JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING, KUKATPALLY, HYDERABAD
M.Tech (Design for Manufacturing)
SCHEME OF INSTRUCTIONS

1st Semester

S. No	Subject & Code	L/T	P/D	Total	Credits
1	Advanced Mechanics of Solids	4	--	4	8
2	Finite Element Analysis	4	--	4	8
3	Materials Technology	4	--	4	8
4	Precision Engineering	4	--	4	8
5	Production Design & Development Strategies	4	--	4	8
6	Elective I	4	--	4	8
7	Manufacturing Simulation & Precision Engg. Lab	--	4	4	4
		24	4	28	52

Electives I:
1. Quality Engineering in Manufacturing
2. Advances in Manufacturing Technology
3. Product Data Management

2nd Semester

S. No	Subject & Code	L/T	P/D	Total	Credits
1	Computer Aided Design	4	--	4	8
2	Performance Modelling and Analysis of Manufacturing Systems	4	--	4	8
		4	--	4	8
3	Design & Manufacturing of MEMS & Microsystems	4	--	4	8
4	Design of Hydraulics & Pneumatic Systems	4	--	4	8
5	Total Quality Management	4	--	4	8
6	Elective II	--	4	4	4
7	Computer Aided Design & Computer Aided Machining Lab				
		24	4	28	52

Elective II:
1. Industrial Robotics
2. Tool design
3. Production and Operations Management

II Year

S. No	Subject & Code	L/T	P/D	Total	Credits
1	Seminar	--	--	--	10
2	Project work	--	--	--	36
			4	28	46

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ADVANCED MECHANICS OF SOLIDS

Unit I

Shear center: Bending axis and shear center-shear center for axi-symmetric and unsymmetrical sections

Unit II

Unsymmetrical bending: Bending stresses in Beams subjected to Nonsymmetrical bending; Deflection of straight beams due to nonsymmetrical bending.

Unit III

Curved beam theory: Winkler Bach formula for circumferential stress – Limitations – Correction factors –Radial stress in curved beams – closed ring subjected to concentrated and uniform loads-stresses in chain links.

Unit IV

Torsion : Torsion of a cylindrical bar of Circular cross Section; Saint-Venant's semi-inverse method; Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section ;Hollow thin wall torsion members ,Multiply connected Cross Section ;Thin wall torsion members with restrained ends.

Unit V

Axi-Symmetric Problems: Rotating Discs- Flat discs , Discs of uniform thickness, Discs of uniform strength; Rotating Cylinders

Unit VI

Theory of Plates: Introduction ;Stress resultants in a flat plate; Kinematics: Strain-Displacement relations for plates; Equilibrium equations for small displacement theory of flat plates ; Stress – Strain – Temperature relation for Isotropic elastic plates; Strain energy of a plate; Boundary conditions for plate; Solution of rectangular plate problem; Solution of circular plate problem.

Unit VII

Beams on Elastic Foundation: General theory; Infinite Beam subjected to Concentrated load: boundary conditions; Infinite beam subjected to a distributed load segment; Semi-infinite beam subjected to a distributed load at its end; Semi-infinite beam with concentrated load near its end; Short Beams.

Unit VIII

Contact stresses: Introduction ;problem of determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area(Line contact), Loads normal to area; Stresses for two bodies in line contact ,Normal and Tangent to contact area.

Textbook:

1.Advanced Mechanics of materials by Boresi & Sidebottom-Wiely International.

References:

1. Advanced strength of materials by Den Hortog J.P.
2. Theory of plates – Timoshenko.
3. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia
4. Strength of materials by Sadhu singh

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FINITE ELEMENT ANALYSIS

UNIT -1:
Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of fem with other methods, variational approach, Galerkin Methods

UNIT -2:
Co-ordinates, basic element shapes, interpolation function. Virtual energy principle, Rayleigh- Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain displacement relations

UNIT -3:
1-D structural problems – axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape function.
Analysis of Trusses – Plane Truss and Space Truss elements.

UNIT -4:
Analysis of beams – Hermite shape functions – stiffness matrix – Load vector – Problems
2-D problems –CST, LST, force terms, Stiffness matrix and load vector, boundary conditions.

