REGULATIONS - 2011

DEPARTMENT OF
MECHANICAL ENGINEERING
(CENTRE FOR MANUFACTURING SCIENCE)

CURRICULUM AND SYLLABI OF
M.E. – PRODUCTION ENGINEERING
# NATIONAL ENGINEERING COLLEGE, K.R.NAGAR, KOVILPATTI

*(An Autonomous Institution Affiliated to Anna University Chennai)*

## REGULATIONS – 2011 CURRICULUM

### M.E., PRODUCTION ENGINEERING

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TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE

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# M.E., PRODUCTION ENGINEERING

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MMA101 NUMERICAL METHODS AND GRAPH THEORY

AIM:
To solve some engineering models and problems by using Numerical Analysis and Graph Theoretical concepts.

OBJECTIVES:
The engineers will have an exposure on various topics such as Systems of Equation, Interpolation and Numerical Integration, Initial and Boundary Value Problems, Fundamentals of Graphs, Graphs Algorithms to understand their applications in engineering problems.

UNIT I SYSTEMS OF EQUATIONS 12

UNIT II INTERPOLATION AND INTEGRATION 12

UNIT III NUMERICAL METHODS FOR ODE 12

UNIT IV FUNDAMENTALS OF GRAPHS 12

UNIT V TREES AND ALGORITHMS 12
Kruskal’s algorithm – Dijkstra’s shortest path algorithm, Prim’s algorithm – Transport Networks.

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:
MPE101 ADVANCED MATERIALS TECHNOLOGY

AIM:
The aim of this course is to impart knowledge on the advanced concepts of material technology.

OBJECTIVE:
- To enlighten the PG students on elastic, plastic, and fractured behavior of engineering materials.
- To train the PG students in the selection of metallic and non-metallic materials for various engineering applications.

UNIT I ELASTIC AND PLASTIC BEHAVIOR
Elasticity in metals and polymers, anelastic and visco-elastic behavior – Mechanism of plastic deformation and non-metallic shear strength of perfect and real crystals – Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain, and strain rate on plastic behavior – Superplasticity – Deformation of non-crystalline materials.

UNIT II FRACTURE BEHAVIOR

UNIT III SELECTION OF MATERIALS
Motivation for selection, cost basis, and service requirements – Selection for mechanical properties, strength, toughness, fatigue, and creep – 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 – Computer-aided materials selection.

UNIT IV MODERN METALLIC MATERIALS

UNIT V NON METALLIC MATERIALS
Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives, and coating – Structure, properties, and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al2O3, SiC, Si3N4 – CBN and diamond – Properties, processing, and applications.

TOTAL: 45 PERIODS
REFERENCES:

MPE102 AUTOMATED AND COMPUTER INTEGRATED MANUFACTURING SYSTEM

AIM:
To stress the role of computers in production.

OBJECTIVE:
To teach the role of computers in processing the information knowing across the various stages and various departments in a manufacturing concern.

UNIT I INTRODUCTION

UNIT II AUTOMATED MANUFACTURING SYSTEMS


Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system.

Deadlocks in Automated manufacturing systems – Petrinet models – Applications in Dead lock avoidance.

UNIT III GROUP TECHNOLOGY AND FMS

UNIT IV     PROCESS PLANNING  10
Typical process sheet – case studies in Manual process planning.


UNIT V     TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE  9

Overview of Automatic identification methods – Bar code technology – Other Automatic data capture technologies.

TOTAL: 45 PERIODS

REFERENCES:

AIM:
To expose the students in the art of manufacturing new products due to the development of new materials and processes. The students will totally get a feel of the relevant suitable process while evaluating and deciding.

OBJECTIVE:
• To inform the students about the various alternative manufacturing processes available.
• To develop an altitude to look for the unconventional manufacturing process to machine
• To make them to understand and appreciate the latest manufacturing process for micro fibre and devices.

UNIT I NEWER MACHINING PROCESSES - I 9

UNIT II NEWER MACHINING PROCESS – II 9

UNIT III NEWER MACHINING PROCESS – III 9

UNIT IV FABRICATION OF MICRO DEVICES 9

UNIT V MICROFABRICATION TECHNOLOGY 9

TOTAL: 45 PERIODS

REFERENCES:
AIM:
To impart the knowledge on training the students in the area of CAD/CAM.

