit III

Multipoint Cutting Tool: Drill geometry, Rake & Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speed & feed machining time-design – from cutters.

Grinding: Specifications of grinding of grinding wheel, mechanics of grinding, Effect of Grinding conditions on wheel wear and grinding ratio. Depth of cut, speed, machining time, temperature power.

Unit IV

Tool Life and Tool Wear: Theories of tool wear – adhesion, abrasive and diffusion wear mechanisms, forms of wear, Tool life criteria and machinability index. Types of sliding contact, real area of contact, laws of friction and nature of frictional force in metal cutting. Effect Tool angle, Economics, cost analysis, mean co-effect of friction.

Unit V

Cutting Temperature: Sources of heat in metal cutting, influence of metal conditions, Temperature distribution, zones, experimental techniques, analytical approach. Use of tool-work thermocouple for determination of temperature. Temperature distribution in Metal Cutting.

Cutting fluids: Functions of cutting fluids, types of cutting fluids, properties, selection of cutting fluids.

Cutting tool materials: Historical developments, essential properties of cutting tool materials, types, composition and application of various cutting tool materials, selection of cutting tool materials.

TEXT BOOKS;

1. Metal Cutting Principles/ MC Shaw / Oxford and IBH Publications, New Delhi, 1969.
2. Fundamentals of Machining /Boothryd/ Edward Arnold publishers Ltd 1975.
3. 'Tool Design' by David Son / Lacain/ Goud, Tata Me Graw Hill.
4. Fundamentals of Tool Design by Wilson fw , ASTME PHI 2010.

Sarjeer

plasma arc welding, laser assisted cutting.

Unit II

Heat flow in Welding:

Significance, theory of heat flow cooling rate determination, selection of welding parameters based on heat flow analysis, residual stresses and distortion. Joint design, analysis of fracture and fatigue of welded joints. Automated welding systems.

Unit III

Investment casting, shell moulding, squeeze casting, vacuum casting, counter-gravity flow-pressure casting, directional and monocrystal solidification, squeeze casting, semisolid metal casting, rheocasting.

Unit IV

Solidification Gating and Riser, Nucleation and grain growth, solidification of pure metals, short and long freezing range alloys. Gating and riser design calculations, Fluidity and its measurement.

Unit V

CAE of Welding and Casting:

Design of weldment, application of finite element method in welding –determination of distortion in weldments, modeling of temperature distribution – case studies. Design forecasting, application of finite element method in casting- determination of hot spots, location of turbulence and other defects, modeling of flow in molds, modeling of heat transfer in castings- case studies.

TEXT BOOKS:

1. Ravi B, "Metal Casting: Computer Aided Design and Analysis" Prentice Hall ,2005.
2. Richard L Little, "Welding and Welding Technology" Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. John Campbell, "Casting Practice" Elsevier Science Publishing CO.,2004
 2. Larry Jeffus, "Welding Principles and Applications" Delmar Publishers, 2004.
 3. John Campbell "Casting Butterworth Heinemann, 2003.
 4. Klas Weman, "Welding Processes Handbook", 2003.
 5. Howard B Cary, "Modern Welding Technology" Prentice Hall, 2002.
 6. Larry Jeffus, "Welding for Collision Repair ", Delmar Publishers, 1999.
- ASM Hand Book "Casting", ASM International 1998.

Sojoo

Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements.

Mechanical

Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot

isostatic pressing. Properties and applications.

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering.

Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT –IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first ply failure-insight strength; Laminate strength-ply discountuncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

REFERENCES

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

arc, isotherms of arcs and arc blow. Metal Transfer: Mechanism and types of metal transfer in various arc welding processes.

UNIT-III

Welding Processes: Manual Metal Arc Welding (MMAW), TIG, MIG, Plasma Arc, Submerged Arc Welding, Electrode Gas and Electroslag, Flux Cored Arc Welding, Resistance welding, Friction welding, Brazing, Soldering and Braze welding processes, Laser beamwelding, Electron beam welding, Ultrasonic welding, Explosive welding, Friction StirWelding, Underwater welding & Microwave welding.

UNIT-IV

Heat Flow Welding: Calculation of peak temperature; Width of Heat Affected Zone (HAZ); cooling rate and solidification rates; weld thermal cycles; residual stresses and their measurement; weld distortion and its prevention.

Weld Design: Types of welds & joints, Joint Design, Welding Symbols, weld defects, Inspection/testing of welds, Introduction to Welding Procedure Specification & Procedure Qualification Record.

UNIT-V

Repair & Maintenance of Welding: Hardfacing, Cladding, Surfacing, Metallizing processes and Reclamation welding. Weldability: Effects of alloying elements on weld ability, welding of plain carbon steel, Cast Iron and aluminium. Micro & Macro structures in welding.

Books and References:

1. Welding and Welding Technology, by- Richard L. Little, McGraw Hill Education.
2. Welding Principles and Practices, by- Edwards R. Bohnart, McGraw Hill Education.
3. Welding Engineering and Technology, by- R. S. Parmar, Khanna Publishers.
4. Welding Handbooks (Vol. I & II).

columns, tables, cross rail for various machines. Various types of guide ways, their relative advantages. Materials for machine tool components including plastic guide way (PTFE)

UNIT – III

Analysis of Spindles, Bearings, and Power Screws: Design of spindles subjected to combined bending and torsion. Layout of bearings. Pre-loading. Anti-friction slide ways. Rolling contact hydrodynamic, hydrostatic, Hydrodynamic design of Journal bearings, Magneto bearings. Machine Tool Vibrations: Effect of vibrations on machine tool. Free and Forced vibrations. Machine tool chatter.

UNIT – IV

Computer- Aided Programming: General information, APT programming, Examples apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of postprocessors. Introduction to CAD/CAM software, automatic Tool Path generation.

UNIT V

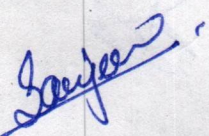
Tooling for CNC Machines: Interchangeable tooling system, present and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control; Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

TEXT BOOK:

1. N.K. Mehta, Machine Tool Design and Numerical Control, Tata McGraw Hill, 1997.

REFERENCE BOOKS:

1. Sen and Battacharya, Principles of Machine Tools, Central book publishers, Calcutta 1995.
2. SK BASU "Machine Tool Design".
3. McGraw "CAD/CAM".
4. Yorenkoren "Computer Control " Manufacturing Systems".



Method – pattern search methods – Powell’s – Hook – Jeeves, Rosenbrock search methods – gradient methods, gradient of function, steepest decent method, Fletcher reeves’ method. Variable metric method.

UNIT – III

Geometric Programming: Polynomials – arithmetic – geometric inequality – unconstrained G.P constrained G.P

Dynamic Programming: Multistage decision process, principles of optimality, examples, conversion of final problem to an initial value problem, application of dynamic programming, production inventory. Allocation, scheduling replacement.

Linear Programming: Formulation – Sensitivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints.

UNIT – IV

Integer Programming: Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method.

Stochastic Programming: Basic concepts of probability theory, random variables – distributions – mean, variance, Correlation, covariance, joint probability distribution – stochastic linear, dynamic programming.

UNIT – V

Simulation: Introduction – Types – Steps – application – inventory – queuing – thermal system

REFERENCES:

1. Optimization theory & Applications/ S.S Rao/ New Age International
2. Introductory to operation research/Kasan & Kumar/Springar
3. Optimization Techniques theory and practice / M.C Joshi, K.M Moudgalya/ Narosa Publications.
4. Operation Research/H.A. Taha/TMH
5. Optimization in operations research/R.L Rardin
6. Optimization Techniques/Benugundu & Chandraputla/Person Asia
7. Optimization Techniques /Benugundu & Chandraputla / Pearson Asia.