UNIT – 5:
Isoparametric element – quadrilateral element, Shape functions – Numerical Integration – sub parametric and superparametric elements.
3-D problems – Tetrahedran element – Jacobian matrix – Stiffness matrix

UNIT -6:
Scalar field problems - 1-D Heat conduction – 1-D fin element – 2-D heat conduction problems – Introduction to Torsional problems.

UNIT -7:
Dynamic considerations, Dynamic equations – consistent mass matrix – Eigen Values, Eigen Vector, natural frequencies – mode shapes – modal analysis.

UNIT – 8:
Non linearity, Introduction, Non linear problems, geometric non linearity, non linear dynamic problems, analytical problems.

TEXT BOOKS:

1. Introduction to finite elements in engineering – Tirupathi K. Chandrupatla and Ashok D. Belagundu.
2. Concepts and applications of finite element analysis – Robert Cook
3. The finite element methods in Engineering – S.S. Rao - Pergamon, New York
4. An Introduction to Finite Element Methods – J. N. Reddy – Mc Graw Hill
5. The Finite element method in engineering science – O.C. Zienkowitz, Mc Graw Hill.
6. Finite Element Procedures in Engineering analysis – K.J Bathe

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MATERIAL TECHNOLOGY

UNIT – I

Elasticity in metals and polymers, mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals, strengthening mechanism, work hardening, solid solution, grain boundary strengthening

UNIT – II

Poly phase mixture, precipitation, particle, fiber and dispersion strengthening, effect of temperature, strain and strain rate on plastic behavior, super plasticity, deformation of non crystalline material.

UNIT – III

Griffth's Theory, stress intensity factor and fracture Toughness, Toughening Mechanisms, Ductile and Brittle transition in steel, High Temperature Fracture, Creep, Larson – Miller Parameter, Deformation and Fracture mechanism maps.

UNIT – IV

Fatigue, Low and High cycle fatigue test, Crack Initiation and Propagation mechanism and Paris Law, Effect of surface and metallurgical parameters on Fatigue, Fracture of non-metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis.

UNIT – V

Motivation for selection, cost basis and service requirements, Selection for Mechanical Properties, Strength, Toughness, Fatigue and Creep.

UNIT – VI

Selection for Surface durability, Corrosion and Wear resistance, Relationship between Materials Selection and Processing, Case studies in Materials Selection with relevance to Aero, Auto, Marine, Machinery and Nuclear Applications.

UNIT – VII

MODERN METALLIC MATERIALS : Dual Phase Steels, Micro alloyed, High Strength Low alloy (HSLA) Steel, Transformation induced plasticity (TRIP) Steel, Maraging Steel, Intermetallics, Ni and Ti Aluminides, Smart Materials, Shape Memory alloys, Metallic Glass, Quasi Crystal and Nano Crystalline Materials.

UNIT – VIII

NONMETALLIC MATERIALS : Polymeric materials and their molecular structures, Production Techniques for Fibers, Foams, Adhesives and Coatings, Structure, Properties and Applications of engineering Polymers, Advanced Structural Ceramics WC, TiC, TaC, Al2 O3 , SiC, Si3 N4 , CBN and Diamond – properties, Processing and applications.

TEXT BOOKS:

1. Mechanical Behaviour of Materials / Thomas H. Courtney / 2nd Edition, McGraw Hill,2000.
2. Mechanical Metallurgy / George E. Dieter / McGraw Hill,1998.

REFERENCES:

Selection and use of Engineering Materials 3e/Charles J.A/ Butterworth Heiremann.

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COLLEGE OF ENGINEERING, KUKATPALLY, HYDERABAD

PRECISION ENGINEERING

UNIT - I: CONCEPTS OF ACCURACY
Introduction – Concept of Accuracy of Machine Tools – Spindle ad 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, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing 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 Transnational and rotational accuracy, Geometric analysis and application.

UNIT - IV: Tolerance Analysis: Process Capability , Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects, Feature Tolerances, Geometric Tolerances.

UNIT - V: Surface finish, Review of relationship between attainable tolerance grades and different machining process. Cumulative effect of tolerances sure fit law, normal law and truncated normal law.

UNIT - VI: 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.

UNIT - VII: FUNDEMENTALS OF NANOTECHNOLOGY: System of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing.

