DEPARTMENT OF
MECHANICAL ENGINEERING

Scheme of Instruction and Syllabi
of
M.E. (Mechanical)

Specialization:
PRODUCTION

Full time / Part time

(2012-13)

UNIVERSITY COLLEGE OF ENGINEERING
(Autonomous)
Osmania University
Hyderabad – 500 007, A.P., INDIA
### Scheme of Instruction & Examination

**M.E. (Mechanical Engineering) 4 Semesters (Full Time)**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Subject</th>
<th>Periods per week</th>
<th>Duration (Hrs)</th>
<th>Max. Marks</th>
<th>Univ. Exam</th>
<th>Sessional</th>
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Note: Six core subjects, Six elective subjects, Two Laboratory Courses and Two Seminars should normally be completed by the end of semester II.

* Project seminar presentation on the topic of Dissertation only
** 50 marks awarded by the project guide and 50 marks by the internal committee.
*** Excellent / Very Good / Good / Satisfactory / Unsatisfactory
**Scheme of Instruction & Examination**  
M.E. (Mechanical Engineering) 6 Semesters (Part Time)

<table>
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<th>Sl. No</th>
<th>Subject</th>
<th>Periods per week</th>
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Note: Six core subjects, Six elective subjects, Two Laboratory Courses and Two Seminars should normally be completed by the end of semester IV.

* Project seminar presentation on the topic of Dissertation only  
** 50 marks awarded by the project guide and 50 marks by the internal committee.  
*** Excellent/Very Good/Good/Satisfactory/Unsatisfactory
## Scheme of Instruction & Examination of Post Graduate Course in Mechanical Engineering with specialization in Production Engineering.

Course duration: 4 Semesters (Full – time), 6 semesters (Part – Time)

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<tr>
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*Excellent/Very Good/Good/Satisfactory/Unsatisfactory
ME 501

AUTOMATION

Instructions 3 periods/week
Duration of university Examination 3 hours
University Examination 80 Marks
Sessional 20 Marks

UNIT – I

UNIT – II

UNIT – III

UNIT – IV

UNIT – V

Suggested Reading:

METALLURGY OF METAL CASTING AND WELDING

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

Unit-I
Metallurgy of Cast Steel and Cast Iron: Solidification microstructure, effect of cooling rate, carbon content, malleable and ductile Cast Iron.

Solidification of Castings: Solidification of pure metals and alloys, solidification rate and directional solidification, grain structure of cast metals, shrinkage, gases in cast metals, degassification.


Unit-II

Zinc based die casting alloys, Nickel chromium high temperature alloys, Foundry practices of copper, aluminium and magnesium base alloys.

Unit-III

Unit-IV

Unit-V
Weldability aspects of low alloy steels, stainless steels, aluminium alloys, Magnesium and Titanium alloys.
Weld cracks – cold and hot cracks; Liquation cracks, Hydrogen Induced cracks, Lamellar cracks.

Suggested Reading:
ME 503

METAL FORMING SCIENCE

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II

UNIT-III
Rod Drawing and Extrusion: Process parameters in drawing and extrusion, Maximum % reduction per pass, Effects of friction and redundant work on drawing stress/extrusion pressure, load estimation techniques like homogeneous work, slab analysis, slip line field theory, and upper bound solutions. Hydrostatic Extrusion. Defects in drawn and extruded products, Metal working lubricants.

UNIT-IV

UNIT-V

Suggested Reading:
METAL CUTTING AND MACHINE TOOL DESIGN

**Instruction** 3 Periods /Week
**Duration of University Examination** 3 Hrs
**University Examination** 80 Marks
**Sessional** 20 Marks

UNIT-I
**Tool Materials:** Tool material properties – HSS, Carbides, coated carbides, ceramic and CBN and diamonds, sialons, powder coatings – Relative advantages.

**Tool Geometry:** Various methods of tool nomenclature and their inter relationship. Theoretical Determination of shear angle and cutting forces: Shear plane theory–Merchant’s models, Lee and Shofer’s model. Velocity relations.