OBJECTIVES:
To teach the students about the drafting of 3D components and analyzing the same using various CAD/CAM softwares.

CAM LABORATORY
1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle.
4. Mini project on any one of the CIM elements is to be done. This can be either a software or hardware simulating a CIM element. At the end of the semester, the student has to submit a mini report and present his work before a Committee.

CAD LABORATORY
2D modeling and 3D modeling of components such as
1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

TOTAL: 30 PERIODS
MPE201 ROBOT DESIGN AND PROGRAMMING

AIM:
To impart knowledge in the area of Robot designing and programming in Robotic languages.

OBJECTIVES:
To teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors.

UNIT I INTRODUCTION
Definition, Need Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence, specifications of robot, degrees of freedoms, end effectors – types, selection applications.

UNIT III ROBOT KINEMATICS

UNIT III ROBOT DYNAMICS AND TRAJECTORY PLANNING
Lagrangeon mechanics, dynamic equations for sing, double and multiple DOF robots – static force analysis of robots, Trajectory planning – joint space, Cartesian space description and trajectory planning – third order, fifth order - Polynomial trajectory planning.

UNIT IV ROBOT PROGRAMMING & AI TECHNIQUES
Types of Programming – Teach Pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

UNIT V ROBOT SENSORS AND ACTUATORS
Design of Robots – characteristics of actuating systems, comparison, microprocessors control of electric motors, magnetostrictive actuators, shape memory type metals, sensors, position, velocity, force, temperature, pressure sensors – Contact and non contact sensors, infrared sensors, RCC, vision sensors.

TOTAL: 45 PERIODS

REFERENCES
AIM:
To expose the students, the importance of measurement and the various latest measuring techniques using Laser, Coordinate measuring machines and Opto- electronics devices. Also to stress upon the Importance of quality in manufacturing.

OBJECTIVES:
To impart through knowledge in various latest measurement systems such as laser metrology, coordinate measuring machines and electro-optical devices. Also to make the students to understand quality.

UNIT – I LASER METROLOGY       8

UNIT – II PRECISION INSTRUMENTS BASED ON LASER        9

UNIT – III CO-ORDINATE MEASURING MACHINE       10

UNIT – IV OPTO ELECTRONICS AND VISION SYSTEM       9

UNIT – V QUALITY IN MANUFACTURING ENGINEERING       9
Importance of manufacturing planning for quality – concepts of controllability – need for quality management system and models – quality engineering tools and techniques – statistical process control – six sigma concepts – Poka Yoke – Computer controlled systems used in inspection.

REFERENCES:
AIM: To impart knowledge on plasticity, surface treatment for forming of various types of metal forming process.

OBJECTIVES:
- To study the basic concepts of metal forming techniques and to develop force calculation in metal forming process.
- To study the thermo mechanical regimes and its requirements of metal forming

UNIT I THEORY OF PLASTICITY


UNIT II THEORY AND PRACTICE OF BULK FORMING PROCESSES

Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing – Effect of friction – calculation of forces, work done – Process parameters, equipment used – Defects – applications – Recent advances in Forging, Rolling, Extrusion and Drawing processes – Design consideration in forming.

UNIT III SHEET METAL FORMING


UNIT IV POWDER METALLURGY AND SPECIAL FORMING PROCESSES


UNIT-V SURFACE TREATMENT AND METAL FORMING APPLICATIONS


TOTAL: 45 PERIODS
REFERENCES:

AIM:
To inspire the students to expect to the trends in manufacturing micro components and measuring systems to nano scale.

OBJECTIVES:
• To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be aware of micro actuators.
• Also to impart knowledge to the students about nano materials and various nano measurements techniques.

UNIT I OVERVIEW OF MEMS AND MICROSYSTEMS 6
Definition – historical development – fundamentals – properties, micro fluidics, design and fabrication micro-system, microelectronics, working principle and applications of micro system.

UNIT II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING 10
Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation – thermal oxidation, silicon diode, chemical vapour deposition, sputtering - deposition by epitaxy – etching – bulk and surface machining – LIGA process Micro system packaging – considerations packaging – levels of micro system packaging die level, device level and system level.

UNIT III MICRO DEVICES AND MATERIALS 8

UNIT IV SCIENCE OF NANO MATERIALS 10
Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Top down processes – bottom up process.

UNIT V CHARACTERIZATION OF NANO MATERIALS 11

TOTAL: 45 PERIODS
REFERENCES:

MPE231  AUTOMATION LAB  L  T  P  C
0 0 4 2

AIM:
To impart knowledge in the area of hydraulics and pneumatic components and its functions.

OBJECTIVE:
• To make the students to learn the basic concepts of hydraulics and pneumatics and its applications in the area of manufacturing process.
• To simulate the various hydraulics and pneumatics circuits.

1. Simulation of single and double acting cylinder circuits
2. Simulation of simple Hydraulic and Pneumatic circuits
3. Simulation of electro pneumatic and electro hydraulic circuits
4. Simulation of electro pneumatic sequencing circuits
5. Simulation of Hydraulic and Pneumatic circuits using PLC circuits
6. Simulation of Hydraulic and Pneumatic circuits using automation studio
7. Exercises on linear, angular and speed measurements
8. Exercises on Vibration measurements
10. Exercises on stepper motor.
11. Exercises on microprocessor based data acquisition system.

TOTAL: 30 PERIODS
AIM:
To impart knowledge in the area of finite element methods and its application in manufacturing.

OBJECTIVE:
To study the fundamentals of one dimensional and two dimensional problems using FEA in manufacturing.

UNIT I   INTRODUCTION       6

UNIT II   ONE DIMENSIONAL ANALYSIS       10
Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III   SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS       10
Shape functions for one and two dimensional elements- Three nodded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and axisymmetric analysis.

UNIT IV   COMPUTER IMPLEMENTATION       9
Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.

UNIT V   ANALYSIS OF PRODUCTION PROCESSES       10

TOTAL: 45 PERIODS

REFERENCES:
6. www.tbook.com
7. www.pollockeng.com
AIM:
To impart knowledge in the area of hydraulics, pneumatic and fluid power components and its functions.

OBJECTIVE:
- To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.
- To train the students in designing the hydraulics and pneumatic circuits using ladder diagram.

UNIT I  INTRODUCTION  5

UNIT II  FLUID POWER GENERATING/UTILIZING ELEMENTS  8

UNIT III  CONTROL AND REGULATION ELEMENTS  8

UNIT IV  CIRCUIT DESIGN  10

UNIT V  ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS  7
Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

REFERENCES:
MPE003   DESIGN FOR MANUFACTURING AND ASSEMBLY          L  T  P  C
                                                    3 0 0 3

UNIT I   TOLERANCE ANALYSIS 8
Introduction – Concepts, definitions and relationships of tolerancing – Matching design
tolerances with appropriate manufacturing process – manufacturing process capability metrics –
Worst care, statistical tolerance Analysis – Linear and Non-Linear Analysis – Sensitivity
Analysis – Taguchi’s Approach to tolerance design.

UNIT II  TOLERANCE ALLOCATION 8
Tolerance synthesis – Computer Aided tolerancing – Traditional cost based analysis – Taguchi’s
quality loss function – Application of the Quadratic loss function to Tolerancing
– Principles of selective Assembly – Problems.

UNIT III  GD&T 10
Fundamentals of geometric dimensioning and tolerancing – Rules and concepts of GD&T
– Form controls – Datum systems – Orientation controls – Tolerance of position – Concentricity
and symmetry controls – Run out controls – Profile controls.

UNIT IV  TOLERANCE CHARTING 9
Nature of the tolerance buildup – structure and setup of the tolerance chart – piece part sketches
for tolerance charts – Arithmetic ground rules for tolerance charts – Determination of Required
balance dimensions – Determination of Mean working Dimensions – Automatic tolerance
charting – Tolerance charting of Angular surfaces.

UNIT V  MANUFACTURING GUIDELINES 10
DFM guidelines for casting, weldment design – Formed metal components – Turned parts –
Milled, Drilled parts – Non metallic parts – Computer Aided DFM software – Boothroyd and
Dewhurst method of DFMA – DCS – Vis/VSA – 3D Dimensional control – Statistical tolerance
Analysis Software – Applications.

TOTAL: 45 PERIODS

REFERENCES:

1. C.M. Creveling, “Tolerance Design – A handbook for Developing Optimal
   1995.
4. Oliver R. Wade, “Tolerance Control in Design and Manufacturing”, Industrial Press,
   NY, 1967.
   1986.
AIM:
To introduce to the students the various functions of materials management and logistics

OBJECTIVE:
To make the students familiar with the various concepts and functions of material management, so that the students will be in a position to manage the materials management department independently.

UNIT I INTRODUCTION
Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II MANAGEMENT OF PURCHASE

UNIT III MANAGEMENT OF STORES AND LOGISTICS

UNIT IV MATERIALS PLANNING

UNIT V INVENTORY MANAGEMENT
ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

TOTAL: 45 PERIODS

REFERENCES
AIM:
To impart knowledge on basic concepts and advances in casting and welding processes.

OBJECTIVES:
- To study the metallurgical concepts and applications of casting and welding process.
- To acquire knowledge in CAD of casting and automation of welding process.

UNIT I  CASTING DESIGN  8
Heat transfer between metal and mould – Design considerations in casting – Designing for directional solidification and minimum stresses – principles and design of gating and risering

UNIT II  CASTING METALLURGY  8

UNIT III  RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT  8
Shell moulding, precision investment casting, CO2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry – pollution control in foundry — Computer aided design of casting.

UNIT IV  WELDING METALLURGY AND DESIGN  10

UNIT V  RECENT TRENDS IN WELDING  11

TOTAL: 45 PERIODS
REFERENCES:

2. ASM Handbook vol.6, welding Brazing & Soldering, 2003
AIM:
To impart the knowledge and train the students in the area of metal cutting theory and its importance.

OBJECTIVES:
To make the students familiar with the various principles of metal cutting, cutting tool materials and its wear mechanisms during the machining operation.

UNIT I INTRODUCTION
Need for rational approach to the problem of cutting materials-observation made in the cutting of metals-basic mechanism of chip formation-thin and thick zone modes-types of chips-chip breaker-orthogonal Vs oblique cutting-force velocity relationship for shear plane angle in orthogonal cutting-energy consideration in machining-review of Merchant, Lee and Shafter theories-critical comparison.

UNIT II SYSTEM OF TOOL NOMENCLATURE
Nomenclature of single point cutting tool-System of tool nomenclature and conversion of rake angles-nomenclature of multi point tools like drills, milling-conventional Vs climb milling, mean cross sectional area of chip in milling-specific cutting pressure.

UNIT III THERMAL ASPECTS OF MACHINING
Heat distribution in machining-effects of various parameters on temperature-methods of temperature measurement in machining-hot machining-cutting fluids.

UNIT IV TOOL MATERIALS, TOOL LIFE AND TOOL WEAR

UNIT V WEAR MECHANISMS AND CHATTER IN MACHINING
Processing and Machining – Measuring Techniques – Reasons for failure of cutting tools and forms of wear-mechanisms of wear-chatter in machining-factors effecting chatter in machining-types of chatter-mechanism of chatter.

TOTAL: 45 PERIODS
REFERENCES
MPE007  PROBABILITY AND STATISTICS  L T P C
            3  0  0  3

AIM:
To introduce the concepts of probability, sampling techniques, estimation to the students.

OBJECTIVE:
To train the students so that students will be able to design experimental designs and use these concepts for research design.

UNIT I   PROBABILITY THEORY  14
Random variables – probability density and distribution functions-moment generating and characteristic functions – Binomial, Poisson, Normal distributions and their applications.

UNIT II  SAMPLING THEORY   9
Sampling distributions – Standard error – t, F, Chi square distributions – applications.

UNIT III ESTIMATION THEORY  5
Interval estimation for population mean, standard deviation, difference in means, ratio of standard deviations – point estimation.

UNIT IV TESTING OF HYPOTHESIS AND ANOVA  12

UNIT V   CORRELATION, REGRESSION AND TIME SERIES ANALYSIS   5

TOTAL: 45 PERIODS

REFERENCES:
AIM:
To introduce the various concepts of manufacturing system simulation.

OBJECTIVES:

• To model manufacturing systems of different kinds.
• To make use of simulation languages for manufacturing systems.

UNIT I INTRODUCTION 8
Basic concepts of system – elements of manufacturing system - concept of simulation – simulation as a decision making tool – types of simulation – Monte-Carlo simulation - system modeling – types of modeling – Limitations and Areas of application of simulation.

UNIT II RANDOM NUMBERS 10
Probability and statistical concepts of simulation – Pseudo random numbers – methods of generating random numbers – discrete and continuous distribution – testing of random numbers – kolmogorov-Smirnov test, the Chi-Square test - sampling - simple, random and simulated.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 10

UNIT IV SIMULATION LANGUAGE 9
Comparison and selection of simulation languages - Study of GPSS (Basic blocks only) Generate, Queue, Depart, Size, Release, Advance, Terminate, Transfer, Enter and Leave.

UNIT V CASE STUDIES 10
Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems – case studies.

TOTAL: 45 PERIODS

REFERENCES:
AIM:
To introduce the various optimization techniques and their advancements.

OBJECTIVES:
To make use of the above techniques while modeling and solving the engineering problems of different fields.

UNIT – I INTRODUCTION

UNIT – II CLASSIC OPTIMIZATION TECHNIQUES

UNIT – III NON-LINEAR PROGRAMMING

UNIT – IV INTEGER PROGRAMMING AND DYNAMIC PROGRAMMING AND NETWORK TECHNIQUES

UNIT – V ADVANCES IN SIMULATION
Genetic algorithms – simulated annealing – Neural Network and Fuzzy systems.

TOTAL: 45 PERIODS

REFERENCES:
UNIT – I \hspace{0.5cm} \textbf{INTRODUCTION} \hspace{1cm} 9


UNIT – II \hspace{0.5cm} \textbf{ANTHROPOMETRY} \hspace{1cm} 9

Physical dimensions of the human body as a working machine – Motion size relationships – Static and dynamic anthropometry – Anthropometric aids – Design principles – Using anthropometric measures for industrial design – Procedure for anthropometric design.

UNIT – III \hspace{0.5cm} \textbf{DESIGN OF SYSTEMS} \hspace{1cm} 10


UNIT – IV \hspace{0.5cm} \textbf{ENVIRONMENTAL FACTORS IN DESIGN} \hspace{1cm} 10


UNIT – V \hspace{0.5cm} \textbf{WORK PHYSIOLOGY} \hspace{1cm} 8

Provision of energy for muscular work – Role of oxygen physical exertion – Measurement of energy expenditure Respiration – Pulse rate and blood pressure during physical work – Physical work capacity and its evaluation.

\textbf{TOTAL: 45 PERIODS}

\textbf{REFERENCES:}

AIM:

To impart on types, physical properties and processing of polymer matrix and composites, metal matrix composites and ceramics matrix composites.

OBJECTIVES:

• To study matrix material, particulates and fibres of polymer matrix composites, MMC and ceramic matrix composites.
• To develop knowledge on processing, interfacial properties and application of computers.

UNIT – I  PROPERTIES OF POLYMERS  8
Chemistry and Classification of Polymers – Properties of Thermo plastics – Properties of Thermosetting Plastics – Applications – Merits and Disadvantages.

UNIT – II  PROCESSING OF POLYMERS  9

UNIT – III  INTRODUCTION TO FIBRES AND COMPOSITE MATERIALS  9
Fibres – Fabrication, Structure, properties and applications - Glass, Boron, carbon, organic, ceramic and metallic fibers whiskers– Matrix materials structure – polymers, – metals and ceramics – Physical and chemical properties

UNIT – IV  PROCESSING OF POLYMER MATRIX COMPOSITES  9

UNIT – V  PROCESSING OF - METAL MATRIX COMPOSITES AND CERAMIC MATRIX COMPOSITES  10

TOTAL: 45 PERIODS
REFERENCES:

AIM:
To stress the importance of NDT in engineering.

OBJECTIVES:
To introduce all types of NDT and their applications in Engineering.

UNIT – I NON-DESTRUCTIVE TESTING: AN INTRODUCTION, VISUAL INSPECTION & LIQUID PENETRANT TESTING
Introduction to various non-destructive methods, Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications. Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods-water washable, Post – Emulsification methods, Applications.

UNIT – II EDDY CURRENT TESTING & ACOUSTIC EMISSION

UNIT – III MAGNETIC PARTICLE TESTING & THERMOGRAPHY
Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications. Principle of Thermography, Infrared Radiometry, Active thermography measurements, Applications – Imaging entrapped water under an epoxy coating, Detection of carbon fiber contaminants.

UNIT – IV ULTRASONIC TESTING & RADIOGRAPHY

UNIT – V CASE STUDIES, COMPARISON AND SELECTION OF NDT METHODS
Case studies on defects in cast, rolled, extruded, welded and heat treated components. Comparison and selection of various NDT techniques. Codes, standards, specification and procedures.

TOTAL: 45 PERIODS
REFERENCES:

4. www.ndt.net
MPE013      ARTIFICIAL INTELLIGENCE      L T P C

AIM:
To understand the various types and applications of Fuzzy Logics and Artificial Neural Networks.

OBJECTIVE:
This course is intended for learning the basic concepts, Operations and Principles of Fuzzy Logic, applications of various Fuzzy Logic systems, architecture and Taxonomy of Neural Networks. This course is also gives the ideas of ANN Architectures, Genetic Algorithms. Meta Heuristic techniques and Applications in Design and Manufacturing.

UNIT – I      INTRODUCTION TO FUZZY LOGIC      8

UNIT – II      FUZZY LOGIC APPLICATIONS      10

UNIT – III      INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS      8

UNIT – IV      OTHER ANN ARCHITECTURES      10

UNIT – V      RECENT ADVANCES      10

TOTAL: 45 PERIODS

REFERENCES:
5. S.Rajasekaran, G.A.Vijayalakshmi Pai, ‘Neural Networks, Fuzzy Logic and Genetic
MPE014            LEAN MANUFACTURING SYSTEM AND IMPLEMENTATION     L T P C
                                    3 0 0 3

AIM:
To introduce the concepts of lean manufacturing system.

OBJECTIVES:
• To study the various tools for lean manufacturing (LM).
• To apply the above tools to implement LM system in an organization.

UNIT – I INTRODUCTION TO LEAN MANUFACTURING 7
Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing –
Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT – II CELLULAR MANUFACTURING, JIT, TPM 9
Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT –
Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and
implementation of TPM.

UNIT – III SET UP TIME REDUCTION, TQM, 5S, VSM 10
Set up time reduction – Definition, philosophies and reduction approaches. TQM –
Principles and implementation. 5S Principles and implementation - Value stream mapping -
Procedure and principles.

UNIT – IV SIX SIGMA 9
Six Sigma – Definition, statistical considerations, variability reduction, design of experiments –
Six Sigma implementation

UNIT – V CASE STUDIES 10
Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

REFERENCES:
1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey
   B.Goldberg, John Wiley & Sons, 2003
2. Rother M. and Shook J, 1999 ‘Learning to See: Value Stream Mapping to Add Value
   and Eliminate Muda’, Lean Enterprise Institute, Brookline, MA.
AIM:
To expose the students to the various quality control techniques and also to understand the importance and concept of reliability and maintainability in industries.

OBJECTIVES:
To make the students to understand the various quality control techniques and to construct the various quality control charts for variables and attributes and also the design concepts for reliable system and maintenance aspects in industries.

UNIT – I QUALITY & STATISTICAL PROCESS CONTROL 8

UNIT – II ACCEPTANCE SAMPLING 8

UNIT – III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

UNIT – IV CONCEPT OF RELIABILITY 9
Definition – reliability vs quality, reliability function – MTBF, MTTR, availability, bathtub curve – time dependent failure models – distributions – normal, weibull, lognormal – Reliability of system and models – serial, parallel and combined configuration – Markove analysis, load sharing systems, standby systems, covariant models, static models, dynamic models.

UNIT – V DESIGN FOR RELIABILITY AND MAINTAINABILITY 11
Reliability design process, system effectiveness, economic analysis and life cycle cost, reliability allocation, design methods, parts and material selection, derating, stress- strength and analysis, failure analysis, identification determination of causes, assessments of effects, computation of criticality index, corrective action, system safety – analysis of down-time – the repair time distribution, stochastic point processes system repair time, reliability under preventive maintenance state dependent system with repair. MTTR – mean system down time, repair vs replacement, replacement models, proactive, preventive, predictive maintenance maintainability and availability, optimization techniques for system reliability with redundancy heuristic methods applied to optimal system reliability.

TOTAL: 45 PERIODS
REFERENCES:

AIM:
To introduce the computer aided modeling and various concepts of product design.

OBJECTIVES:
• To model a product using CAD software.
• To apply the various design concepts and design tools and techniques while designing a product.

UNIT – I INTRODUCTION
Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware & Peripherals – software packages for design and drafting.

UNIT – II COMPUTER GRAPHICS FUNDAMENTALS AND GEOMETRIC MODEL

UNIT – III PRODUCT DESIGN CONCEPTS

UNIT – IV PRODUCT DESIGN TOOLS & TECHNIQUES

UNIT – V PRODUCT DATA MANAGEMENT

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:
AIM:
To introduce the concepts of financial and various functions of financial management so that the students will be able to handle higher level financial decisions.

OBJECTIVES:
To train students in various functions of finance such as working capital management, current assets management so that students will be able to make high investment decisions when they take up senior managerial positions.

UNIT – I  FINANCIAL ACCOUNTING  8
Accounting principles - Basic records - Preparation and interpretation of profit and loss statement - balance sheet - Fixed assets - Current assets.

UNIT – II COST ACCOUNTING  12

UNIT – III MANAGEMENT OF WORKING CAPITAL  10
Current assets - Estimation of working capital requirements - Management of accounts receivable - Inventory - Cash - Inventory valuation methods.

UNIT – IV CAPITAL BUDGETING  8
Significance of capital budgeting - payback period - present value method - accounting rate of return method - Internal rate of return method.

UNIT – V PROFIT PLANNING AND ANALYSIS  7
Cost - Volume profit relationship Relevant costs in decision making profit management analysis - Break even analysis.

TOTAL: 45 PERIODS

REFERENCES:
AIM:
To expose the students the importance of concurrent engineering in the present manufacturing and also the need and importance of rapid prototype tooling in manufacturing.

OBJECTIVES
To make the students understand the concepts of concurrent engineering such as artificial intelligence, expert system, JIT, automated assembly system etc. Also to impart knowledge in various rapid tooling techniques and processes.

UNIT – I   INTRODUCTION TO CONCURRENT ENGINEERING   7

UNIT – II   DESIGN STATE   9

UNIT – III   MANUFACTURING CONCEPTS AND ANALYSIS   9

UNIT – IV   RAPID PROTOTYPE TOOLING PROCESSES   10

UNIT – V   MODULAR AND RAPID TOOLING   10
Principle – Thermojet printer, Sander’s model 3D printer, Genisys Xs printer, JP system object yudra system – In direct rapid tooling , silicon rubber tooling – aluminium fitted epoxy tooling – spray metal tooling, direct rapid tooling – quick cast process – copper polyamide, rapid tools sand casting tooling laminated tooling soft tooling Vs hard tooling.

TOTAL: 45 PERIODS

REFERENCES:
4. Prasad Concurrent Engineering Fundamentals Integrated Product Development
Prentice Hall 1996.
7. www.tm.tu.nl/vace/ce/ce95.html
AIM:
To introduce the concepts of manufacturing management and various manufacturing management function to the students.

OBJECTIVE
To train the students on various functions of manufacturing management so that the students will be able to take up these functions as they get in to senior managerial positions.

UNIT – I  PLANT ENGINEERING

UNIT – II  WORK STUDY

UNIT – III  PROCESS PLANNING AND FORECASTING
Process planning – Aims of process planning – steps to prepare the detailed work sheets for manufacturing a given component – Break even analysis – Forecasting – Purpose of forecasting – Methods of forecasting – Time series – Regression and Correlation – Exponential smoothing – Forecast errors.

UNIT – IV  SCHEDULING AND PROJECT MANAGEMENT

UNIT - V  Personnel and Marketing Management

TOTAL: 45 PERIODS

REFERENCES
1. Dr. R. Kesavan, C.Elanchezian and B.Vijayaramnath, Production Planning and Control, Anuratha Publications, Chennai – 2008
5. