JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
Course Structure and syllabi for
M.Tech-ME-Production Engineering
Offered by Department of Mechanical Engineering
for affiliated Engineering Colleges 2017-18

I YEAR - I Semester

S. No	Course Code	Subjects	L	T	P	C
1	17D94101	Theory of Metal Cutting & Tool Design	4	-	-	4
2	17D94102	Advanced Welding Technology	4	-	-	4
3	17D04201	Advanced Optimization Techniques	4	-	-	4
4	17D15104	Materials Technology	4	-	-	4
5	 17D90102 17D94103 17D04103	Elective-I a Quality Engineering b Mechatronics c Advances In Manufacturing Technology	4	-	-	4
6	 17D90204 17D94105 17D04208	Elective-II a. Friction and Wear in Machinery b. Nanotechnology c. Rapid Prototyping	-	-	-	4
7	17D94106	Production Engineering Lab	-	-	3	2
Total			24	-	3	26

I YEAR II Semester

S. No	Course Code	Subject	L	T	P	C
1	17D94201	Machine Tool Design	4	-	-	4
2	17D87201	Simulation & Modeling of Manufacturing Systems	4	-	-	4
3	17D87101	Automation in Manufacturing	4	-	-	4
4	17D90203	Advanced Metal forming	4	-	-	4
5	 17D94202 17D04205 17D94203	Elective-III a. Advanced Casting Technology b. Computer Graphics c. Measurement Systems	4	-	-	4
6	 17D87205 17D04209 17D94204	Elective-IV a. Design and Manufacturing of MEMS and MICRO systems b. Artificial Intelligence & Expert Systems c. Machine Tool Dynamics	4	-	-	4
7	17D11211	Manufacturing Simulation Lab	-	-	3	2
Total			24	-	3	26

III SEMESTER

S.No	Subject Code	Subject	L	T	P	C
1.	17D20301 17D20302 17D20303	Elective V a) Research Methodology b) Human Values and Professional Ethics c) Intellectual Property Rights	4	-	-	4
2.	17D94301	Elective VI (MOOCS)	-	-	-	-
3.	17D94302	Comprehensive Viva – Voice	-	-	-	2
4.	17D94303	Seminar	-	-	-	2
5.	17D94304	Teaching Assignment	-	-	-	2
6.	17D94305	Project work phase – I	-	-	-	4

IV SEMESTER

S.No	Subject Code	Subject	L	T	P	C
1.	17D94401	Project work Phase – II	-	-	-	12

Project Viva Voce Grades:

A: Satisfactory

B: Not Satisfactory

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M. Tech – I year I Sem. (PE)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D94101) THEORY OF METAL CUTTING AND TOOL DESIGN

Course objectives:

1. The course provides students with fundamental knowledge and principles in material removal processes.
2. In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, Computer Numerical Control etc.
3. To demonstrate the fundamentals of machining processes and machine tools.
4. To develop knowledge and importance of metal cutting parameters.
5. To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
6. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes

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 tools throwaway inserts.

Cutting tool Materials: Carbon and Medium alloy steels, High Speed steels, Cast-Cobalt alloys, Carbides, Coated tools, Alumina based ceramics, Carbon boron Nitride, SNB Ceramics, Whisker-Reinforced tool materials.

UNIT -III

Multipoint Cutting Tools: Drill geometry, design of drills, Rake and Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, end and face milling cutters, cutting speed and feed – machining time – design - form 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 of Tool angle.

Cutting Temperature: Types of cutting fluids, 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.

UNIT -V

Tool Design: Determination of shank size for single point carbide tools, Determining the insert thickness for carbide tools.

Design of jigs and fixtures: Basic principles of location and clamping; Locating methods and devices. Jigs- Definition, Types. General consideration in the design of Drill jigs, Drill bushing, Methods of construction. Fixtures- Vice fixtures, Milling, Boring, Lathe Grinding fixtures**.**

Course Outcomes:

1. Students will be able to analyze cutting forces in turning, drilling and milling
2. Students will be able to adjust varies parameters and reduce temperature developed during machining
3. Students will be able to reduce the cost of machinery
4. Students will be able to prevent failures of cutting tool.

TEXT BOOKS:

1. Metal Cutting Principles , M C Shaw , Oxford and IBH Publications, New Delhi,1969
2. Fundamentals of Machining , Boothryd , Edward Amold publishers Ltd. 1975

REFERENCE BOOKS:

1. Fundamentals of Metal cutting and Machine tools , B.L.Juneja, G. S. Sekhom and Nitin Seth , New Age International publishers
2. Tool Engineering, G.R.Nagpal, Khanna Publishers

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M. Tech – I year I Sem. (PE)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D94102) ADVANCED WELDING TECHNOLOGY

Course Objective:

To impart knowledge about welding behaviour of machine and process during welding, analysis of common and newer welding techniques and metallurgical and weldability aspects of different common engineering materials.

Unit I:-

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

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.

Unit II:-

Friction and friction stir welding: Details of process and process parameters, specific applications.

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, flame cutting plasma arc welding, laser assisted cutting.

Unit III:-

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. Join design, analysis of fracture and fatigue of welded joints. Automated welding systems.

Unit IV:-

Physics of welding arc - characteristics of arc and mode of metal transfer, welding fluxes and coatings - type and classification; electrode codes and their critical evaluation; welding machine characteristics - conventional and pulsed power sources, inverter type determination of preheat temperature, use of Schaefflers diagram, weldability tests,

Unit V:-

NDT methods for welds-visual inspection methods, magnetic particle inspection method, Dye penetration method,- Eddy current testing and acoustic emission methods, ultrasonic inspection method, Radiographic method. Analysis of welding defects-types, causes and remedies.

Course Outcomes:

- Deeper knowledge of materials technology of welding
- Deeper knowledge of different metals and their properties in welded constructions
- Knowledge of quality techniques at production by welding
- Knowledge of current computer systems and cost for welding operations
- Knowledge of applications of strength of materials on welded constructions
- Knowledge of applications of fracture mechanics on welded constructions, pressure vessels etc.

TEXT BOOKS:

1. Richard L Little, "Welding and Welding Technology" Tata McGraw Hill, 2004.
2. Welding Engineering and Technology,R. S. Parmar, Khanna Publishers, 2010

REFERENCE BOOKS:

1. Larry Jeffus, "Welding Principles and Applications" Delmar Publishers, 2004
2. Klas Weman, "Welding Processes Handbook",2003
3. Howard B Cary, "Modern Welding Technology" Prentice Hall, 2002
4. Larry Jeffus, "Welding for Collision Repair, "Delmar Publishers, 1999

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M. Tech – I year I Sem. (PE)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D04201) ADVANCED OPTIMIZATION TECHNIQUES

Course Objectives:

The general objectives of the course is

1. To introduce the fundamental concepts of Optimization Techniques;
2. To make the learners aware of the importance of optimizations in real scenarios;
3. To provide the concepts of various classical and modern methods of for constrained and unconstrained problems in both single and multivariable.

UNIT - I

Integer programming- cutting plane method and branch and bound technique, mixed integer programming

UNIT - II

Classical optimization techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method.

UNIT - III

Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, solving differential equations using GP.

UNIT – IV

Multi-Objective Decision making: Introduction to goal programming , Non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems . Introduction to Analytical hierarchical process, analytical network process.

UNIT V

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

Course Outcomes:

Upon successful completion of this course, students will be able to

1. Formulate optimization problems;

2. Understand and apply the concept of optimality criteria for various type of optimization problems;

3. Solve various constrained and unconstrained problems in single variable as well as multivariable;

4. Apply the methods of optimization in real life situation.

Text Books:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S.Rao, New Age Publishers
4. Operation Research by Hamdy A. Taha, Pearson publications

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
2. Genetic Programming- Koza
3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

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(17D15104) MATERIALS TECHNOLOGY

Course Objectives:

1. Able to understand the concept of materials i.e., conventional materials such as metallic and nonmetallic materials with their structures and applications
2. Explain the differences in properties of different materials, including metals, alloys, ceramics, polymers and composites
3. Relate the properties of materials to microstructure (quantitative skills)
4. Describe the basics of processing techniques for altering the microstructure and properties of different materials.

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

UNIT – II:

Griffth's Theory of brittle fracture 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. Simple problems.

UNIT – III:

Fatigue, Low and High cycle fatigue test, Crack Initiation and Propagation mechanism and Paris Law, Effect of surface and metallurgical parameters on Fatigue, effect of creep on fatigue. Fracture of non-metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis. Selection for Surface durability, Corrosion and Wear resistance, Relationship between Materials Selection and Processing

UNIT – IV:

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. Metal-Matrix composites

UNIT-V

Nonmetallic Materials: Polymeric materials and their molecular structures, Production Techniques for Fibers, Foams, Adhesives and Coatings, Structure, Properties and Applications of engineering Polymers. Advanced structure of ceramics –WC, TiC, Al_2O_3, SiC, CBN and diamond- properties and applications, Composite Materials.

Course Outcomes:

1. Students are capable to define the concept of materials i.e., conventional materials with their structure, such as electronic configuration, structure of atom, etc.
2. Students become aware of different conventional materials such as metallic and nonmetallic materials, structures and their applications.
3. Students will be able to demonstrate the need for newer materials by comparing the limitations of conventional materials.
4. They will be able to compare the types of newer materials along with their properties and applications.
5. They will be able to compile about the properties, structure of ceramic materials and their need for newer applications and processing techniques

TEXT BOOKS:

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

REFERENCE BOOK:

1. Selection and use of Engineering Materials,Charles J.A, Butterworth Heiremann

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	4	**0**	**0**	**4**

(17D90102) QUALITY ENGINEERING

Elective-I

Course Objectives:
To impart knowledge about the significance of quality and the various tools/ concepts of building quality into products.
To learn the techniques used for quality control and quality improvement.

UNIT-I
Quality value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design production processes.
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-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, Introduction to tolerance design, tolerance design using the Taguchi loss function, identification of tolerance design factors.

UNIT- III
Design of Experiments: Introduction, Task aids and Responsibilities for DOE process steps, DOE process steps description.
Analysis of variance (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, conducting and analyzing an experiment.
Interpolation of experimental results: Interpretation methods, percent contribution, estimating the mean

UNIT-V
ISO-9000 Quality system, BDRE, Quality improvement Techniques, 6-sigma, bench marking, quality circles-brain storming-fishbone diagram-problem analysis.

Course Outcomes:

The student will be able to:

1. Apply the tools and techniques of quality to resolve industrial engineering issues.
2. Estimate the obvious and hidden quality costs for a given production system.
3. Apply a system based approach for quality management.

TEXT BOOKS:

1. Taguchi techniques for quality engineering/Philip J.Ross / McGraw Hill Intl. 2nd Edition, 1995.
2. Total Quality Management by Dale H. Besterfield, Glen Besterfield

REFERENCES:

1. Quality Engineering in Production systems/G.Taguchi, A.Elasayed 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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L	T	P	C
4	0	0	4

(17D94103) MECHATRONICS

Elective-I

Course Objectives:

1) To develop an ability to identify, formulate, and solve engineering problems.
2) To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
3) To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

UNIT- I

Introducing Mechatronics- Examples of Mechatronic System-Sensors and transducers-performance terminology-Displacement, Position and proximity-velocity and motion-Force-Fluid pressure-Liquid flow-Liquid level-temperature-Light sensors-Selection of sensors-Signal conditioning-The operational amplifier-Protection-Filtering-Wheatstone bridge-Pulse modulation- Digital signals- Analogue and digital signals- Digital-to-analogue and analogue-to-digital converters-Multiplexers- Data acquisition-Digital Signal Processing – digital logic – Logic Gates- Applications of logic gates-Sequential logic.