Estimation of shear angle experimentally. Metal cutting friction. Real area of contact-Rules of dry sliding, stress distribution of tool face-variation of co-efficient of tool face friction with the rake angle.

UNIT-II
**Dynamometry:** Theoretical and empirical estimation of force and power in turning, drilling, milling and grinding processes optimization in cutting forces – Dynamometer requirements – Force measurements – Electric transducers. Lathe, drilling and milling dynamometers.


UNIT-III
**Tool Wear, Tool life and Machinability:** Mechanism of tool wear – Adhesive, Abrasive, Diffusive and Chemical wear – Taylor’s tool life equation. Cutting Fluids – Carbon tetrachloride – Direction of fluid application – Chip curl-economics of machining – Comparison of machinability of different metals.

Recent development in metal cutting: Hot machining. Rotary machining – High speed machining, rapid proto typing.

UNIT-IV


UNIT-V


Suggested Reading:

With effect from the Academic Year 2012 - 2013

ME 505

COMPUTER INTEGRATED MANUFACTURING

Instructions 3 periods/week
Duration of university Examination 3 hours
University Examination 80 Marks
Sessional 20 Marks

UNIT – I

UNIT – II
CIM database and database management systems: Introduction, Manufacturing Data: Types, sources; Database Terminology, Database requirements, Database models, Database Management System, DBMS Architecture, Query Language, Structural Query Language (SQL): Basic structure, Data definition Language (Create, Alter, Drop, Truncate, View), Data Manipulation Language (store, retrieve, update, delete). Illustration of Creating and Manipulating a Manufacturing Database. SQL as a Knowledge Base Query Language. Features of commercial DBMS: Oracle, MySQL, SQL Access, Sybase, DB2. Product Data Management (PDM), Advantages of PDM.

UNIT – III

UNIT – IV

CIM Models: ESPRIT-CIM OSA Model, NIST-AMRF Model, Siemens Model of CIM, Digital Equipment Corporation Model, IBM Concept of CIM.

UNIT – V

Suggested Reading:
3. P.Radhakrishnan, S.Subramanyam: CAD/CAM/CIM, New Age International
4. Alavudeen, Venkateshwaran: Computer Integrated Manufacturing, Printice-Hall India
TOOL ENGINEERING

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Design of Cutting Tools: S.P. tools, geometry, design of shank, form tools, types, form correction, drills, geometry, effect of feed, axial thrust and torque. Reamers – cutting elements, geometry, tolerances, milling cutters minimum no. of teeth, geometry different types of cutters. Cutting principle by form generation gear shapers & hobs.

UNIT-II

UNIT-III

UNIT-IV
Tooling for Automats: Cam design for automats, gauge design – gauge allowances and tolerance – materials for gauges. Economics of Tooling: Selection of economical method – amortization of tooling costs.

UNIT-V
Manufacturing and Sharpening of Cutting Tools: Manufacture of drills, reamers, milling cutters, broaches, gear hobs. Sharpening of single point tools, drills, reamers, milling cutters, broaches and gear hobs.

Suggested Reading:
1. ASTME, Fundamentals of Tool Design.
2. Rodin, Design and production of Metal Cutting Tools.
3. Palay, Manufacture of Metal Cutting Tools.
4. Surendra Kumar, Production Engineering Design (Tool Design).
5. G.R. Nagpal, Tool Engineering.
ROBOTIC ENGINEERING

Instruction: 3 Periods/week
Duration of University Examination: 3 Hrs
University Examination: 80 Marks
Sessional: 20 Marks

Unit-I
**Brief History.** Types of robots, Overview of robot subsystems, resolution, repeatability and accuracy, Degrees of freedom of robots, Robot configurations and concept of workspace, Mechanisms and transmission, End effectors and Different types of grippers, vacuum and other methods of gripping. Pneumatic, hydraulic and electrical actuators, applications of robots, specifications of different industrial robots.