UNIT –VIII: MEASURING SYSTEMS PROCESSING: In processing or in-situ measurement of position of processing point-Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

TEXT BOOKS:

1. Precision Engineering in Manufacturing / murthy R. L., / New Age International(P) limited, 1996.
2. Geometric Dimensioning and Tolerancing / James D.Meadows / Marcel Dekker Inc.1995.

REFERENCE BOOKS:

1. Nano Technology / Norio Taniguchi / Oxford University Press, 1996

Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd, London.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING, KUKATPALLY, HYDERABAD

PRODUCT DESIGN AND DEVELOPMENT STRATEGIES

Unit - I
INTRODUCTION
Nature and scope of product engineering - creative thinking and organizing for product innovation criteria for product success in life cycle of a product.

Unit - II
MODELLING AND SIMULATION
Modeling and simulation - the role of models in product design mathematical modeling similitude relations -weighted property index.

Unit - III
MATERIAL SELECTION
Material selection - problems of material selection-performance characteristics of materials - the materials selection process-economics of materials-cost versus performance relations-weighted property index.

Unit - IV
DESIGN CONSIDERATIONS
Functional and production design-form design-influence of basic design, mechanical loading and material on form design - form design of gray castings, malleable iron castings, aluminum+ castings, pressure die castings, plastic mouldings, welded fabrications, forging and manufacture by machining methods. Influence of space, size, weight, etc., on form design, aesthetic and ergonomic considerations.

Unit -V
TOLERANCE AND ANALYSIS
Dimensioning and tolerancing a product-functional production and inspection datum-tolerance analysis.

Text Books:

1. *Dieter, G.E., "Engineering Design", McGraw Hill, 1983.*
2. *Orlov,P.,"MachineDesign",Vol 1,2 and 3,Mir Publishers,1976*

REFERENCES:

1. Jones J.C., "Design Methods", Interscience, 1970.
2. Buhl, H.R., "Creative Engineering Design", Iowa State University Press, 1960.
3. Robert Matouseek, "Engineering Design", Blackie & Sons Ltd., 1963.
4. Niebel, B.W. & Draper, A.B., "Product Design and Process Engineering, McGraw Hill, 1974.
5. Harry Peck, "Designing for Manufacturing", Sir Issac Pitman and Sons Ltd., 1973.
6. Gladman, C.A., "Manual for Geometric Analysis of Engineering Designs", Austrlian Trade Publications Ltd.,
7. Wade, Or., "Tolerance Control in Design and Manufacture", Industrial Press, Inc.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING, KUKATPALLY, HYDERABAD

QUALITY ENGINEERING IN MANUFACTURING
(Elective)

UNIT - I:
Quality Value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design of production processes.

UNIT - II:
Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type,S-type and L-type)

UNIT - III:
Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type, L-type and S-type characteristics, tolerance allocation for multiple components.

UNIT - IV:
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 - V:
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 - VI:
Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment.

UNIT - VII:
Interpolation of Experimental Results: Interpretation methods, percent contribution, estimating the mean.

UNIT - VIII:
ISD-9000 Quality System, BDRE, 6-sigma, Bench making, Quality circles – Brain Storming – Fishbone diagram – problem analysis.

TEXT BOOKS:

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 Ind. Pvt. Ltd., New Delhi.

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ADVANCES IN MANUFACTURING TECHNOLOGY
(Elective)

Unit - I

Casting Design: Solidification of pure metals and alloys, shrinkage in cast alloys, design of sprue, runner, gate and risers.

Unit – II

Casting testing methods: Casting defects and remedies, destructive and non-destructive testing of castings, modernization and mechanization of foundry.

Unit - III

Machining methods: Orthogonal and Oblique cutting, Merchant's circle diagram, theories of machining, estimation of cutting tool life. Broaching, Lapping, Honing, Burnishing and super finishing.

Unit – IV

Unconventional machining methods: Principles and applications of Ultrasonic Machining, Electro Chemical Machining, Electro Discharge Machining, Abrasive jet Machining, Electro Beam Machining, Laser Beam Machining, and Plasma Machining.

Unit - V

Rapid Prototyping: Working principle, methods-Steriolithography, Laser sintering, Fused deposition method, applications and limitations.