UNIT-II

Data Presentation Systems-Displays, Data Presentation Elements-Magnetic recording –Optical Recording –Displays, Data acquisition systems-Measurement systems-Testing and calibration-Actuation systems- Pneumatic and Hydraulic systems –rotary actuators- Mechanical systems-Electrical systems- D.C. motors- A.C. motors- Stepper motors**.**

UNIT-III

Basic system models-Mathematical models- Mechanical system building blocks- Electrical system building blocks- Fluid system building blocks- Thermal system building blocks-Rotational–translational systems- Electro-mechanical systems- Linearity- Hydraulic–mechanical systems.

UNIT-IV

System transfer functions-objectives- The transfer function- First-order systems- Second-order systems- Systems in series-Systems with feedback loops- Effect of pole location on transient response- Sinusoidal input- Phasors- Frequency response- Bode plots- Performance specifications.

UNIT-V

Closed-loop controllers-Continuous and discrete control processes- Terminology- Two-step mode- Proportional mode- Derivative control- Integral control- PID controller- Digital controllers- Control system performance- Controller tuning- Velocity control- Adaptive control.

Course Outcomes:

1. Be able to model and analyze electrical and mechanical systems and their interconnection.
2. Be able to integrate mechanical, electronics, control and computer engineering in the design of mechatronics systems.
3. Be able to do the complete design, building, interfacing and actuation of a mechatronic system for a set of specifications.

Text Books

Mechatronics by W. Bolton

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	4	**0**	**0**	**4**

(17D04103) ADVANCES IN MANUFACTURING TECHNOLOGY

Course Objectives:

This subject provides students with

1. Machining principles and processes in the manufacturing of precision components and products that use conventional, nonconventional, and surface engineering technologies;

2. A basic understanding of the machining capabilities, limitations, and productivity of advanced manufacturing processes.

Unit - I

Surface Processing Operations: Plating and Related Processes, Conversion Coatings, Physical Vapour Deposition, Chemical Vapour Deposition, Organic Coatings, Porcelain Enamelling and other Ceramic coatings, Thermal and Mechanical Coating Processes.

Unit - II

Un-conventional Machining Methods

Abrasive jet machining - Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent developments. Ultrasonic machining: Elements of the process, machining parameters, effect of parameters on surface finish and metal removal rate, mechanics of metal removal process parameters, economic considerations, applications and limitations.

UNIT- III

Electro-Chemical Processes: Fundamentals of electro chemical machining, metal removal rate in ECM, Tool design, Surface finish and accuracy economics aspects of ECM.

Wire EDM Process: General Principle and applications of Wire EDM, Mechanics of metal removal, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy.

UNIT - IV

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, principle, advantages, limitations, comparison of thermal and non-thermal processes.

Plasma Arc Machining: Principle, machining parameters, effect of machining parameters on surface finish and metal removal rate, applications, limitations

Unit - V

Laser Beam Machining: Principle, effect of machining parameters on surface finish, applications, and limitations.

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

Course Outcomes:

Upon completion of the subject, students will be able to:

1. Apply the working principles and processing characteristics of ultra-precision machining, high-speed machining methods, and nontraditional machining to the production of precision components.
2. Determine the quality and surface integrity of products treated by surface engineering processes.
3. Determine the formability of a given material and geometric combination using fine-blanking processes.
4. Prescribe a laser materials processing technique suitable for a given product with material, size, precision, and surface quality requirements.

TEXT BOOKS:

1. Manufacturing Technology - P. N. Rao, TMH Publishers
2. Fundamentals of Modern Manufacturing, Mikell P. Groover, John Wiley & Sons Publishers

REFERENCES:

1. Production Technology - HMT
2. Manufacturing Science - Cambel
3. Welding Technology - R.S, Parmar,
4. Introduction to Nanotechnology - Poole and Owens, Wiley (2003).

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	4	**0**	**0**	**4**

(17D90204) FRICTION AND WEAR IN MACHINERY

Elective II

Course Objectives:

1. To develop an understanding on the principles and engineering significance of tribology.
2. It highlights the tribological considerations for the design of various machine elements.

UNIT–I

Introduction to Tribology- History of Tribology, interdisciplinary approach- economic benefits

UNIT-II

Friction causes of friction- Adhesion Theory- abrasive theory- Junction growth theory- Laws of rolling friction – Friction instability

UNIT-III

Wear- Wear mechanisms- Adhesive wear- Corrosive wear- abrasive wear- Fretting wear- wear analysis

Unit-IV

Lubricants and lubrication- Importance to lubrication- Boundary lubrication- mixed lubrication- Full Fluid Film Lubrication Hydrodynamic lubrication- Elasto Hydrodynamic lubrication- Types and properties of lubricants- lubricants additives.

Unit-V

Fluid Film Lubrication –Fluid Mechanics Concepts- Equation of Continuity and motion, Generalised Reynolds Equation with Compressible and Incompressible lubricants.
Rolling contact bearings –Gears-Journal Bearings- Finite Bearing

Course Outcomes:

The students will be able to:

1. Identify the causes of wears and friction in different contact surfaces.
2. Perform design calculations of hydrostatic and hydrodynamic lubrication for basic problems.
3. Design and analyze the performance of bearings

REFERENCE BOOK:

Ludema K.C- Friction, Wear, Lubrication- A Text Book in Tribology – CRC Press 2010

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	4	**0**	**0**	**4**

(17D94105) NANO TECHNOLOGY

Elective II

Course Objectives:

To understand the characteristics of nano materials and know the techniques of preparing the nano materials, to study the physical and chemical properties of the nana materials

UNIT-I

Characterization and characterization techniques of nanomaterials : Introduction, structural characterization, X-ray diffraction (XRD-Powder/Single crystal), Small angle X-ray scattering (SAXS), scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy dispersive X-ray analysis (EDAX), Low Energy Electron Diffraction (LEED), scanning probe microscopy (SPM) – principle of operation, instrumentation and probes, Atomic force microscopy (AFM), Optical spectroscopy, luminescence spectroscopy, UV-vis spectroscopy (liquid and solid state), UV Photo electron spectroscopy (UPS), Infrared spectroscopy, Raman spectroscopy, XPS, ESCA, Auger, Thermal Analysis Methods etc.