Unit-II
**Rotation matrices.** Euler angle and RPY representation, Homogeneous transformation matrices, Denavit-Hartenberg notation, representation of absolute position and orientation in terms of joint parameters, direct kinematics.

Unit-III
**Inverse Kinematics.** inverse orientation, inverse locations, Singularities, Jacobian, Trajectory Planning: joint interpolation, task space interpolation, executing user specified tasks, sensor based motion planning: The Bug Algorithm, The Tangent Bug Algorithm, The Incremental Voronoi Graph.

Unit-IV
**Static force analysis** of RP type and RR type planar robots, Dynamic analysis using Lagrangean and Newton-Euler formulations of RR and RP type planar robots, Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, force feedback, hybrid control

Unit-V
**Sensors and controllers:** Internal and external sensors, position, velocity and acceleration sensors, proximity sensors, force sensors, laser range finder. Robot vision: image processing fundamentals for robotic applications, image acquisition and preprocessing. Segmentation and region characterization object recognition by image matching and based on features

Suggested Reading:
FINITE ELEMENT TECHNIQUES

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II
Analysis of trusses and frames: Analysis of plane truss with number of unknowns not exceeding two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node. Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node for beam element.

UNIT-III
Finite element modeling of two dimensional stress analysis problems with constant strain triangles and treatment of boundary conditions. Two dimensional four noded isoparametric elements and numerical integration. Finite element modeling of Axisymmetric solids subjected of axisymmetric loading with triangular elements. Convergence requirements and geometric isotropy.

UNIT-IV
Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional conduction analysis of thin plate.
Analysis of a uniform shaft subjected to torsion using Finite Element Analysis.

UNIT-V

Suggested Reading:
PROGRAMMING METHODOLOGY AND DATA STRUCTURES

Instruction 3 periods / week
Duration of University Examination 3 hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT I
Programming Methodology: Introduction, Algorithm, Data Flow Diagrams, Decision Tree, Decision Table and Life Cycles of Project Development.

UNIT II
Programming in ‘C’: Data types & Memory size, Expressions, Statements, Operators, Control flows, Arrays, Pointers, Structures, Functions, Dynamic Memory Allocation and Simple programs in Mechanical Engineering.

UNIT III
Sorting and Searching Techniques: Selection sort, Quick sort, Radix sort, Heap sort. Linear search, Binary search trees and Applications in Mechanical Engineering.

UNIT IV
Data Structures: Classification of Data Structures, Definitions of Linked Lists, Double Linked Lists, Stacks and Queues. Operations and Implementations of Stack, Queues and Linked List. General and Mechanical Engineering Applications

UNIT V
Advanced Data Structures: Tree, Basic Terminology, Binary Trees, Operations on Binary tree, Tree traversals, Graph, Graph representation Adjacency matrix, Adjacency Lists and Applications.

Suggested Reading:
ME 510

COMPUTER AIDED MODELLING & DESIGN

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Introduction to CAD, Criteria for selection of CAD workstations, Shigle Design Process, Design criteria, Geometric modeling, entities, 2D & 3D Primitives.
2D & 3D Geometric Transformations: Translation, Scaling, Rotation, Reflection and Shearing, concatenation. Graphics standards: GKS IGES, PDES.

UNIT-II
Synthetic curves – Cubic, Bezier, B-Spline, NURBS.

UNIT-III
Surface Modeling: Surface entities, Surface Representation.
Analytic Surface – Plane Surface, Ruled Surface, Surface of Revolution, Tabulated Cylinder.
Synthetic Surface-Cubic, Bezier, B-spline, Coons.

UNIT-IV
Solid Modeling Techniques: Graph Based Model, Boolean Models, Instances, Cell Decomposition & Spatial – Occupancy Enumeration, Boundary Representation (B-rep) & Constructive Solid Geometry (CSG).

UNIT-V
Capabilities of Modeling & Analysis Packages such as solid works, Unigraphics, Ansys, Hypermesh.
Computer Aided Design of mechanical parts and Interference Detection by Motion analysis.

Suggested Reading:

ME 511

OPTIMISATION TECHNIQUES

Instruction 3 Periods/week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT – I
Simulation: Introduction, Types of Simulation, Simulation Models, Monte Carlo Simulation, Random Number, Pseudo Random Number, Mid-Square Method of generating Random Numbers, Application & Limitation, Application of Simulation to Inventory Control and Queuing Problem

UNIT – II
Decision Theory: Introduction, Decision, Decision Making & Decision Theory, Types of Decisions, decision making process, Types of Decision making Environment:
Decision making under certainty – Expected Monetary Value (EMV), Expected Opportunity Loss (EOL) Criterion & Expected Value of Perfect Information (EVPI) Criterion
Decision making under risk - Criterion of Pessimism or Manimax, Criterion of Optimism or Maximin, Minimax Regret Criterion, Criterion of Realism & Criterion of Rationality
Decision making under uncertainty and Decision tree analysis: Introduction, Procedure of Constructing Decision Trees & Solution through Decision Tree Analysis.

UNIT – III

UNIT – IV

UNIT – V
Classical Optimization: Introduction; Unconstrained problems of maxima and minima, constrained problems of maxima and minima; Constraints in the form of equations – Lagrangian method, Constraints in the form of inequalities -Kuhn-tucker conditions.

Suggested Reading:
NEURAL NETWORKS AND FUZZY LOGIC

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Concepts of fuzzy sets: Introduction – Crisps sets, notation of fuzzy sets, basic concepts of fuzzy sets, operation, fuzzy compliment, union, intersection, Binary relation, Equivalence and similarity relations, belief and plausibility measures, probability measures, computability, relations, ordering morphisms, possibility and necessary measures.

UNIT-II
Adaptive fuzzy systems: Neural and Fuzzy intelligence, Fuzziness as multivalent, fuzziness in probabilistic world, randomness verses ambiguity.

UNIT-III

UNIT-IV
Introduction to Neural networks: Knowledge base information processing, general view of knowledge based algorithm, neural information processing, Hybrid intelligence, and artificial neurons.

UNIT-V
Characteristics of artificial Neural Networks: Single Neural Networks, Multi Layer Neural Networks, Training of ANN – objective, supervise training, unsupervised training, overview of training.

Suggested Reading:
ME 513

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Instruction: 3 Periods /Week
Duration of University Examination: 3 Hrs
University Examination: 80 Marks
Sessional: 20 Marks

UNIT-I

UNIT-II
Computer Vision: Perception, early processing, representation and recognition of scenes, Guzman’s algorithms of spurting objects in a scene, Waltz algorithm.

UNIT-III
Neural Language understanding problems, syntactic analysis, semantic analysis, augmented transition networks.

UNIT-IV
Knowledge representation (Logic): Representing facts in logic predicate logic, resolution, unification, question answering, mathematical theorem proving. Knowledge representation (Structured): Declarative representation, Semantic nets, procedural representation.

UNIT-V
Learning: Learning as induction, failure drive learning, learning by teaching, learning through examples (Winston’s program) skill acquisition.

Suggested Reading:
ME 514

MECHANICS OF COMPOSITE MATERIALS

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II
Micromechanics of Composites: Mechanical properties-Prediction of Elastic constant, micromechanical approach, Halpin-Tsai equations, Transverse stresses. Thermal properties-Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

UNIT-III
Macromechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, inter-laminar stresses and edge effects. Simplified composite beam solutions. Bending of laminated beams.

UNIT-IV

UNIT-V

Suggested Reading:
ME 515

MACHINE TOOL DYNAMICS

Instruction: 3 Periods /Week
Duration of University Examination: 3 Hrs
University Examination: 80 Marks
Sessional: 20 Marks

UNIT-I
Vibration theory: Review of systems with one and two degrees of freedom, damped, undamped free and forced vibrations, beat phenomenon. Transmissibility of vibration and vibration isolation. Vibration measurement.

UNIT-II
Dynamics of structures: Force and stiffness methods, Eigen value problem using lumped mass technique, application to simple structures with damping.