Text Books:

1. Manufacturing Technology - P. N. Rao, TMH Publishers
2. Manufacturing Metallurgy - Dieter, Mc Graw Hill Publishers
3. Production Technology - R. K. Jain, Khanna Publishres

References:

1.Production Technology - HMT
2.Manufacturing Science - Cambel
3.Welding Technology - R. Little, TMH Publishers

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
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PRODUCT DATA MANAGEMENT
(Elective)

UNIT - I: INTRODUCTION: Need for IPPD – strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and costumer – behavior analysis

UNIT - II: Understanding customer-promoting promoting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specification.

UNIT - III: CONCEPT GENERATION AND SELECTION: Task – Structured approaches – Clarification – Search – Externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT - III: PRODUCT ARCHITECTURE : Implications – Product change – variety – component standardization – product performance – manufacturability

UNIT - IV: PRODUCT DEVELOPMENT MANAGEMENT – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.

UNIT – V: INDUSTRIAL DESIGN : Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process

UNIT – VI: Investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT – VII: DESIGN FOR MANUFACTURING AND PRODUCY DEVELOPMENT
Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimiza system complexity

UNIT – VIII: Prototype basics – Principles of prototyping – planning for prototypes – Economic analysis – Understanding and representing tasks – baseline project planning – accelerating the project execution.

TEXT BOOKS:

1. Product Design and Development / Kari T. Ulrich and Steven D. Eppinger /McGraw Hill International Edns. 1999.
2. Concurrent Engg/ integrated Product development / Kemnneth Crow / DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310)377-569, Workshop Book.
3. Effective Product Design and Development / Stephen Rosenthal / Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4.
4. Tool Design – Integrated Methodds for Successful Product Engineering / Staurt Pugh / Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5.

WEB REFERENCES:

http:// www. me.mit/2.7444

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING, KUKATPALLY, HYDERABAD

MANUFACTURING SIMULATION & PRECISION ENGINEERING LABORATORY

MANUFACTURING SIMULATION

The students will be given training on the use and application of the following software to Manufacturing problems :

1) Auto MOD Software,
2) PROMOD
3) SLAM-II
4) CAFIMS
5) Flexsim

They also learn how to write sub routines in C-language and interlinking with the above packages.

Problems for modelling and simulation experiments:

1) AGV planning
2) ASRS simulation and performance evaluation
3) Machines, AGVs and AS/RS integrated problems
4) JIT system
5) Kanban flow
6) Material handling systems
7) M.R.P. Problems
8) Shop floor scheduling etc.

PRECISION ENGINEERING

1. Hydraulic and Pneumatic circuits
2. Closed loop control systems
3. Study of the chip formation in turning process
4. Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder
5. Determination of cutting forces in turning
6. Experiments in unconventional manufacturing processes- AJM and study of USM, EDM**,** Laser Machining and Plasma spraying
7. Inspection of parts using tool makers microscope, roughness and form tester
8. Study of micro-controllers, programming on various CNC machine tools and also controllers
9. Studies on PLC programming
10. Study and programming of robots
11. Condition monitoring in machining processes using acoustic emission.

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COMPUTER AIDED DESIGN

UNIT - I:

CAD TOOLS: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, software documentation, efficient use of CAD software.

UNIT - II:

GEOMETRICMODELLING: Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves her mite cubic splines Bezier curves B-splines rational curves

UNIT - III:

SURFACE MODELING :Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.

UNIT - IV:

PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES – Hermite Bi-cubic surface, Bezier surface, B- Spline surface, COONs surface, Blending surface , Sculptured surface, Surface manipulation – Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

UNIT - V:

GEOMETRICMODELLING-3D : Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG).

UNIT - VI:

CAD/CAM Exchange : Evaluation of data – exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF.

UNIT - VII:

Design Applications : Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly.

UNIT – VIII:

Collaborative Engineering: Collaborative Design, Principles, Approaches, Tools, Design Systems.

TEXT BOOKS:

1. CAD/CAM Theory and Practice / Ibrhim Zeid / Mc Graw Hill international.

REFERENCE BOOKS :

1. Mastering CAD/CAM / Ibrhim Zeid / Mc Graw Hill international.
2. CAD/CAM / P.N.Rao / TMH.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING, KUKATPALLY, HYDERABAD

PERFORMANCE MODELLING AND ANALYSIS OF MANUFACTURING SYSTEMS

Unit – I :
MANUFACTURING SYSTEMS & CONTROL
Automated Manufacturing Systems - Modelling - Role of performance modelling - simulation models-Analytical models.
Product cycle - Manufacturing automation - Economics of scale and scope - input/output model - plant configurations.
Performance measures - Manufacturing lead time - Work in process -Machine utilization - Throughput -Capacity - Flexibility - Performability – Quality Control Systems - Control system architecture - Factory communications - Local area networks - Factory net works - Open systems interconnection model - Net work to network interconnections - Manufacturing automation protocol - Database management system.

Unit – II:
MANUFACTURING PROCESSES
Examples of stochastic processes - Poisson process
Discrete time Markov chain models - Definition and notation - Sojourn times in states - Examples of DTMCs in manufacturing - Chapman - Kolmogorov equation - Steady-state analysis.
Continuous Time Markov Chain Models - Definitions and notation - Sojourn times in states - examples of CTMCs in manufacturing - Equations for CTMC evolution - Markov model of a transfer line.
Birth and Death Processes in Manufacturing - Steady state analysis of BD Processes - Typical BD processes in manufacturing.

Unit – III:
QUEUING MODEL
Notation for queues - Examples of queues in manufacturing systems - Performance measures - Little's result -Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns -Analysis of a flexible machine center.

Unit – IV:
QUEUING NETWORKS
Examples of QN models in manufacturing - Little's law in queuing networks - Tandem queue - An open queuing network with feed back - An open central server model for FMS - Closed transfer line - Closed server model - Garden Newell networks.

Unit – V:

PETRINETS

Classical Petri Nets - Definitions - Tansition firing and reachability - Representational power - properties -Manufacturing models.

Stochastic Petri Nets - Exponential timed Petri Nets - Generalized Stochastic Petri Nets - modelling of KANBAN systems - Manufacturing models.

Text Books

1. Viswanadham, N and Narahari, Y. "Performance Modelling of Automated Manufacturing Systems", Prentice Hall of India, New Delhi, 1994.

REFERENCES:

1. Trivedi, K.S., "Probability and Statistics with Reliability, Queuing and Computer Science Applications", Prentice Hall, New Jersey, 1982.

2. Gupta S.C., & Kapoor V.K., "Fundamentals of Mathematical Statistics", 3rd Edition, Sultan Chand and Sons, New Delhi, 1988.

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DESIGN & MANUFACTURE OF MEMS & MICROSYSTEMS

Unit – I:
Overview and working principles of MEMS and Microsystems
MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & Miniaturization, Applications of MEMS in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics.

Unit – II:
Engineering Science for Microsystems Design and Fabrication
Atomic structure of Matter, Ions and Ionization, Molecular Theory of Mater and Intermolecular Forces, Doping of Semiconductors, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics

Unit – III:
Engineering Mechanics for Microsystems Design
Static Bending of Thin Plates, Mechanical Vibration, Thermo mechanics Fracture Mechanics, Thin-Film Mechanics, Overview of Finite Element Stress Analysis

Unit –IV:
Thermo Fluid Engineering & Microsystems Design
Overview of Basics of Fluid Mechanics in Macro and Mesoscales, Basic equations in Continuum Fluid Dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Micro conduits, Fluid Flow in Sub micrometer and Nanoscale, Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design Mechanical Design, Mechanical Design using FEM, Design of a Silicon Die for a Micro pressure Sensor

Unit – V:
Materials for MEMS & Microsystems and their fabrication
Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon Compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz , Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation, Chemical and physical vapor deposition, Etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process.

TEXT BOOK:

1. Tai –Ran Hsu, MEMs & Microsystems: Design & Manufacture, Tata Mc-Graw Hill,.ed., 2002.

REFERENCES:

1. Maluf, M., *"An Introduction to Microelectromechanical Systems Engineering",* Artech House, Boston, 2000.
2. Trimmer, W.S.N., " *Micro robots and Micromechanical Systems'",* Sensors & Actuators , vol. 19, no. 1989.
3. Trim, D.W., *"Applied Partial Differential Equations'",* PWS-Kent Publishing, Boston, 1990.
4. Madou, *M." Fundamentals of Microfabriaction",* CRC Press, Boca Raton, 1997.
5. Hsu, T.R., *"The Finite Element Method in Thermomechanics",* Alien & Unwin, London, 1986.

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DESIGN OF HYDRAULIC & PNEUMATIC SYSTEMS

Unit - I: Oil hydraulic systems Hydraulic pumps, types and construction details, sizing and selection.

Direction control valves, flow and pressure control valves.

Unit – II: Linear actuators types Piston rod design sizing and selection, Rotary actuators, hydraulic reservoir accumulators

Unit - III: Design of hydraulic circuits, seals and packings hydraulic servo techniques, cylinders and air motors

Unit – IV: Sequencing and synchronizing circuits, accumulator, low cost automation circuits, accumulators
Hydro pneumatic circuits principles of pneumatic circuit design.

Unit – V: Maintenance and trouble shooting of hydraulic and pneumatic circuits and components
PLC Automation and use of Microprocessors.

References:-

S.R. Majumdar, “Oil Hydraulic Systems,” Tata Mc. Graw Hill

S.R. Majumdar, “ Pneumatic systems, principles and maintenance”, / Tata Mc. GrawHill

Andrew Darr., “Hydraulics and pneumatics”, Jaico Publishing Hoise.

Antony Espossito,” Fluid power with applications”, Prentice Hall.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING, KUKATPALLY, HYDERABAD

TOTAL QUALITY MANAGEMENT

UNIT – I:

Introduction: The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems.

UNIT – II:

Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT – III:

Customer Focus and Satisfaction: Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.

UNIT – IV:

Bench Marketing: Evolution of Bench Marketing, meaning of bench marketing, benefits of bench marketing, the bench marketing process, pitfalls of bench marketing.

UNIT – V:

Organizing for TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles.

UNIT – VI:

Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

UNIT – VII:

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

UNIT – VIII:

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

Reference Books:

1. "Total Quality Management" by Joel E.Ross.
2. "Beyond TQM" by Robert L.Flood.
3. "Statistical Quality Control" by E.L. Grant.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
COLLEGE OF ENGINEERING, KUKATPALLY, HYDERABAD

INDUSTRIAL ROBOTICS
(Elective)

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.

UNIT – II:
CONTROL SYSTEM AND COMPONENTS: basic concept and modals controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

UNIT – III:
MOTION ANALYSIS AND CONTROL: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

UNIT – IV:
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, uses sensors in robotics.

UNIT – V:
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 – VI:
ROBOT PROGRAMMING: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINGNAL AND DELAY commands, Branching capabilities and Limitations.
ROBOT LANGUAGES: Textual robot languages, Generation, Robot language structures, Elements in function.

UNIT – VII:
ROBOT CELL DESGIN AND CONTROL: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, Work and control, Inter locks, Error detection, Work cell controller.

UNIT – VIII:

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.

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TOOL DESIGN
(Elective)

Unit – I: TOOL MATERIALS
Prosperities of materials; Tool steels, Cast Iron, Mild or low carbon steels, Non metallic and nonferrous materials, Heat treating

Unit – II: DESIGN OF CUTTING TOOLS
Single point cutting tools; Milling cutters, Drills, Selection of carbide steels-Determination of shank size for single point carbide tools, Determining the insert thickness for carbide tools

Unit – III: DESIGN OF JIGS AND FIXTURES
Basic principles of location and clamping; Locating methods and devices. Jigs-Definition, Types, General considerations in the design of Drill jigs, Drill bushing, Methods of Construction. Fixtures-Vice fixtures, Milling, Boring Lathe Grinding fixtures.

Unit – IV: DESIGN OF SHEET METAL BLANKING AND PIERCING DIES
Fundamentals of Die cutting operations, Power press types, General press information, Material Handling equipment. Cutting action in Punch and die operations. Die clearance, Types of Die construction. Die design fundamentals-Blanking and piercing die construction, pilots, stripper and pressure pads presswork material, Strip layout, Short run tooling for piercing.

Unit – V:
DESIGN OF SHEET METAL BENDING, FORMING AND DRAWING DIES
Bending dies, Drawing dies, Forming dies, Drawing operations, Variables that effect metal flow during drawing. Determination of blank size, Drawing force, Single and double action draw dies.

Text Books:

1. *Donaldson " Tool Design", Tata Mc Graw Hill*
2. *George E Dieter " Mechanical Metallurgy" Tata Mc. Graw Hill*

REFERENCES:

1. Taylour Altan, Sool Ik-Oh and Harold L. Gegel - " Americal Society for Metals ", 1983.
2.. Kurt Lange, " Hand Book of Metal forming", McGraw-Hil,. 1987

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PRODUCTION AND OPERATIONS MANAGEMENT
(Elective)

UNIT - I:
Facility Location Planning: Need, general procedure, facility location models, behavioral impact in facility location. Layout Planning: Layout concepts, developing the process layout-models and behavior:

UNIT - II :
Developing the product layout – Assembly line models and behavior, comparative approaches to repetitive manufacturing.

UNIT - III :
Production and Operation Management: Contemporary operations, management topics, Technology and mechanization, operations analysis,

UNIT - IV:
Management information systems – Structure, Applications, Operating Capacity: Capacity planning environment, capacity modeling, managing capacity change, considerations.

UNIT - V:
Job Design, Productive/ Operations Standards and Work Management: Job design, effective job design, combining engineering and behavioral approaches, production and operations standards, work measurement

UNIT - VI:
Project Planning and Scheduling: Project planning, project scheduling, models, GANTT Charts, Program evaluation and review technique, CPM, PDM, managing the project.

UNIT - VII:
Material Requirement Planning: Planning for materials needs, role of MRP in the operations scheduling system, detailed capacity planning, limitations and advantages of

UNIT - VIII :
MRP.Value Engineering: Introduction, criteria used to evaluate value, function and its role in achieving value, graphical function analysis, techniques of value engineering.

TEXT BOOKS:

1. Production and Operations Management / Buffa.
2. Opearations management, Theory and Problems / Joseph G. Monks.
3. Production and Operations Management / Chary.
4. Industrial Engineering and Management / Dr. Ravishankar / GALGOTIA

REFERENCES:

1. Production and Operations Management / Everette E.Adam, Jr & Ronald J. Embert
2. Production & Operations Management / R.Pannerselvam / PHI
3. Wiest , J.D. & F.K. Levy, Management guide to PERT / CPM with GERT/PDM/DCPM and other networks, PHI.
4. Production & Operations Analysis / Steven Nahmias / Mc. Graw Hill.
5. Analysis of Inventory Systems / Hadley, G. J. & T.M. Whitin / PHI.

Production & Operation Management / Chase et al / Mc. Graw Hill

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CAD / CAM LABORATORY

CAD

Exercises will be given on Modelling of mechanical Components using packages like Auto CAD, Iron CAD , PRO-E, Unigraphics, Catia, Ansys etc.

1 Creation of working drawings of components and preparation of assembly models of screw jack, leaf jig, plummer block, lathe chuck, machine-vice, box type drilling jig assembly etc. by using the following techniques.
Generation of surfaces of revolution.
Generation of surfaces of extrusion
Generation of surfaces by skinning operation.
Generation of solid models using constructive solid geometry, methods- shading and rendering.
2 Generation of Ferguson's cubic surface patches, Generation of Bezier UNISURF surface patches, Generation of Coon's patches.
3 Finite element modeling of two dimensional problems in heat transfer, plane elasticity, viscous fluid flow, etc.,
4 Finite element analysis of time dependent problems in incompressible viscous fluid flow, heat transfer, plane elasticity, etc.,
5 Familiarization of available artificial intelligence interpreters and compilers.
6 Familiarization with file inquiry, access to data sorting & indexing
7 Exercises in database management, Familiarization with multiple file operations and preparation of various reports with respect to CIM.

CAM

Exercises will be given on Modelling & Simulation of mechanical Components and their machining using packages like Master CAM, UG CAM, GIBBS CAM & Edge CAM and their interface with turning / Milling / Machining Centres .

1 Practice in part programme and operation of a turning center.
2 Diagnosis and trouble shooting in CNC machine.
3 Practice in part programming and operations of a machining center.
4 Tool planning and selection for machining center/turning center.
5 Programming using CAD based software.
6 Practice in APT based NC programming languages.
7 Practice in robot programming and its languages
8 Preparation of various reports and route sheets.
9 Simulation of a manufacturing system.