UNIT-II

Fabrication of nanomaterials: Top Down Approach Grinding, Planetary milling and Comparison of particles, Bottom Up Approach, Wet Chemical Synthesis Methods, Microemulsion Approach, Colloidal Nanoparticles Production, Sol Gel Methods, Sonochemical Approach, Microwave and Atomization, Gas phase Production Methods : Chemical Vapour Depositions.

UNIT-III

Functional coatings and thin films: Philosophy of functional surface engineering, general applications and requirements, Principles and design of optical coatings, Physics of the plasma state and plasma surface interactions, Surface engineering as part of a manufacturing process, Integrating coating systems into the design process, Coating, manufacturing processes; Electro deposition.

UNIT-IV

Auto-catalytic deposition, Physical and chemical vapor deposition, Ion-beam techniques, plasma spray deposition, overview of synchrotron-radiation based techniques for thin films, Data interpretation and approaches to materials analysis, Coating systems for mechanical applications, Multilayered coating architectures, Applications of functional films in electronic, catalysis and biomedical applications.

UNIT-V

Nanocomposites - design and synthesis: Introduction to Nanocomposites, Composite material, Mechanical properties of Nano composite material: stress - strain relationship, toughness, strength, plasticity. Synthesis methods for various nanocomposite materials: mechanical alloying, thermal spray synthesis etc. Nano composites for hard coatings; DLC coatings; Thin film nanocomposites; Modeling of nanocomposites.

Course Outcomes:

The students will be able to:

1. Identify the properties of nano materials .
2. Design and analyze the performance of nano materials

TEXT BOOKS:

1. Charles P.Poole.Jr.& Frank J.ownes, Introduction to Nano technology - John wielly&sons Inc. Publishers -2006
2. Guozhong Cao, Nano structures and Nano materials: Synthesis, properties and applications - Imperial College press.
3. Kulkarni Sulabha K, Nanotechnology: Principles and Practices, Capital Publishing Company, 2007
4. Stuart M. Lindsay, Introduction to Nanoscience, Oxford University Press, 2009.
5. Robert Kelsall, Ian Hamley, Mark Geoghegan, Nanoscale Science and Technology, John Wiley & Sons, England 2005.
6. Gabor L. Hornyak , H.F. Tibbals , Joydeep Dutta , John J. Moore Introduction to Nanoscience and Nanotechnology CRC Press
7. Davies, J.H. „The Physics of Low Dimensional Semiconductors: An Introduction", Cambridge University Press, 1998.

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M. Tech – I year I Sem. (PE)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D04208) RAPID PROTOTYPING
Elective-II

Course objectives:

At the end of this course the students would have developed a thorough understanding of the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Rapid Prototyping Technologies.

UNIT-I

Introduction: Need for the compression in product development, History of RP system, Survey of applications, Growth of RP industry and classification of RP system.

Stereo Lithography System: Principle, Process parameter, Process details, Data preparation, Data files and machine details, Applications.

UNIT –II

Fusion Decomposition Modeling: Principle, process parameter, Path generation, Applications.

Solid ground curing: Principle of operation, Machine details, Applications,

Unit- III

Laminated Object Manufacturing: Principle of Operation, LOM materials, Process details, Applications.

Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer, Genesis Xs printer HP system 5, Object Quadra system.

Unit IV

LASER ENGINEERING NET SHAPING (LENS)

Rapid Tooling: Indirect Rapid tooling- Silicon rubber tooling- Aluminum filled epoxy tooling Spray metal tooling, Cast kriksite, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.

Software for RP: STL files, Overview of Solid view, magics, imics, magic communication, etc. Internet based software, Collaboration tools.

Unit –V

Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data preparation error, Part building error, Error in finishing, Influence of build orientation.

COURSE OUTCOME: It helps the students to get familiarized with the various methods of rapid prototyping technologies and rapid tooling.

TEXT BOOKS:

1. " Stereo lithography and other RP & M Technologies**"**, Paul F.Jacobs, SME, NY 1996
2. " Rapid Manufacturing **",** Flham D.T & Dinjoy S.S, Verlog London 2001
3. "Rapid automated**"**, Lament wood, Indus Press New York.

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	0	**0**	**3**	**2**

(17D94106) PRODUCTION ENGINEERING LAB

Course objectives:

To train the students about the mould making techniques, mould hardness testing metal cutting and measuring machining parameters.

Experiments on

a) Sand moulding with cores and spilt cores
b) Mould hardness testing
c) Evaluation of green sand mould parameters such as permeability, moisture etc.
d) Friction stir welding
e) Gear cutting – at least two types on gear hobbing machine
f) Measurement of machining parameter such as force, temperature etc.
g) At least two experiments on Rapid Prototyping

Course outcomes:

Upon completing this course, the students

1. Will understand the mould parts manufacturing technique
2. Will attain knowledge in machining process

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(17D94201) MACHINE TOOL DESIGN

Course Objectives:

1. To impart the fundamental notions of the machine tools including the different types, construction, applications and their technological capabilities.
2. To provide exposure to the systematic methods for solving the problems of designing machine tools and their components by exploring the various design aspects of machine tools elements like transmissions, structures, materials, kinematics, dynamics and construction of machine tools, etc.

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. 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.

Structure Design: Design of beds, bases, columns, tables, cross rail for various machines. Various types of guide ways, their relative advantages.

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.

UNIT-IV

Machine Tool Vibrations: Effect of vibrations on machine tool. Free and Forced vibrations. Machine tool chatter. Elimination of vibrations.

Testing, Maintenance and Erection of Machine Tools: Testing equipment, Preventive and Corrective maintenance, general inspection, Installation of machine tools.

UNIT-V

Economics of machine tool selection: Estimation and comparison of costs, operation time, various methods of machine selection: Method of total cash flow, present worth, break even analysis.

Course Outcomes:

The students will be able to:

1. Analyze constructions and kinematic schemata of different types of machine tools.
2. Construct ray diagrams and speed spectrum diagrams for speed and feed box.
3. Develop the conceptual design, manufacturing framework and systematic analysis of design problems on the machine tools.
4. Apply the design procedures on different types of machine tool and/or machine tool components.

TEXT BOOKS:

1. Sen and Battacharya, " Principles of Machine Tools", Central Book publishers, Calcutta 1995.

REFERENCE BOOKS:

1.G.R. Nagpal, " Machine Tool Engineering", Khanna Publishers.
2.SK BASU "Design of Machine Tools" – Oxford and IBH Publishing Co.Pvt. Ltd.,
3.N.K. Mehta, "Machine Tool Design and Numerical Control", Tata McGraw Hill, 1997.

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(17D87201) SIMULATION AND MODELLING OF MANUFACTURING SYSTEMS

Course objectives:

1. To impart knowledge about the energy interaction of different components of a system.
2. To model systems residing in different energy domains and to control directly the theoretical and real systems. Provide students with the ability to apply modeling technique for analysis and synthesis of thermal, mechanical, biological systems etc.

UNIT - I

System – ways to analyze the system – Model - types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages and Disadvantages.

Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1 & 2 errors – Framing – Strang law of large numbers.

UNIT - II

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model.

UNIT-III

Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

Generation of random variants – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – Weibull – normal Bernoullie – Binomial – uniform – Poisson.

UNIT-IV

Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.QUEST, WITNESS, PROMODEL and AUTOMOD

UNIT -V

Output data analysis – Types of Simulation with respect to output data analysis – warm up period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

Course Outcomes:

1. Introducing simulation tool
2. Explaining the concept and types of models
3. Understanding discrete and continuous simulation
4. Introducing various simulation languages and software
5. Understanding the role of probability distributions in simulation
6. Explaining the verification and validation of simulation models.

TEXT BOOKS:

1. Simulation Modelling and Analysis, Law, A.M.& Kelton, McGraw Hill, 2nd Edition, New York, 1991.
2. Discrete Event System Simulation, Banks J. & Carson J.S., PH , Englewood Cliffs, NJ, 1984.
3. Simulation of Manufacturing Systems, Carrie A. , Wiley, NY, 1990.
4. A Course in Simulation, Ross, S.M., McMillan, NY, 1990.
5. Simulation Modelling and SIMNET , Taha H.A. , PH, Englewood Cliffs, NJ, 1987
6. Performance modeling and analysis of manufacturing systems, Viswanat Narahari, PHI

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(17D87101) AUTOMATION IN MANUFACTURING

Course Objectives:

1. To study the types and strategies and various components in Automated Systems.
2. To understand the automated flow lines, line balancing, material storage and retrieval and inspection
3. To learn the adaptive control systems.

UNIT-I

Introduction to Automation: Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation

UNIT-II

Introduction to Material Handling, Overview of Material Handling Equipment, Material Handling System Design considerations, Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems.

UNIT-III

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-IV

Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, assembly line design considerations. Transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with and without Storage buffers.

UNIT V

Manual Assembly Lines - Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, 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.

Course Outcomes:

At the end of the course student will be able to learn the-

1. Solve the line balancing problems in the various flow line systems with and without use buffer storage
2. Understand the different automated material handling, storage and retrieval systems and automated inspection systems.
3. Use of Adaptive Control principles and implement the same online inspection and control

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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(17D90203) ADVANCED METAL FORMING

Course Objective:

To study and observe through demonstration the metal forming processes (Rolling, Forging and Sheet metal forming)

UNIT - I

Fundamentals of Metal Forming: Classification of forming processes, mechanisms of metal forming: slab method, Upper and lower bound analysis, Deformation energy method and finite element method.

Rolling of metals: Rolling processes, forces and geometrical relationship in rolling, simplified analysis, rolling load, rolling variables, theories of cold and hot rolling, problems and defects in rolling, torque and power calculations, Problems.

UNIT - II

Forging: Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging. problems on flow stress ,true strain and forging load.

Extrusion: Classification, Hot Extrusion, Analysis of Extrusion process, defects in extrusion, extrusion of tubes, production of seamless pipes. Problems on extrusion load.

UNIT – III

Press tool design: Design of various press tools and dies like piercing dies, blanking dies, compound dies and progressive blanking dies, design of bending, forming.

Sheet Metal forming: Forming methods, Bending, stretch forming, spinning and Advanced techniques of Sheet Metal Forming, Forming limit criteria, defect in formed parts.

UNIT - IV

Drawing: Drawing of tubes, rods, and wires: Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing. Problems on draw force. Design of drawing dies.

UNIT - V

Advanced Metal forming processes: HERF, Electromagnetic forming, residual stresses, in-process heat treatment and computer applications in metal forming. Problems on Blanking force, Blank diagram in Cup Diagram, Maximum considering shear.

Course Outcomes:

1. To acquire a deeper knowledge about metal forming under different conditions and in various processes.
2. Metal forming fundamentals and applications.
3. Metal forming mechanics.
4. Workability of testing techniques.

TEXT BOOKS:

1. Mechanical Metallurgy, G.E. Dieter , Tata McGraw Hill, 1998. III Edition
2. Principles of Metal Working , Sunder Kumar

REFERENCES:

1. Principles of Metal Working processes , G.W. Rowe
2. ASM Metal Forming Hand book.

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(17D94202) ADVANCED CASTING TECHNOLOGY

ELECTIVE-III

Course objectives:

1. To inculcate the principle, thermal and metallurgical aspects during solidification of metal and alloys.
2. To impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting, defects in cast objects and requirements for achieving sound casting.

UNIT- I

Processes, parameters and applications of Investment casting, Centrifugal casting, Continuous Casting, shell moulding, Gravity die/ permanent mold casting, pressure die casting, squeeze casting, vacuum casting, counter-gravity flow-pressure casting, squeeze casting, semisolid metal casting, rheocasting. Non metal Molding /Ceramic Molding

UNIT- II

Solidification Gating and Risering, Nucleation and growth, solidification of pure metals, short and long freezing range alloys, directional and monocrystal solidification. Gating and risering desining calculation, Feeding of metals / alloys, design of feeder, Chvorinov's rule,, Fluidity and its measurement.

UNIT- III

Need, Areas for Mechanization, Typical Layout, Sand Reclamation Techniques, Material Handling, Pollution Control in Foundry, Application of Computers in Casting Processes, safety aspects.

UNIT-IV:

Various Fettling, Finishing and Heat Treatment of Casting, Casting defects-causes and remedies- design principles, Economics of Casting: Cost estimation in foundry shop including material cost, labor cost, direct and other expenses, overhead expenses.,

UNIT- V:

Design of castings, general principles, case studies: Use of CAD-CAE and Rapid Prototyping in foundry - A case study using CAD/CAE/CAM for developing pattern and core box for castings.

Course Outcomes:

The student will be able to:

1. Analyze the thermal, metallurgical aspects during solidification in casting,their role on quality of cast objects.
2. Design the gating and riser system needed for casting and requirements to achieve defect free casting.

TEXT BOOKS:

1. Heine R W, Loper C R and Rosenthal P C, "Principles of Metal Casting", Tata McGraw Hill, New Delhi, 2004.
2. Ravi B, “Metal Casting: Computer Aided Design and Analysis” Prentice Hall, 2005.

REFERENCES:

1. Jain P L, “Principles of Foundry Technology”, Tata McGraw Hill, New Delhi, 2006.
2. Elliot R, “Cast Iron Technology”, Jaico Publications, 2005.
3. Taylor H F, Flemings M C and Wulff J, "Foundry Engineering", 1993.
4. ASM Metals Handbook - Castings, Vol .15, ASM Int. Metals Park, OHIO, 1991.
5. Indian Foundry Journal (Institute of Indian Foundrymen - IIF).
6. Manuals on CAD/CAM Software (like ProEngineer, Unigraphics, etc.).

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(17D04205) COMPUTER GRAPHICS

Elective-III

Course Objective: The students can understand the Basics of computer Graphics like drawing line, arc etc., Drawing of spline curves , Creation of surfaces, Algorithms for 3D viewing, Available drawing standards

UNIT -I

Introduction to computer graphics: Color CRT raster scan monitors, plasma display & liquid crystal display monitors, computer input devices, hard copy devices.

Raster scan graphics: Line drawing algorithms – DDA & Bresenham algorithms, circle generation, general function rasterization, displaying lines, characters and polygons

UNIT-II

Filling algorithms: polygon filling, edge fill algorithm, seed fill algorithm, fundamentals of antialiasing and half toning.

UNIT–III

Line CLIPPING: Simple visibility algorithm, Cohen-Sutherland subdivision line clipping algorithm, mid point sub division algorithm.

Polygon clipping: polygon clipping, reentrant polygon clipping – Sutherland – Hodgeman algorithm, character clipping, 3D- clipping.

UNIT-IV

Transformations: Cartesian and homogeneous coordinate systems two dimensional and three dimensional transformations – scaling, rotation, Shearing, Zooming, viewing transformation, reflection, rotation about an axis, concatenation.

Unit -V

Rendering: Hidden line removal algorithms, surface removal algorithms, painters, Warnock, Z-buffer algorithm.

Shading algorithms: Constant intensity algorithm, Phong's shading algorithm, gourand shading algorithm, Comparison of shading algorithms.

Course Outcomes:

The students can understand the following

1. Basics of computer Graphics like drawing line, arc etc.
2. Drawing of spline curves
3. Creation of surfaces
4. Algorithms for 3D viewing
5. Available drawing standards
6. Basics of computer Graphics like drawing line, arc etc.

TEXT BOOKS:

1. Procedural elements for computer graphics-D.F.Rogers, Tata McGraw-Hill.
2. Computer Graphics-Donald Hearn & M.P. Bakers.
3. Computer graphics-Harrington.

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(17D94203) MEASUREMENT SYSTEMS

Elective-III

Course objectives:

1. To educate students on different measurement systems and on common types of Errors.
2. To introduce different types of sensors, transducers and strain gauges used for measurement.
3. To give knowledge about thermocouples, thermometers and flow meters used for measurements.

UNIT-I

Introduction History and overview of measurement system, General system principles Fundamentals of Measurement system, Static and Dynamic, Characteristics of measurement systems: Systematic Characteristics, Generalized model, Calibration errors, Transfer function, Techniques for dynamic compensation Accuracy of measurement systems in steady state: Measurement error, Error probability function, Error reduction techniques, Reliability, Choice and Economics of measurement systems

UNIT- II

Physics, Principles and Applications of sensing elements -Resistive and Capacitive sensing elements-Inductive and Electromagnetic sensing Element-Thermoelectric, and Elastic sensing elements Piezoelectric/Piezoresistive sensing elements-Electrochemical and Hall effect sensing elements

UNIT -III

Pressure sensing elements: Barometers, McLeod gauge, Pirani gauge, Penning gauge and Ionization gauge, Signal Conditioning Elements: Deflection bridges, Amplifiers, AC carrier system, Current transmitters, Oscillators and Resonators

UNIT -IV

Specialized measurement systems: Flow measurement systems: Measurement of velocity, volume and mass flow rate; Heat transfer effect in measurement systems: Characteristics of thermal sensors, Gas thermal conductivity and composition measurement

UNIT -V

Ultrasonic measurement systems: Principles of ultrasonic transmission, Basic links, Examples of ultrasonic measurement system; Intelligent multivariable measurement system: Modeling methods for multivariable systems.

Course Outcomes:

1. Students will be able to work in Quality control and quality assurances divisions in industries.
2. Students will be able to design measuring equipments for the measurement of temperature and flow.
3. Students will be able to maintain quality in engineering products.

TEXT BOOKS:

1. E.O. Doebelin, D.N. Manik, Measurement systems, 6/E, Tata McGraw Hill, New Delhi, 2011

2. J.P. Bentley, Principles of Measurement systems, 4/E, Pearson education ltd, UK, 2005

REFERENCES:

1. G.C.M. Meijer, Smart Sensor Systems, Vol 10, John Wiley and Sons, UK, 2008

2. Alan S. Morris, R. Langari, Measurement and Instrumentation; Theory and Application, Academic Press, USA, 2012

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	4	**0**	**0**	**4**

(17D87205) DESIGN AND MANUFACTURING OF MEMS AND MICRO SYSTEMS

Elective-IV

Course Objectives:

1. To introduce students to the basics MEMS and Microsystems
2. To help the students to design MEMS based structures
3. To make students understand the various methods of fabrication

UNIT - I

Overview and working principles of MEMS and Microsystems: MEMS and Microsystems, Evolution of Micro fabrication, Microsystems and Microelectronics, Microsystems and miniaturization, Applications of MEMs in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics.

Atomic structure of Matter, Ions and Ionization, Molecular Theory of Matter and Intermolecular Forces, Doping of Semiconductors, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

UNIT - II

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.

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 Nano scale,

UNIT- III

Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design

UNIT- IV

Mechanical Design, Mechanical design using FEM, Design of a Silicon Die for a Micro pressure sensor.

UNIT- V

Materials for MEMS and Microsystems and their fabrication: Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon compounds, Silicon Piezo resistors, 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.

Course Outcome:

Students who have successfully completed this course will be able to understand the basics of MEMS and analyze a MEMS based structure.

TEXT BOOK:

1. MEMS and Microsystems. Design and Manufacturing, Tia-Ran Hsu, TMH 2002

2. Foundation of MEMS, Chang Liu,Pearson, 2012

REFERENCES:

1. An Introduction to Microelectromechanical Systems Engineering. Maluf, M., Artech House, Boston 2000
2. "Micro robots and Micromechnaical Systems", Trimmer , W.S.N., Sensors & Actuators, Vol 19, 1989
3. Applied Partial Differential Equations, Trim., D.W., PWS-Kent Publishing, Boston, 1990

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	4	**0**	**0**	**4**

(17D04209) ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

Elective-IV

Course Objectives:

1. Able to understand the concepts of Artificial Intelligence and expert systems.
2. To learn, how to represent knowledge and interface in manufacturing application.

UNIT-I

Artificial Intelligence : Introduction, definition, underlying assumption, Important of Al, Al & related fields State space representation, defining a problem, production systems and its characteristic, search and control strategies –Introduction, preliminary concepts, examples of Search , problems.

Uniformed or Blind Search, Informed Search, Or Graphs, Heuristic Search techniques- Generate and Test, Hill climbing, Best first search, Problem reduction, Constraint satisfaction, Means-Ends Analysis.

UNIT- II

Knowledge Representation Issues: Representations and Mapping, Approaches, Issues in Kr, Types of knowledge procedural Vs Declarative, Logic programming, Forward Vs Backward reasoning, Matching, Non monotonic reasoning and it logic.

Representing simple facts, Instance and is a relationships, Syntax and Semantics for Propositional logic, FOPL, and properties of Wffs, conversion to casual form, Resolution, Natural deduction.

UNIT-III

Statistical and Probabilistic Reasoning: Symbolic reasoning under uncertainly, Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic.

UNIT-IV

Expert Systems: Introduction, Structure and uses, Representing and using domain knowledge, Expert System Shells. Pattern recognition, introduction, Recognition and classification process, learning classification patterns, recognizing and understanding speech.

UNIT-V

Introduction to Knowledge Acquisition: Types of learning, General learning model, and performance measures.

Typical Expert Systems: MYCIN, Variants of MYCIN, PROSPECTOR DENDRAL, PRUFF etc.

Introduction to Machine Learning: Perceptons, Checker Playing examples, Learning, Automata, Genetic Algorithms, Intelligent Editors.

Course Outcomes:

At the end of the course student will be able to learn the-

1. Fundamental theories, concepts, and applications of computer science in solving real-time problems.
2. Able to Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.
3. Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems.

TEXT BOOKS

1. " Artificial Intelligence**"** , Elaine Rich & Kevin Knight**,**M/H 1983
2. **"**Artificial Intelligence in Business**"**, Wendry B.Ranch**,** Science & Industry –Vol -II application, Ph 1985.
3. **"** A Guide to Expert System**"** Waterman, D.A., Addison,**–** Wesley inc. 1986.
4. **"**Building expert sys**tem"** Hayes, Roth, Waterman, D.A (ed), AW 1983.
5. **"**Designing Expert System**"**, S.M. and Kulliknowske Weis, London Champion Hull 1984.

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M. Tech – I year II Sem. (PE)	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

(17D94204) MACHINE TOOL DYNAMICS

ELECTIVE-IV

Course Objectives:

1. Dynamics of machining by varying parameters.
2. Automation of machine parts.

UNIT-I

Chatter in machine Tools- sources of chatter, primary chatter, regenerative chatter, chatter frequency, Chatter in grinding machine, forced vibration for machine tools, forced vibration due to perturbance of the cutting process, forced vibration due to perturbance of equivalent elastic system.

UNIT- II

Theories of machine tool chatter: Tlusty's, Kudinovs, Tablas theories.

UNIT -III

Machine tool stability: Methods of reducing the instability in machine tool, dynamic characteristic of the cutting process, general procedure for assessing the dynamic characteristic of machine tool in single degree and many degree of freedom system,

UNIT –IV

Static and dynamic analysis of machine tools: lumped parameter method, finite element method, dynamic acceptance tests

UNIT -V

Damping in machine tools: requirements of damping system,. Viscous dampers, active dampers,

Course Outcomes:

1. Identify various parts of machine tools
2. Reduce vibration and chatter developing on machine tools

TEXT BOOKS:

1. Principles of machine Tools:- G.C.Sen and Amitabh Bhattacharya(New central book agency Calcutta)
2. Machine Tool Design: - S.K. Mehta (TMH)

REFERENCES:

1. Mikell P. Groover, mitchell Weiss, " Industrial robotics, technology, Programming and Applications ", McGraw Hill International Editions, 1986.
2. Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, " Robotic engineering - An Integrated Approach ", Prentice Hall Inc, Englewoods Cliffs, NJ, USA, 1989.

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	0	**0**	**3**	**2**

(17D11211) MANUFACTURING SIMULATION LAB

List of Experiments:

1. Study of elements , entities , activities and basic models of a simulation package modeling and simulation
2. Throughput analysis of a individual production facility using simulation.
3. Modeling of a typical manufacturing facility and study its performances.
4. Breakdown analysis of a production facility with one machine
5. Breakdown analysis of a production system having multiple machines
6. Modeling and Simulation of layouts
7. Study of transport system in a shop floor
8. Buffer size design
9. Identification of bottleneck machine on a given shop floor
10. Study of conjunction, collision and dead locks through simulation

Lab Facilities:

Adequate number of Computer Systems in Networked Environment

Packages : 1. QUEST

2.PROMODEL

3.FLEXSIM

4.AUTOMOD

5.WITNESS

Course outcomes:

At the end of the course, the student shall be able to:

1. Design and run simulation experiments using software packages including PROMODEL, FLEXSIM, AUTOMOD.

2. Model and study a given manufacturing scenario using simulation.

3. Analyze the behaviour of manufacturing system using simulation.

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M.Tech III semester (PE)

L	T	P	C
4	0	0	4

(17D20301) RESEARCH METHODOLOGY

(Elective V-OPEN ELECTIVE)

UNIT I

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

UNIT II

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design.

Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation.

Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

UNIT III

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

UNIT IV

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multi-variate Analysis.

UNIT V

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Text Books:

1. Research Methodology:Methods And Techniques – C.R.Kothari, 2nd Edition,New Age International Publishers.
2. Research Methodology: A Step By Step Guide For Beginners- Ranjit Kumar, Sage Publications (Available As Pdf On Internet)
3. Research Methodology And Statistical Tools – P.Narayana Reddy And G.V.R.K.Acharyulu, 1st Edition,Excel Books,New Delhi.

REFERENCES:

1. Scientists Must Write - Robert Barrass (Available As Pdf On Internet)

2. Crafting Your Research Future –Charles X. Ling And Quiang Yang (Available As Pdf On Internet)

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M.Tech III semester (PE)

L	T	P	C
4	0	0	4

(17D20302) HUMAN VALUES AND PROFESSIONAL ETHICS

(Elective V-OPEN ELECTIVE)

Unit I:

HUMAN VALUES:Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Spirituality.

Unit II:

ENGINEERING ETHICS: Senses of Engineering Ethics- Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg‟s theory- Gilligan‟s theory- Consensus and controversy – Models of professional roles- Theories about right action- Self interest - Customs and religion –Uses of Ethical theories – Valuing time –Co operation – Commitment.

Unit III :

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

UNIT IV:

ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK: Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing riskSafety and the Engineer- Designing for the safety- Intellectual Property rights(IPR).

UINIT V:

GLOBAL ISSUES: Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics .

Text Books :

1. "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.

2. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

3. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGrawHill– 2003.

4. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.

5. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran , Laxmi Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech III semester (PE)

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(17D20303) INTELLECTUAL PROPERTY RIGHTS

(Elective V-OPEN ELECTIVE)

UNIT – I

Introduction To Intellectual Property: Introduction, Types Of Intellectual Property, International Organizations, Agencies And Treaties, Importance Of Intellectual Property Rights.

UNIT – II

Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

Law Of Copy Rights : Fundamental Of Copy Right Law, Originality Of Material, Rights Of Reproduction, Rights To Perform The Work Publicly, Copy Right Ownership Issues, Copy Right Registration, Notice Of Copy Right, International Copy Right Law.

Law Of Patents : Foundation Of Patent Law, Patent Searching Process, Ownership Rights And Transfer

UNIT – IV

Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.

Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V

New Development Of Intellectual Property: New Developments In Trade Mark Law ; Copy Right Law, Patent Law, Intellectual Property Audits.

International Overview On Intellectual Property, International – Trade Mark Law, Copy Right Law, International Patent Law, International Development In Trade Secrets Law.

TEXT BOOKS & REFERENCES:

1. Intellectual Property Right, Deborah. E. Bouchoux, Cengage Learing.

2. Intellectual Property Right – Nleashmy The Knowledge Economy, Prabuddha Ganguli,

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