UNIT-II

Introduction to Material Handling:

Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

UNIT -III

Manual Assembly Lines: Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

UNIT-IV:

Transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, and applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

UNIT-V:

Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

TEXT BOOK:

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover/ Pearson Education.

REFERENCE BOOKS:

1. CAD CAM : Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne/ Pearson edu. (LPE).
2. Automation, Buckingham W, Haper & Row Publishers, New York, 1961.
3. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972

DEPARTMENTAL ELECTIVE – III

Subject Name: RAPID PROTOTYPING & TOOLING

Subject Code: MMP- 211

L T P : 3-0-0

Credit : 03

Objectives:

- Understand the historical developments and fundamentals of Rapid Prototyping (RP) systems, their classification, and the role of RP technologies in modern manufacturing mechanical design.
- Examine the principles and applications of liquid and powder-based RP processes, focusing on STL principles and typical methodologies such as SLA and selective laser sintering.
- Explore solid-based RP processes, including fused deposition modeling and laminated object modeling, and their significance in prototyping.
- Investigate the principles and processes of rapid tooling for the quick batch production of plastic and metal parts.
- Assess the integration of RP with traditional manufacturing processes, including investment casting, vacuum casting, and laser additive manufacturing.

Outcomes:

- Students will be able to analyze the impact of design changes on the cost and effectiveness of the RP process throughout various stages of product development.
- Examine the principles and applications of liquid and powder-based RP processes, focusing on STL principles and typical methodologies such as SLA and selective laser sintering.
- Students will be able to compare and contrast different solid-based RP techniques and their respective advantages and limitations in manufacturing applications.
- Students will develop the ability to design and propose solutions for rapid tooling applications, evaluating their effectiveness in reducing production times and costs.
- Students will be able to conduct case studies to evaluate the performance and effectiveness of various RP interfacing techniques within manufacturing systems, demonstrating an understanding of their practical applications.

UNIT I

INTRODUCTION: Historical developments, Fundamentals of RP Systems and its Classification, Rapid prototyping process chains, 3D modeling and mesh generation, Data conversion and transmission. The cost and effects of design changes during conceptual modeling, detail designing, prototyping, manufacturing and product release. Fundamentals of

Subject Name: SUPPLY CHAIN MANAGEMENT

Subject Code: MMP- 212

L T P : 3-0-0

Credit : 03

Objectives:

- Understand the scope, importance, and evolution of logistics and supply chain management, and identify the competitive strategies and performance drivers in supply chains.
- Examine the role of distribution within the supply chain and the factors influencing distribution network design, including practical design options and decision frameworks.
- Evaluate the role of transportation in the supply chain, focusing on decision factors, design options for transportation networks, and strategies for routing and scheduling.
- Explore the critical role of sourcing, supplier selection, and coordination in the supply chain, including strategies to mitigate the bullwhip effect and enhance strategic partnerships.
- Assess the impact of information technology on supply chain operations, including the frameworks for customer relationship management, internal supply chain management, and supplier relationship management.

Outcomes:

- Students will be able to analyze the evolution of supply chain decision phases and assess the impact of various drivers and obstacles on supply chain performance.
- Students will be able to develop effective distribution network designs that optimize supply chain performance based on identified factors and decision frameworks.
- Students will be able to formulate tailored transportation strategies that enhance logistics efficiency and effectiveness within the supply chain.
- Students will be able to design effective sourcing strategies and foster coordination within the supply chain to reduce obstacles and build trust among partners.
- Students will be able to implement IT solutions to improve supply chain processes and evaluate the future of IT in enhancing supply chain efficiency, including the role of e-business.

UNIT I

INTRODUCTION: Role of Logistics and Supply chain Management: Scope and Importance.

Evolution of Supply Chain Decision Phases in Supply Chain - Competitive and Supply chain

Strategies Drivers of Supply Chain Performance and Obstacles.

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Subject Name: INDUSTRIAL AUTOMATION AND ROBOTICS

Subject Code: MMP- 213

L T P : 3-0-0

Credit : 03

UNIT I

Introduction to Automation: Automation production system, Mechanization and automation, Types of automation, Automation strategies, Mechanical, electrical, hydraulic and Pneumatic automation devices and controls, Economics of automation.

UNIT II

High Volume Manufacturing Automation: Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines, design of single model, multimodel and mixed model production lines.

Programmable Manufacturing Automation: CNC machine tools, Machining centers, Programmable robots, Robot time estimation in manufacturing operations.

UNIT III

Flexible Manufacturing Automation: Introduction to Group Technology, Grouping methods, Cell Design, Flexible manufacturing system.

Assembly Automation: Assembly systems, Automatic transfer, feeding and orienting devices, Flexible assembly systems, Performance evaluation and economics of assembly systems.

UNIT IV

Robotics: Review of robotic technology and applications, Laws of robotics, Robot systems and anatomy, Robot classification, End Effectors, Robot kinematics, Object location, Homogeneous transformation, Direct and inverse kinematics, Manipulator motions, Robot drives, actuators and control, Drive systems, Hydraulic, Pneumatic Electrical DC and AC servo motors and stepped motors, Mechanical transmission method Rotary-to-rotary motion conversion, Robot motion and path planning control and Controllers, Robot sensing, Range sensing, Proximity sensing, touch sensing, Force and torque sensing etc., Robot vision, Image representation, Image recognition approaches.

UNIT V

Robot Applications: Robot applications in manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Robot cell design and control, Robot cell layouts-Multiple robots & Machine interference, Economics and social aspects of robotics, Future applications.

Books:

1. Automation, Production System & Computer Integrated Manufacturing Groover Prentice Hall India.
2. Principles of Automation & Automated Production Process Malov and Ivanov Mir Publication.
3. Automation in Production Engineering Oates and Georgy Newness.
4. Stochastic Models of Manufacturing Systems Buzacott & shanty Kumar Prentice Hall India.
5. Robotics K.S. Fu, R.C. Gonzalez, C.S.G. Lee McGraw Hill.
6. Robotics J.J. Craig Addison-Wesely.
7. Robot Engineering: An Integrated Approach R.D. Klafter, t.a. Chmielewski and M. Negin Prentice.

Ergonomics and Production: Ergonomics and product design, ergonomics in automated systems; Expert systems for ergonomic design; Anthropometrics data and its applications in ergonomic design; Limitations of anthropometric data, Use of computerized database; Case study.

UNIT IV

Visual Effects of Line and Colour: The mechanics of seeing; Psychology of seeing; General influence of line and form; Colour and light; Colour and objects; Colour and the eye; Colour consistency; Colour terms; Reaction to colour and colour continuation; Colour on engineering equipments.

UNIT V

Aesthetic Concepts: Concept of unity; Concept of order with variety; Concept of purpose style and environment; Aesthetic expressions; Style, Components of style; House style; Observation style in capital goods; Case study.

Books:

1. Industrial design for Engineers W.H. Mayall London Hiffee Books Ltd.
2. Introduction to Ergonomics R.C. Bridger McGraw Hill
3. Human Factor Engineering Sanders & McComlic



UNIT III

Abrasive Hybrid Machining (AHM) Processes, Abrasive Electrochemical Machining processes, Electrochemical assistance of Ultrasonic Machining (USMEC), Abrasive Electrical Discharge Grinding.

UNIT IV

Laser Assisted Micromachining: Laser-assisted etching (LAE), Electrochemical Micromachining with Laser Assistance (ECML),

UNIT V

Methods of Metal Deposition: Thermal Spray Coating: Vapor Deposition Chemical Vapor Deposition

Books:

1. Advance Machining Processes V.K. Jain New Age
2. Modern Machining Processes P.C. Pandey New Age
3. Manufacturing Processes Degarmo -
4. Manufacturing Processes Kalpakjian Tata McGraw-Hill International
5. Amitabh Gosh and A.K. Mallik, "Manufacturing Science", Affiliated East-West Press Pvt. Ltd., 1985

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Subject Name: PRECISION ENGINEERING

Subject Code: MMP- 223

L T P : 3-0-0

Credit : 03

Objectives:

- To understand concepts of accuracy and errors due to numerical interpolation.
- To know about tolerance zone conversions, form controls, orientation controls and logical approach to tolerancing.
- To learn about design and distribution of tolerances.
- To understand the relationship between tolerance grades, machining processes and related cost aspects

UNIT-I:

Concepts of Accuracy: Introduction-Concepts of Accuracy of Machine Tools-Spindle and Displacement Accuracies-Accuracy of Numerical Control Systems-Errors due to Numerical Interpolation Displacement Measurement System and Velocity Lags.

UNIT-II:

Geometric Dimensioning and Tolerancing: Tolerance Zone Conversions-Surfaces, Features of Size, Datum Features-Datum Oddly Configured and Curved Surfaces as Datum Features, Equalising Datums, Datum Feature of Representation-Form Controls, Orientation Controls-Logical Approach to Tolerancing.

UNIT-III:

Datum Systems: Design of Freedom, Grouped Datum Systems-Different types, Two and Three mutually perpendicular grouped datum planes, Grouped Datum System with spigot and recess, pin and hole, Grouped Datum System with spigot and recess pair and Tongue-Slot Pair-Computation of Translational and Rotational accuracy, Geometric Analysis and Application.

UNIT-IV:

Tolerance Analysis: Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, C_p , C_{pk} , Cost Aspects, Feature Tolerances, Geometric Tolerances. Surface Finish, Review of relationship between attainable tolerance grades and different Machining Process. Cumulative effect of Tolerances: normal fit law, normal law and truncated normal law.

UNIT-V:

Tolerance Charting Techniques: Operation Sequence for typical shaft type of components, Preparation of Process drawings for different Operations, Tolerance Worksheets and centrally analysis, Examples. Design features to facilitate Machining: Datum Features-functional and Manufacturing. Components design Machining considerations, Redesign for Manufactured Examples.

TEXT BOOK:

1. Precision Engineering in Manufacturing – Murthy R.L., New Age International (p) Limited, 1996.

REFERENCE BOOKS:

1. Geometric Dimensioning and Tolerancing – James D. Meadows, Marcel Dekker Inc. 1995.
2. Precision Manufacturing – David Dorfield, Dae Eur Lee, Springer Publishers, 2008.

OPEN ELECTIVE – V

Subject Name: MECHATRONICS

Subject Code: MMP- 231

L T P : 3-0-0

Credit : 03

Unit I

Introduction: Definition of Mechatronics products, Design Considerations and Tradeoffs. Overview of Mechatronic products. Intelligent Machine vs Automatic. Machine Economic and Social Justification.

Actuators and Motion Control: Characteristics of Mechanical, electrical, Hydraulic and pneumatic actuators and their limitations. Control parameters and system objectives. Mechanical configurations. Popular control system configurations. S-curve, Motor/Load inertia matching. Design with linear slides.

Unit-II

Motion Control Algorithms: significance of feed forward control loops, shortfalls, Fundamental concepts of adaptive and fuzzy control. Fuzzy logic compensatory control of transformation and deformation non-Linearities.

Unit-III

Architecture of Intelligent Machines: Introduction to Microprocessor and programmable logic controllers and identification of system, System design Classification. Motion control aspects in Design.

UNIT-IV

Manufacturing Data Bases: Data Base management system, CAD/CAM Data bases, Graphic Data Base, Introduction to object-oriented concepts, object-oriented model language interface, procedures and methods in creation, edition and manipulation of Data.

Unit-V

Sensor Interfacing: Analog and Digital Sensors for Motion Measurement, Digital Transducers, Human — Machine and Machine — Machine Interfacing devices and strategy.

Machine Vision: Feature and Pattern Recognition methods, concepts of perception and cognition in decision making.



Subject Name: DESIGN FOR MANUFACTURING & ASSEMBLY

Subject Code: MMP- 233

L T P : 3-0-0

Credit : 03

Unit I

Introduction: Design philosophy steps in Design process, General Design rules for manufacturability, basic principles of design Ling for economical production, creativity in design. Materials: Selection of Materials for design Developments in Material technology, criteria for material selection, Materialselection interrelationship with process selection process selection charts.

UNIT II:

Machining Process: Overview of various machining processes, general design rules for machining. Dimensional tolerance and surface roughness, Design for machining, Ease Redesigning of componentsfor machining ease with suitable examples. General design recommendations for machined parts.

Metal Casting: Appraisal of various casting processes, selection of casting process, - general designconsiderations for casting, casting tolerances, use of solidification simulation in casting design, product design rules for sand casting.

UNIT III:

Metal Joining: Appraisal of various welding processes, Factors in design of weidments, general designguidelines, pre and post treatment of welds, effects of thermal stresses in weld joints, design ofbrazed joints. Forging, Design factors for Forging, Closed die forging design, parting lines of diedrop forging die design, general design recommendations. Extrusion & Sheet Metal Work: Designguidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing,Keeler Goodman Forming Line Diagram, Component Design for Blanking.

UNIT-IV

Assemble Advantages: Development of the assemble process, choice of assemble method assembleadvantages social effects of automation.

Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms,and operator - paced free - transfer machine.

UNIT-V:

Design Of Manual Assembly: Design for assembly fits in the design process, general design guidelinesfor manual assembly, development of the systematic DFA methodology, assembly efficiency, classificationssystem for manual handling, classification system for manual insertion and fastening, effect of part symmetryon handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamferdesign on insertion operations, estimation of insertion time.

TEXT BOOKS:

1. Geoffrey Boothroyd, "Assembly Automation and Product Design", Marcel Dekker Inc., NY, 1992.
2. Engineering Design – Material & Processing Approach – George E. Deiter, McGraw Hill Intl. 2nd Ed. 2000.

MANDATORY COURSES (MC)

AUDIT I and II:

METC-111/METC-211: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Syllabus:

Unit I:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit II:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit III:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit IV:

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit V:

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

Unit VI:

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

DISASTER MANAGEMENT

METC-112/212

L-T-P- 2-0-0

UNIT-1

Disaster: Definition, Factors and Significance ; Difference Between Hazard And Disaster ; Natural And Manmade Disasters: Difference, Nature Types And Magnitude.

UNIT-II

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem, Natural Disasters: Earthquakes, Volcanisms Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster, Nuclear Reactor Meltdown, Industrial Accidents Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT-III

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches, Areas Prone to Cyclonic Coastal Hazards With Special Reference To Tsunami Post-Disaster Diseases And Epidemics.

UNIT-IV

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard, Evaluation Of Risk: Application Of Remote Sensing Data From Meteorological And Other Agencies Media Reports, Governmental And Community Preparedness.

UNIT-V

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation, Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment Strategies for Survival.

Books:

1. Environmental Hazards by Smith, K., Routledge, London, 1992. 2. Geological Hazards by Bell, F.G., Routledge, London, 1999.