UNIT-III

UNIT-IV

UNIT-V

Suggested Reading:
THEORY OF ELASTICITY AND PLASTICITY

Instruction 3 Periods/week
Duration of University Examination 3 Hrs.
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Basic Concepts of Stress: Definition, State of Stress at a point, Stress tensor, invariants of stress tensor, principle stresses, stress ellipsoid; derivation for maximum shear stress and planes of maximum shear stress, octahedral shear stress, Deviatoric and Hydrostatic components of stress, Invariance of Deviatoric stress tensor, plane stress.

UNIT-II
Basic concepts of Strain: Deformation tensor, Strain tensor and rotation tensor; invariants of strain tensor, principle strains, derivation for maximum shear strain and planes of maximum shear strain, octahedral shear strain, Deviatoric and Hydrostatic components of strain tensor, Invariance of Deviatoric strain tensor, plane strain.

UNIT-III
Generalized Hooke’s Law: Stress-strain relationships for an isotropic body for three dimensional stress space, for plane stress and plane strain conditions, differential equations of equilibrium, compatibility equations, Material (D) matrix for Orthotropic Materials.

UNIT-IV

UNIT-V
Analysis methods: Slab method, Slip line field method, uniform deformation energy method, upper and lower bound solutions. Application of Slab method to forging, wire drawing, extrusion and rolling processes.

Suggested Readings:
1. Timoshenko and Goodieer, Theory of Elasticity, Mcgraw Hill Publications 3rd Edition,
2. Madleson, Theory of Plasticity,
EXPERIMENTAL TECHNIQUES AND DATA ANALYSIS

Instruction 3 Periods /Week
Duration of University Examination 3 Hrs
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II
Temperature Measurement: Circuits and instrumentation for different transducers viz, bimetallic, expanding fluid, electrical resistance, thermister, thermocouples, pyrometers.

UNIT-III
Metallurgical Studies: Optical and electron microscopy, X-Ray diffraction, Bragg's Law and its application for studying crystal structure and residual stresses. Electron spectroscopy, electron microprobe.
Surface Measurements: Micro hardness, roughness, accuracy of dimensions and forms. 3-D co-ordinate measuring machines.

UNIT-IV
Experiment design & data analysis: Statistical methods, Randomised block design, Latin and orthogonal squares, factorial design. Replication and randomization.
Data Analysis: Deterministic and random data, uncertainty analysis, tests for significance: Chi-square, student's 't' test. Regression modeling, direct and interaction effects. ANOVA, F-test. Time Series analysis, Autocorrelation and autoregressive modeling.

UNIT-V

Suggested Reading:
4. Box and Jenkins; Time Series analysis, Forecasting and control, Holden Day, Sanfrancisco.
ME 518

ADVANCED METROLOGY

Instruction
Duration of University Examination
University Examination
Sessional

3 Periods /Week
3 Hrs
80 Marks
20 Marks

UNIT-I
End & line standards for length, Airy & Bessel points, desirable features of end standards, slip gauge manufacture, calibration of end standards by interferometry. NPL gauge interferometer, calibration of line standards by micrometer microscope – superposition, coincidence and symmetric straddling, photoelectric microscope and Moir fringe techniques, measurement of large displacements using lasers, calibration of Tomlinson gauges by interferometry. Photoelectric Autocollimator, calibration of polygons & circular scales. Types of interchangeability, dimensional chains.

UNIT-II
Fixed & Indicating Gauges: Taylor’s principles of gauge design, limitations of ring & plug gauges, position and receiver gauges, types of indicating gauges.
Comparators: Multirange Sigma comparator, Back pressure and free flow type pneumatic comparators, Differential back pressure gauge, usage of different types of jets, contact & non contact tooling. Amplification selection. Air to electric transducer, Differential transducer, Variation transducer, Pre process, In-process & Post process gauging, computation & match gauging. Usage of LVDT & Capacitive type gauge heads, Automatic inspection.

UNIT-III

UNIT-IV
Form Errors: Evaluation of straightness & flatness, usage of beam comparator, evaluation of roundness – intrinsic & extrinsic datums. Talyrond. PGC, RGC, MZC & LSC, methods, roundness evaluation for even & odd number of lobes.

UNIT-V
Screw Threads: Measurement of thread elements for internal & external threads, progressive periodic, drunkenness and irregular pitch errors. NPL pitch measuring machine, virtual effective diameter, thread gauging.
Gears: measurement of tooth thickness, involute profile, pitch, concentricity and alignment, rolling gear test.

Suggested Reading:
2. ASTME, Hand Book of Industrial Metrology, Prentice Hall of India Pvt Ltd.
PRODUCT DESIGN AND PROCESS PLANNING

Instruction
3 Periods /Week
Duration of University Examination
3 Hrs
University Examination
80 Marks
Sessional
20 Marks

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

UNIT-V
Role of computer in product design and management of manufacturing, creation of manufacturing data base, Computer Integrated Manufacturing, communication network, production flow analysis, Group Technology, Computer Aided product design and process Planning. Integrating product design, manufacture and production control.

Suggested Reading:
ME 520

RAPID PROTOTYPING PRINCIPLES AND APPLICATIONS

Instruction 3 Periods/Week
Duration of University Examination 3 hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I

UNIT-II


UNIT-III


UNIT-IV

Rapid Prototyping Software's: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT-V

Suggested Reading:
ENGINEERING RESEARCH METHODOLOGY

UNIT-I

Defining the Research Problem: Definition of Research Problem, Problem Formulation, Necessity of Defining the Problem, Technique involved in Defining a Problem.

UNIT-II
Literature Survey: Importance of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT-III

UNIT-IV

Data Analysis: Deterministic and random data, Uncertainty analysis, Tests for significance: Chi-square, student's 't' test, Regression modeling, Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Autocorrelation and Autoregressive modeling.

UNIT-V

Suggested Reading:
1. C.R Kothari, Research Methodology, Methods & Technique; New Age International Publishers, 2004
4. Vijay Upagade and Aravind Shende, Research Methodology, S. Chand & Company Ltd., New Delhi, 2009
FLEXIBLE MANUFACTURING SYSTEMS

Instruction 3 periods/week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Systems Planning: Objective, introduction planning, preparation guidelines, the project team, supplier selection, system description and sizing, facility preparation planning, FMS layouts. Human resources: staff considerations, team work, communication and involvement, the supervisors role, personnel selection, job classifications, employee training.

UNIT-II
Group Technology: Concepts, classification and coding, benefits and relationship to FMS, design of group technology using rank order clustering technique.

UNIT-III
FMS Design – Using Bottleneck, Extended bottleneck models, Processing and Quality Assurance: Turning centres, Machining centre, construction and operations performed, axes, programming, and format information, work-holding and work-changing equipment, automated features and capabilities, cleaning and deburring – station types and operation description, importance to automated manufacturing, coordinate measuring machines, types, construction and general function, operation cycle description, importance to flexible cells and systems.

UNIT-IV
Automated movement and storage systems–AGVs, Robots, automated storage and retrieval systems, storage space design, queuing carousels and automatic work changers, coolant and chip Disposal and recovery systems, auxiliary support equipment, cutting tools and tool Management – introduction, getting control of cutting tools, Tool Management, tool strategies, data transfer, tool monitoring and fault detection, guidelines, work holding considerations, General fixturing, Modular fixturing. FMS and the relationship with workstations – Manual, automated and transfer lines design aspects.

UNIT-V
FMS: computer Hardware, Software, Communications networks and Nanotechnology – general functions, and manufacturing usages, hardware configuration, programmable logic controllers, cell controllers, communications networks. FMS implementation.

Suggested Reading:
NON-TRADITIONAL MACHINING AND FORMING

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Mechanical Process: Ultrasonic Machining-Definition-Mechanism of metal elements of the process- Tool feed mechanism. Theories of mechanics of causing effect of parameter applications.
Abrasive Jet Machining: Principles - parameters of the process, applications, advantages and disadvantages.
Water Jet Machining (WJM): Schematic diagram, equipment used, advantages and applications.

UNIT-II

UNIT-III
Plasma Arc Machining: Introduction-Plasma-Generation of Plasma and equipment Mechanism of metals removal, PAN parameters-process characteristics - type of torches applications.

UNIT-IV
Laser Beam Machining (LBM): Introduction-principle of generation of lasers Equipment and Machining procedure-Types of Lasers-Process characteristics-advantages and limitations-applications
Ion Beam Machining: Introduction-Mechanism of metal removal and associated equipment-process characteristics applications

UNIT-V

REFERENCE BOOKS:
1. New Technology Institution of Engineers - Bhattacharya - India
7. Modern Manufacturing Method - Adithan - New Age International (p) Limited –
ADVANCED NON-DESTRUCTIVE EVALUATION TECHNIQUES

Instruction 3 periods/ week
Duration of University Examination 3 Hours
University Examination 80 Marks
Sessional 20 Marks

UNIT-I
Types of defects and characteristics, Quantification aspects relevant for NDE including fracture aspects and stress intensity factors - NDT overview – quality assurance–visual inspection–comparative features of conventional Nondestructive Testing and Evaluation Methods including Optical, Radiography, Ultrasonic Testing, Dye penetrant testing, Eddy current testing etc.

UNIT-II

UNIT-III
Infrared and thermal testing – imaging systems – detectors – analysis methods.
Ultrasonic testing – generation of ultrasound – methodologies – transducers and equipment used – flaw detection - sensitivity and calibration.

UNIT-IV
Computer aided image processing methods for radiography and ultrasonics, tomography in these areas.
Optical techniques of nondestructive evaluation: Principles of Photoelasticity, holographic Interferometry and Laser speckle techniques; use of fibre optics, noninvasive techniques in medical field and NDT.

UNIT-V
Machine Vision-system components, Sensors, specifications for resolution & range.
Grid and Moire NDT, acoustic, ultrasonic and shearography, Principles of Microwave, acoustic emission techniques and Infrared thermography.

Suggested Reading:
PRODUCTION ENGINEERING LAB

Instruction 3 Periods/week
Sessional 50 Marks

List of Experiments:

1. Study of the morphology of chips produced from different materials and machining processes.
2. Study of cutting ratio/chip thickness ratio in simulated orthogonal cutting with different materials and tool geometry.
3. Study of cutting ratio/chip thickness ratio in simulated orthogonal cutting with different materials and tool geometry.
4. Roughness of machined surface. Influence of tool geometry and feed rate.
5. Study of the construction and operating parameters of metal spinning Lathe.
6. Study of the water hammer equipment and hydrostatic extrusion setup.
7. Extrusion of cylindrical billets through dies of different included angles and exit diameters and their effect on extrusion pressure.
8. Practice and study of blanking and punching process and their characteristic features on mechanical press with existing dies.
9. Experiments on EDM to measure MRR and Surface roughness of different metals.
10. Programming and experiments on CNC milling for different profiles.
11. Programming and experiments on CNC lathe for cylindrical jobs.
12. Experiments on TIG and MIG welding to find out the mechanical properties of metals.
13. Testing of mechanical properties of metals by using UTM.
ME 524

COMPUTATIONAL LABORATORY

Instruction 3 Periods/week
Sessional 50 Marks

List of Experiments:

1. Introduction to Finite Element Analysis Software.
2. Static Analysis of a corner bracket.
3. Statically indeterminate reaction force analysis.
4. Determination of Beam stresses and Deflection.
5. Bending analysis of a Tee-shaped beam.
6. Analysis of cylindrical shell under pressure.
8. Stress analysis in a long cylinder.
9. Solidification of a casting.
10. Transient Heat transfer in an infinite slab.
11. Transient Thermal stress in a cylinder.
12. Vibration analysis of a Simply supported beam.
14. Thermal-Structural contact of two bodies.
15. Drop test of a container (Explicit Dynamics).