Reference books:

1. Principles of Engineering Geology by Krynine, D.S. and Judd, W.R., CBS, New Delhi, 1998.
2. Natural Hazards by Bryant, E., Cambridge University Press. London, 1985.
3. Landslide Disaster – Assessment and Monitoring Nagarajan, R., Anmol Publications, New Delhi, 2001.
4. Environmental risks and hazards by Cutter, Susan L., Prentice Hall of India, New Delhi, 1999.
5. Bill Mc Juire, Ian Mason and C. Killburn (2002) Natural hazards and Environmental change, Oxford University Press, New York.
6. Gupta, Harsh K. (2003) Disaster Management, Universities Press (India) Pvt. Ltd
7. Coppola, Damon P. (2006) Introduction to International Disaster Management,
8. Butterworth -Heinemann
9. Jha, Madan Kumar (2010) Natural and Anthropogenic Disasters: Vulnerability,
10. Preparedness and Mitigation, Springer
11. Glade, Thomas, Malcolm G. Anderson, Michael J. Crozier (2005) Landslide Hazard and
12. Risk, edited Springer
13. Singh, Surendra, Leszek Starkel, Hiambok Jones Syiemlieh (2008) Environmental Changes and Geomorphic Hazards, Bookwell.



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REFERENCE BOOKS:

1. Geoffrey Boothroyd, "Hand Book of Product Design" Marcel and Dekken, N.Y. 1990.
2. A Delbainbre "Computer Aided Assembly London, 1992

Subject Name: INDUSTRIAL ROBOTICS

Subject Code: MMP- 234

L T P : 3-0-0

Credit : 03

UNIT: I

Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement.

Control System and Components: basic concept and controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, powertransmission system.

UNIT: II

Motion Analysis and Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

UNIT: III

End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design. **SENSORS:** Desirable features, tactile, proximity and range sensors, use ssensors in robotics.

Machine Vision: Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

UNIT: IV

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINONAL AND DELAY commands, Branching capabilities and Limitations.

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

UNIT: V

Robot Cell Desgin and Control: Robot cell layouts-Robot centered cell, In-line robot cell, Considerationsin work design, Work and control, Inter locks, Error detect ion.

Robot Application: Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection, Feature Application.

TEXT BOOKS:

1. Industrial robotics, Mikell P.Groover/McGraw Hill.
2. Robotics, K.S.Fu / McGraw Hill.

Subject Name: INDUSTRIAL SAFETY

SUBJECT CODE- MMP-232

L-T-P 300

OBJECTIVES: – For bringing high awareness for ensuring safe operations in industries, by appraisal of various factors involved in occupation of the employees and implementing the safety measures adopting cost-effective methods.

UNIT I: OPERATIONAL SAFETY 9 Hrs

Hot metal operation, boiler, pressure vessels – heat treatment shop – gas furnace operation – electroplating – hot bending pipes – safety in welding and cutting, Cold – metal operation – safety in machine shop – cold bending and chamfering of pipes- metal cutting – shot blasting, grinding, painting – power press and other machines. Management of toxic gases and chemicals – industrial fires and prevention – road safety – highway and urban safety – safety of sewage disposal and cleaning – control of environmental pollution – managing emergencies in industries – planning security and risk assessments, on – site and off site. Control of major industrial hazards.

UNIT II: SAFETY APPRAISAL AND ANALYSIS 9 Hrs

Human side of safety – personal protective equipment – causes and cost of accidents. Accidents prevention program – specific hazard control strategies – HAZOP training and development of employees – first aid – fire fight devices – accident reporting, investigation. Measurement of safety performance, accident reporting and investigation – plant safety inspection, job safety analysis – safety permit procedures. Product safety – plant safety rules and procedures – safety sampling – safety inventory systems. Determining the cost effectiveness of safety measurement.

UNIT III: OCCUPATIONAL HEALTH 9 Hrs

Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chloride, SO₂, H₂S.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT IV: SAFETY AND HEALTH REGULATIONS 9 Hrs

Safety and health standards – industrial hygiene – occupational diseases prevention welfare facilities. The object of factories act 1948 with special reference to safety provisions, model rules 123a, history of legislations related to safety – pressure vessel act – Indian boiler act – the environmental protection act – electricity act – explosive act.

UNIT V: SAFETY MANAGEMENT 9 Hrs

Evaluation of modern safety concepts – safety management functions – safety organization, safety departmentsafety committee, safety audit – performance measurements and motivation – employee participation in safety - safety and productivity. Total no. of hrs : 45

REFERENCES

1. John.V .Grimaldi and Rollin. H Simonds,(1989) "Safety Management", All India traveler book seller, New Delhi
2. Krishnan N.V,(1996) "Safety in Industry", Jaico Publisher House
3. "Industrial Safety and the law", P.M.C Nair Publishers, Trivandrum
4. Singh, U.K and Dewan, J.M.,(1996) "Safety, Security And Risk Management", APH publishing company, New Delhi
5. John V Grimaldi,(2003) "Safety Management", AITB publisher

Subject Name: INTELLIGENT MANUFACTURING SYSTEMS

Subject Code: MMP- 224

L T P : 3-0-0

Credit : 03

UNIT - I:

Computer Integrated Manufacturing Systems – Structure and functional areas of CIM system - CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM. Manufacturing Communication Systems – MAP/TOP, OSI Model, Data Redundancy, Top-down and Bottomup Approach, Volume of Information. Intelligent Manufacturing – System Components, System Architecture and Data Flow, System Operation.

UNIT - II:

Components of Knowledge Based Systems – Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Inference Engine, Knowledge Acquisition.

UNIT - III:

Machine Learning – Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing

UNIT - IV:

Automated Process Planning – Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning Knowledge Based System for Equipment Selection (KBSES) – Manufacturing system design, Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KBSES.

UNIT - V:

Group Technology: Models and Algorithms – Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation – Similarity Coefficient Method, Sorting-based Algorithms, Bond Energy Algorithm, Cost. Based method, Cluster Identification Method, Extended CI Method. Knowledge Based Group Technology Group Technology in Automated Manufacturing System, Structure of Knowledge based system for group technology (KBSGT) – Data Base, Knowledge Base, Clustering Algorithm.

TEXT BOOKS:

1. Intelligent Manufacturing Systems, Andre Kusaic.
2. Artificial Neural Networks, Yagna Narayana.
3. Automation, Production Systems and CIM, Groover M.P.
4. Neural Networks, Wassarman

Subject Name: QUALITY ENGINEERING IN MANUFACTURING

Subject Code: MMP- 222

L T P : 3-0-0

Credit : 03

UNIT I:

Quality Value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratle loss function, economic consequences of tightening tolerances as a means to improve quality, e valuations and types tolerances.(N-type,S-type and L-type)

UNIT II:

Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type. L-type and S-type characteristics, tolerance allocation for multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT III:

Analysis of Variance (ANOVA): NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT IV:

Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT V:

IS] -9000 Quality System, BDRE, 6.-sigma, Bench making, Quality circles Brain Storming — Fishbone diagram — problem analysis.

Text Book:

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill, Intl. II Edition, 1995.

Reference Books:

1 . Quality Engineering in Production systems / G. Taguchi, A. Elsayed et al / Mc.Graw Hill Intl. Edition, 1989.

2. Taguchi Methods explained: Practical steps to Robust Design / Papan P. Bagchi / Prentice Hall md. Pvt. Ltd., New Delhi.

3. Design of Experiments using the Taguchi Approach/Ranjit K. Roy, John wiley & sons. Inc. 2001.

DEPARTMENTAL ELECTIVE – IV

Subject Name: HYBRID MANUFACTURING

Subject Code: MMP- 221

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the concept of hybrid machining processes and the rationale behind their development, focusing on the integration of various machining techniques.
- To explore the principles and methodologies of chemical and electro-chemical machining processes, including their operational mechanics and economic factors.
- To examine abrasive hybrid machining processes, including abrasive electrochemical machining and ultrasonic assistance in machining.
- To investigate laser-assisted micromachining techniques, including laser-assisted etching and electrochemical machining with laser assistance.
- To learn about various metal deposition techniques, focusing on thermal spray coating and chemical vapor deposition.

Outcomes:

- Students will be able to analyze the challenges and feasibility of implementing hybrid machining processes in manufacturing, identifying potential applications and advantages.
- Students will demonstrate the ability to evaluate the advantages and disadvantages of various chemical and electro-chemical machining processes and their applications in industry.
- Students will gain the skills to assess the effectiveness of different abrasive hybrid machining techniques and their impact on machining efficiency and surface quality.
- Students will be able to apply laser-assisted methods to solve specific machining challenges, evaluating their benefits over traditional machining approaches.
- Students will be equipped to analyze and compare different metal deposition methods, understanding their applications, advantages, and limitations in manufacturing processes.

UNIT I

Hybrid Machining Processes: Introduction, Needs of Hybridization of the machining process, Challenges and feasibility of process.

UNIT II

Chemical and Electro-chemical Type Material Removal Processes: Principle, working advantages, disadvantages and applications of Electrochemical, Chemical machining, Economy aspects of ECM, Electro-chemical deburring and honing. Mechanical and Thermal interaction, Electrical Hybrid Machining Processes (ECDM, ECAM), Electrical Discharge Machining with Ultrasonic Assistance (EDM/US).

Subject Name: INDUSTRIAL DESIGN & ERGONOMICS

Subject Code: MMP- 214

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the fundamental principles of industrial design and its elements, focusing on the man-machine relationship and workstation design.
- To explore the design principles of controls and displays, including the shapes, sizes, and usability in various contexts such as automobiles and machine tools.
- To investigate the integration of ergonomics into product design and production systems, emphasizing the use of anthropometric data and computerized databases.
- To examine the psychological and visual impact of line, form, colour, and light on human perception and interaction with engineering equipment.
- To explore key aesthetic concepts, including unity, order, and style, and their application in design and engineering.

Outcomes:

- Students will be able to analyze and apply ergonomic principles to create efficient and effective workstation designs that enhance user comfort and productivity.
- Students will be equipped to design user-friendly control systems and displays that improve interaction in complex environments, ensuring safety and efficiency.
- Students will be able to evaluate and implement ergonomic principles in automated systems, leading to improved user experience and reduced physical strain.
- Students will gain the ability to apply colour theory and visual design principles to enhance the aesthetic and functional aspects of engineering products.
- Students will develop the skills to assess and implement aesthetic principles in design projects, creating visually appealing and contextually relevant products.

UNIT I

Introduction to Ergonomics and Industrial Design: An approach to industrial design-elements of design, Structure for industrial design in engineering; Application in modern manufacturing systems; General approach to the man-machine relationship, Work station design, Working position.

UNIT II

Control and Displays: Shapes and sizes of various controls and displays- Multiple displays and control situations; design of major controls in automobiles, machine tools etc.; Design of furniture; Redesign of instruments.

UNIT III

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UNIT II

SUPPLY CHAIN NETWORK DESIGN: Role of Distribution in Supply Chain, Factors influencing Distribution network design, Design options for Distribution Network Distribution Network in Practice Role of network, Design in Supply Chain, Framework for network Decisions.

UNIT III

LOGISTICS IN SUPPLY CHAIN: Role of transportation in supply chain, factors affecting transportations decision, Design option for transportation network, tailored transportation, Routing and scheduling in transportation.

UNIT IV

SOURCING AND COORDINATION IN SUPPLY CHAIN: Role of sourcing supply chain supplier selection assessment and contracts- Design collaboration sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT V

SUPPLY CHAIN AND INFORMATION TECHNOLOGY: The role IT in supply chain- The supply chain IT frame work Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.

Books:

1. Sunil Chopra, Peter Meindl and Kalra, "Supply Chain Management, Strategy, Planning, and Operation", Pearson Education,
2. Jeremy F. Shapiro, "Modeling the Supply Chain", Thomson Duxbury.
3. Srinivasan G.S, "Quantitative models in Operations and Supply Chain Management", PHI,
4. David J. Bloomberg, Stephen Lemay and Joe B. Hanna, "Logistics" PHI.
5. James B. Ayers, "Handbook of Supply Chain Management", St. Lucie press

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RPT technologies, various CAD issues for RPT. RPT and its role in modern manufacturing mechanical design.

UNIT II

LIQUID AND POWDER BASED RP PROCESSES: Liquid based process: Principles of STL and typical processes such as the SLA process, solid ground curing and others - Powder based process: Principles and typical processes such as selective laser sintering and some 3D printing processes. 3D solid modeling software and their role in RPT. Creation of STL or SLA file from a 3D solid model.

UNIT III

SOLID BASED RP PROCESSES Principles and typical processes such as fused deposition modeling laminated object modeling and others.

UNIT IV

RAPID TOOLING Principles and typical processes for quick batch production of plastic and metal parts through quick tooling.

UNIT V

RP INTERFACING WITH MANUFACTURING PROCESSES:

Investment Casting, Vacuum Casting, Laser Additive Manufacturing. Rapid manufacturing processes like - Vacuum Casting Processes via RP Processes, Electroplated Prototypes, RTV Silicon Moulds, Direct Inkjet SL Tooling, Electron Beam Melting, 3D scanning, 3D digitizing and Data fitting. High speed machining- Hardware and software - Applications: Evaluation, bench marking and various case studies.

REFERENCES

1. Chua Chee Kai, Leong Kah Fai, Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, 2010.
2. Ian Gibson, David W Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.
3. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.
4. Burns. M, "Automated Fabrication", PHI, 1993.
5. Chua. C.K, "Rapid Prototyping", Wiley, 1997.
5. Jacobs P.F., "Stereolithography and other Rapid Prototyping and Manufacturing Technologies", ASME, 1996.
6. Pham D.T. and Dimov S.S., "Rapid Manufacturing; the technologies and application of RPT and Rapid tooling", Springer, London 2001

WELDING & CASTING PROCESS LAB

SUBJECT CODE-251

L-T-P 0-0-3

Note: Conduct any Three Experiments/Study in each Part

Part I: Welding: 1. Study of arc characteristics in simulated MMA welding; arc gap-arc voltage relationship; recording of voltage oscillograms and its study.
2. Study of heat flow and temperature distribution in welding
3. Study of characteristics of TIG/MIG welding
4. Ultrasonic/dye penetrates inspection or computer simulation of welding heat flow/analysis of arc voltage pattern.

Part II: Casting: 1. Practice on CAD of gating and risering
2. Experiment to determine the effect of molding variables in sand moulds
3. To determine the effect of mould additive on the properties of castings
4. To determine the characteristics of base sands.

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Subject Name: Automation in Manufacturing

Subject Code: MMP- 124

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the fundamental principles of automation in production systems and identify the key elements that contribute to automated manufacturing.
- To explore the various types of material handling equipment and the design considerations necessary for effective material handling systems.
- To study the fundamentals of manual assembly lines and the various methods for optimizing assembly line design and efficiency.
- To understand the operation and analysis of automated production lines, particularly focusing on transfer lines and their performance.
- To investigate the principles and design aspects of automated assembly systems, including quantitative analysis techniques for assembly operations.

Outcomes:

- Students will be able to analyze various automated manufacturing systems and articulate the benefits and costs associated with implementing automation strategies in production operations.
- Students will be equipped to evaluate and design material transport and storage systems using the ten principles of material handling, along with appropriate automated guided vehicle systems and storage solutions.
- Students will be capable of applying different line balancing techniques and design for assembly principles to improve the productivity and efficiency of manual assembly lines.
- Students will be able to analyze and optimize transfer lines, assessing the impact of storage buffers on production efficiency.
- Students will develop the ability to design and analyze automated assembly systems, considering the efficiency of parts delivery systems and the role of automation in assembly processes.

UNIT-I

Introduction to Automation:

Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

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Subject Name: Advanced Optimization Technique

Subject Code: MMP- 123

L T P : 3-0-0

Credit : 03

Objectives:

- To understand and apply various one-dimensional optimization methods for solving unconstrained optimization problems involving uni-modal functions.
- To explore advanced techniques in multi-variable optimization, focusing on direct search methods and gradient-based methods for unconstrained problems.
- To introduce the concepts of geometric programming and dynamic programming, including their applications in decision-making processes and resource allocation.
- To provide a foundational understanding of integer programming techniques and basic concepts of stochastic programming, emphasizing their formulations and applications.
- To introduce simulation as a powerful tool for modeling complex systems, exploring different types of simulation and their applications in various fields.

Outcomes:

- Students will be able to effectively utilize methods such as the Fibonacci method and golden section method to find the optimum value of a function in one dimension
- Students will demonstrate the ability to implement algorithms like Powell's method and steepest descent method to optimize multi-variable functions, improving their problem-solving skills in complex scenarios.
- Students will be able to formulate and solve problems using geometric programming and apply dynamic programming principles to real-world scenarios such as production scheduling and inventory management.
- Students will gain proficiency in formulating integer programming problems and using techniques like the Gomory cutting plane algorithm, as well as an understanding of stochastic processes and their implications in optimization.
- Students will be able to design and implement simulation models for applications such as inventory management and queuing systems, enhancing their ability to analyze and optimize operational processes.

UNIT – I

Single Variable Non-Linear Unconstrained Optimization: One dimensional Optimization methods, Uni-modal function, elimination method, Fibonacci method, golden section method, interpolation methods- quadratic & cubic interpolation methods.

UNIT – II

Multi Variable Non-Linear Unconstrained Optimization: Direct search method – Univariant

Subject Name: MACHINE TOOL DESIGN

Subject Code: MMP- 122

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the principles of kinematics in machine tools and their application in designing and developing various machine tools.
- To explore the design principles for strength and rigidity in machine tool structures and their components.
- To study the design considerations and analysis techniques for spindles, bearings, and power screws in machine tools.
- To introduce students to computer-aided programming concepts and techniques for CNC machines.
- To explore the various tooling systems for CNC machines and understand the concepts of DNC and adaptive control.

Outcomes:

- Students will be able to analyze and design kinematic schemes for machine tools like lathes, milling machines, and drilling machines, considering productivity loss and regulation mechanisms.
- Students will gain the ability to design machine tool components such as beds, columns, and guideways, taking into account materials and overall compliance.
- Students will be equipped to design spindles under combined loading conditions and understand the effects of vibrations on machine tools, including the identification and mitigation of chatter.
- Students will be proficient in APT programming for 2D machining and able to implement NC programming on CAD/CAM systems, including tool path generation.
- Students will be able to design and implement interchangeable tooling systems and demonstrate knowledge of DNC systems and adaptive control in machining processes.

UNIT – I

Kinematics of Machine Tools: -

shaping of geometrical and real surfaces, Developing and designing of kinematic schemes of machine tools, kinematics structures of lathe, drilling, milling, grinding, gear shaping and gear hobbing machines. Kinematic design of speed and feed boxes. Productivity loss. Stepped and stepless regulation, clutched drive.

UNIT – II

Strengths and Rigidity of Machine tool Structures: Basic principles of design for strength. Different types of structures. Overall compliance of machine tools. Design of beds, bases,

DEPARTMENTALELECTIVE – II

Subject Name: ADVANCED WELDING TECHNOLOGY

Subject Code: MMP- 121 L T P : 3-0-0

Credit : 03

Objectives:

- Understand the importance, classification, and safety measures in welding processes, along with the fundamentals of welding power sources.
- Learn the physics behind the welding arc, its characteristics, and the effects of various parameters like shielding gas and metal transfer mechanisms.
- Study various welding processes, including arc welding, resistance welding, and advanced techniques like laser and ultrasonic welding.
- Understand heat flow in welding, the thermal cycles, and how to prevent defects and distortions in welded joints.
- Explore repair and maintenance methods in welding, such as hardfacing, cladding, and surfacing, and assess weldability for different materials.

Outcomes:

- Students will be able to classify different welding processes and identify appropriate power sources for specific welding tasks, while adhering to health and safety measures.
- Students will be able to analyze arc characteristics and determine the most efficient metal transfer mechanisms for specific arc welding processes.
- Students will acquire the ability to differentiate between various welding techniques and select the appropriate process for different materials and applications.
- Students will be able to calculate critical welding parameters like heat-affected zones (HAZ) and design weld joints to minimize defects and residual stresses.
- Students will be able to evaluate the weldability of various metals and apply appropriate repair and maintenance techniques for enhancing the lifespan of welded components.

UNIT-I

Introduction: Welding as compared with other fabrication processes, Importance and application of welding, classification of welding processes, Health & safety measures in welding. **Welding Power Sources:** Physics of welding Arc, Basic characteristics of power sources for various arc welding processes, Transformer, rectifier and generators.

UNIT-II

Physics of Welding Arc: Welding arc, arc initiation, voltage distribution along the arc, arc characteristics, arc efficiency, heat generation at cathode and anode, Effect of shielding gas on

Subject Name: Composite Materials

Subject Code: MMP- 122

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the classification, characteristics, and functional requirements of composite materials, focusing on how reinforcement factors like size, shape, and distribution affect performance.
- To learn about the preparation, properties, and applications of various fibers such as glass, carbon, Kevlar, and boron, along with understanding the mechanical behavior of composites under different conditions.
- To explore different manufacturing techniques of Metal, Ceramic, and Carbon Matrix Composites, including casting, hot isostatic pressing, and weaving.
- To learn about the various methods of manufacturing Polymer Matrix Composites, such as hand layup, filament winding, and compression moulding.
- To understand laminate strength criteria and failure theories in composites, focusing on factors like stress concentration and failure prediction.

Outcomes:

- Students will be able to identify the impact of reinforcement characteristics on composite material properties and applications.
- Students will be able to explain the mechanical behavior of fiber and particle-reinforced composites and apply the Rule of Mixtures in composite design.
- Students will gain knowledge of various manufacturing processes for MMCs, CMCs, and Carbon-Carbon composites, along with their properties and industrial applications.
- Students will understand the preparation of molding compounds and apply different manufacturing techniques for Polymer Matrix Composites.
- Students will be able to analyze composite strength and failure using criteria such as maximum stress, strain, and hygrothermal effects, applying these in design considerations.

UNIT – I

INTRODUCTION: Definition – Classification and characteristics of Composite materials.
Advantages and application of composites. Functional requirements of reinforcement and matrix.
Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers,

M.Tech. 2nd Semester (Production Engineering)

Subject Name: Advanced Welding & Casting Technology

Subject Code: MMP- 201

L T P : 3-0-0

Credit : 03

Objective:

- Understand the working principles and applications of advanced welding methods such as Laser Beam Welding (LBW), Friction Stir Welding (FSW), Electron Beam Welding (EBW), and Ultrasonic Welding.
- Analyze the theory of heat flow in welding and its impact on cooling rates, residual stresses, and joint design.
- Understand the principles of various casting processes, such as investment casting, shell molding, vacuum casting, and counter-gravity casting.
- Explore the fundamentals of nucleation, grain growth, and solidification in metals, focusing on gating and risering design.
- Learn the application of finite element methods (FEM) in welding and casting for predicting distortions, temperature distribution, and defects.

Outcome:

- Gain knowledge of how to select appropriate welding techniques and process parameters for specific industrial applications, including power calculations and equipment selection for LBW, EBW, and FSW.
- Develop the ability to optimize welding parameters based on heat flow analysis, minimizing residual stresses and ensuring joint integrity in automated welding systems.
- Acquire the skills to implement advanced casting techniques and improve casting quality through controlled solidification processes.
- Apply solidification theory to design efficient gating systems and risers that enhance fluidity and reduce defects in castings.
- Use CAE tools to model and optimize welding and casting processes, ensuring better design of weldments and castings with reduced hot spots, turbulence, and defects.

Unit I

Laser Beam Welding: Types of lasers, equipment, power calculation, applications, dual laser beam welding, use of fibre optics in LBW.

Friction Stir Welding; Details of process and process parameters, specific applications.

Electron Beam Welding; The interaction of electron beam with matter, mode of heat generation, mode of energy losses, details of the equipment, product design for EBW, case studies.

Ultrasonic Welding; Propagation of ultrasonic waves in matter, mode of joint formation, joint types and design of product for ultrasonic welding, details of equipment and case studies cutting and gauging, flamecutting

Saini

Subject Name: Theory of Metal Cutting

Subject Code: MMP- 114

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the geometry of the metal cutting process and its influence on chip formation, cutting forces, and power consumption.
- To study the geometry of single-point cutting tools and the theories related to built-up edge formation.
- To understand the mechanics of multipoint cutting tools, including drill geometry, milling cutters, and grinding processes.
- To examine different wear mechanisms affecting tool life and the machinability of materials.
- To analyze the sources and distribution of heat during metal cutting and the role of cutting fluids in the process.

Outcomes:

- Students will be able to calculate the cutting forces, material removal rate (MRR), and the effect of cutting variables on the machining process using Merchant's Analysis.
- Students will be able to design single-point cutting tools and understand the influence of cutting tool geometry on performance and tool life.
- Students will be able to analyze and optimize machining parameters like speed, feed, depth of cut, and machining time for milling and grinding processes.
- Students will be able to evaluate tool wear, apply the laws of friction in metal cutting, and conduct economic cost analysis for machining operations.
- Students will be able to select appropriate cutting fluids and tool materials based on thermal effects, cutting conditions, and tool material properties.

Unit -I

Mechanics of Metal Cutting: Geometry of Metal Cutting Process, Chip formation, Chip thickness ratio, radius of chip curvature, cutting speed, feed and depth of cut – Types of chips chip breakers. Orthogonal and Oblique cutting processes – definition, Forces and energy calculations (Merchant's Analysis)– Power consumed – MRR- Effect of Cutting variables on Forces, Force measurement using Dynamometers.

Unit II

Single Point Cutting Tool: Various systems of specifications, single point cutting tool geometry and their inter-relation. Theories of formation of built-up edge and their effect, design of single point contact tool throwaway inserts.

Sayer

Subject Name: Simulation, Modelling & Analysis

Subject Code: MMP-113

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the fundamental concepts of simulation, including its tools, advantages, disadvantages, and applications.
- To learn the principles and algorithms used in discrete event simulation.
- To explore statistical models and distributions used in simulation, including queuing and inventory systems.
- To understand the characteristics of queuing systems and how to measure their performance.
- To learn techniques for generating random numbers and variates, and to understand the process of input modeling and validation.

Outcomes:

- Students will be able to differentiate between discrete and continuous systems, and describe the components of a simulation system.
- Students will be able to perform manual simulations using event scheduling techniques and apply the time advance algorithm.
- Students will gain proficiency in applying discrete and continuous statistical distributions, such as Bernoulli and Exponential distributions, in simulation models.
- Students will be able to analyze server utilization in G/G/1 and G/G/C queues and calculate performance measures for various queuing models.
- Students will be able to generate random numbers using different techniques, perform Goodness of Fit tests, and validate simulation models effectively.

UNIT I

Introduction: Simulation: a tool, advantages and disadvantages of simulation, areas of application, systems and system environment, components of a system, discrete and continuous systems, discrete event system simulation.

UNIT II

General Principles: Concepts in discrete event simulation, time advance algorithm, manual simulation using event scheduling, basis properties and operations.

UNIT III

Models In Simulation: Terminology and concepts, statistical models: queuing systems; inventory systems; reliability and maintainability, limited data, discrete distributions: Bernoulli

Sagar

Subject Name: Computer Integrated Manufacturing Systems

Subject Code: MMP- 112

L T P : 3-0-0

Credit : 03

Objectives:

- To introduce students to the basics of CAD/CAM, manufacturing models, and metrics, and provide an understanding of automation in manufacturing.
- To familiarize students with production planning, control systems, and computer-aided process planning (CAPP).
- To introduce group technology (GT), cellular manufacturing, and machine cell design and layout.
- To provide an understanding of flexible manufacturing systems (FMS) and automated guided vehicle systems (AGVS).
- To explore the anatomy, classification, and control systems of industrial robots and their applications in manufacturing.

Outcomes:

- Students will be able to explain the key concepts of CAD/CAM and CIM, along with the role of automation and its different levels in manufacturing systems.
- Students will develop the ability to create process plans using CAPP and apply concepts of aggregate production and material requirement planning (MRP).
- Students will be able to apply quantitative methods like Rank Order Clustering and Hollier Method for designing machine cells in cellular manufacturing.
- Students will be able to analyze the components, planning, and benefits of FMS and AGVS, and understand their applications in manufacturing.
- Students will gain knowledge of robot control systems, programming, and sensors, and will be able to assess robot accuracy and repeatability in industrial applications.

UNIT I

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control
Introduction to CAD/CAM – Concurrent Engineering - CIM concepts – Computerised elements of CIM system –Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In Time Production.

UNIT II

Production Planning And Control And Computerised Process Planning

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production

DEPARTMENTAL ELECTIVE – I

Subject Name: METAL FORMING

Subject Code: MMP- 111

L T P : 3-0-0

Credit : 03

Objectives:

- To understand the stress and strain relations in two and three dimensions and their representations using Mohr's circle.
- To comprehend the principles of plasticity, including the behavior of ductile metals under combined stress conditions and yield criteria.
- To analyze metal deformation processes using methods such as slip-line field theory, slab method, and understand the effect of factors like strain rate and friction.
- To gain insights into the analysis and load calculations of various metal forming processes, such as forging, rolling, extrusion, and drawing.

Outcomes:

- Learners will be able to analyze and interpret the state of stress and strain at any point within a material, applying the concepts of hydrostatic and deviatoric stress components.
- Learners will be able to apply yield criteria like Von Mises and Tresca to predict material yielding and analyze metal forming processes based on different stress-strain relations.
- Learners will develop the capability to perform deformation analysis and determine flow stress under various working conditions, including hot and cold working, for different materials.
- Learners will be able to calculate forces, loads, and torques involved in forming processes, and optimize process parameters in industrial applications like cold rolling and extrusion.

UNIT I

Review of two dimensional stress and strain, state of stress in three dimensions, Stress tensor, Invariants, Mohr's circle for 3-dimensional state of stress, strain at a point- Mohr's circle for strain, Hydrostatic & Deviatoric components of stress, Elastic stress-strain relations.

UNIT II

Elements of theory of plasticity; Flow curve, True stress & true strain, Yield criteria for ductile metals, Von Mises & Tresca yield criteria, combined stress tests. The yield locus, Anisotropy in yielding, Yield surface, Levy-Mises, Prandtl-Reuss Stress-Strain relation, Classification of forming processes variables in metal forming and their optimization.

UNIT III

Analysis of deformation processes- Method based on homogeneous compression slip line field theory, Upper bounds and lower bounds, Slab method of analysis. Flow stress determination, Hot

Unit 3:

Data Collection Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research

Unit 4:

Data Analysis and interpretation Data analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis testing, Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results

Unit 5:

Technical Writing and reporting of research Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing and citation of Journals, Intellectual property, Plagiarism

Text Books:

1. C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques, New Age International publishers, Third Edition.
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005
3. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
4. Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013.



Post Processors for CNC: Introduction to Post Processors:

The necessity of a Post Processor, the general structure of a Post Processor, the functions of a Post Processor, DAPP — based- Post Processor: Communication channels and major variables in the DAPP — based Post Processor, th creation of a DAPP — Based Post Processor.

UNIT IV:

Micro Controllers:

Introduction, Hardware components, I/O pins, ports, external memory:, counters, timers and serial data I/O interrupts. Selection of Micro Controllers Embedded Controllers, Applications and Programming of Micro Controllers. Programming Logic Controllers (PLC' s): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC's in CNC Machines.

UNIT V:

Computer Aided Process Planning, Hybrid CAAP System, Computer Aided Inspection and quality control, Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods, Artificial Intelligence and expert system: Artificial Neural Networks, Artificial Intelligence in CAD, Experts systems and its structures.

Text Books:

1. Computer Control of Manufacturing Systems / Yoram Koren / Mc Graw Hill. 1983.
2. Computer Aided Design Manufacturing – K. Lalit Narayan, K. Mallikarjuna Rao and M.M.M. Sarcar, PHI, 2008.

Reference Books:

1. Systems approach to Computer Integrated Design and Manufacturing – Nana Singh, John Wiley, 1996.
2. Computer Aided Manufacturing – Tien Chien Chang, Richrad A. Wysk and Hsu-Pin Wang, Pearson Third Editon, 2012.
3. Computer Numerical Control, Operations and Programming – Jon Stenerson, Kelly Cuman, PHI.

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Unit III

Surface treatment:

Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating, Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

Unit IV

Non-Traditional Machining:

Introduction, need AJM, Parametric Analysis, Process capabilities, USM Mechanics of Cutting, models, Parametric Analysis, WJM – principles, equipment, generators, analysis of R-C circuits, MRR, Surface finish, WEDM.

Unit V

Laser Beam Machining :Principles of working, equipment, Material removal rate, Process parameters, performance characterization, applications.

Plasma Arc Machining – Principles of working, equipment, Material removal rate, Process Parameters, performance characterization, applications

Electron Beam Machining – Principle of working equipment, Material removal rate, Process performance characterization, applications

Electro Chemical Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, applications

Books

1. Manufacturing Engineering and Technology, Kalpakijian, Adisson Wesley 1995.
2. Process and Materials of Manufacturing RA Lindburg 4th edition PHI 1990.
3. Foundation of MEMS/Chang Liu/ Pearson, 2012.
4. Advanced Machining Processes VKJin, Allied Publications.
5. Introduction to Manufacturing Processes, John A Schey, Mc Graw Hill.
6. Fundamentals of Metal Cutting and Machine Tools, B.L. Juneja and G.S. Sekhon, New Age International

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W.E.F. ACADEMIC SESSION 2023-24

LIST OF ELECTIVES, OPEN ELECTIVES AND MANDATORY COURSES

Departmental Elective-I	MMP-111	Metal Forming
	MMP-112	Computer Integrated manufacturing systems
	MMP-113	Simulation, Modeling & Analysis
	MMP-114	Theory of Metal Cutting
Departmental Elective-II	MMP-121	Advanced Welding Technology
	MMP-122	Machine Tool Design
	MMP-123	Advanced Optimization Techniques
	MMP-124	Automation in Manufacturing
Departmental Elective-III	MMP-211	Rapid Prototyping & Tooling
	MMP-212	Supply Chain Management
	MMP-213	Industrial Automation & Robotics
	MMP-214	Industrial Design & Ergonomics
Departmental Elective-IV	MMP-221	Hybrid Manufacturing
	MMP-222	Quality Engineering in Manufacturing
	MMP-223	Precision Engineering
	MMP-224	Intelligent manufacturing system

Open Elective-V	MMP-231	Mechatronics
	MMP-232	Industrial Safety
	MMP-233	Design for manufacturing assembly
	MMP-234	Industrial Robotics

Audit Course 1 & 2METC- (111-118) /METC-(211-218)	English for Research Paper Writing
	Disaster Management
	Sanskrit for Technical Knowledge
	Value Education5.Constitution of India
	Pedagogy Studies
	Stress Management by Yoga
	Personality Development through Life
	Enlightment Skills

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**SWAMIVIVEKANANDSUBHARTIUNIVERSITY,MEERUTS
UBHARTIINSTITUTE OF TECHNOLOGY AND ENGINEERING
DY&EVALUATIONSCHEME**

M.Tech I Year/ I Semester (Production Engineering)

w.e.f academic Session 2023-24

SEMESTER I														
S. No.	Course Code	CourseName	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	C T	T A	Total	P S	T E	PE		
1	MMP-101	Advanced Manufacturing Process	PCC-1	3	0	0	20	10	30	-	70	-	100	3
2	MMP-102	Computer Aided Manufacturing	PCC-2	3	0	0	20	10	30	-	70	-	100	3
3	MMP-111-114	Departmental Elective-I	PEC-1	3	0	0	20	10	30	-	70	-	100	3
4	MMP-121-124	Departmental Elective -II	PEC-2	3	0	0	20	10	30	-	70	-	100	3
5	MMP-151	Production Engineering Lab-I	PCC-3	0	0	4	-	-	-	15	-	35	50	2
6	MMP-152	Advanced Manufacturing Lab-I	PCC-4	0	0	4	-	-	-	15	-	35	50	2
7	METC-101	Research Methodology & IPR	MC-1	2	0	0	20	10	30	-	70	-	100	3
8	METC 111-118	Audit course-I	MC-2	2	0	0	20	10	30	-	70	-	100	3
TOTAL												700	22	

M.Tech I Year/II Semester (Production Engineering)

w.e.f academic Session 2023-24

SEMESTER II														
S. No.	Course Code	CourseName	Course Type	Periods			CCA				ESE		Total	Credit
				L	T	P	CT	T A	Total	PS	TE	PE		
1	MMP-201	Advanced Welding & Casting Technology	PCC-5	3	0	0	20	10	30	-	70	-	100	3
2	MMP-202	Composite Material	PCC-6	3	0	0	20	10	30	-	70	-	100	3
3	MMP-211-214	Departmental Elective -III	PEC-3	3	0	0	20	10	30	-	70	-	100	3
4	MMP-221-224	Departmental Elective -IV	PEC-4	3	0	0	20	10	30	-	70	-	100	3
5	MMP-231-234	Open Elective-V	OEC-1	3	0	0	20	10	30	-	70	-	100	3
6	MMP-251	Welding & casting process lab I	PCC-7	0	0	3	-	-	-	15	-	35	50	2
7	MMP-252	Seminar-I	PROJ	0	0	1	-	-	-	50	-	-	50	1
8	METC-211-218	Audit course-II	MC-3	2	0	0	20	10	30	-	70	-	100	3
TOTAL												700	21	

Sajjan

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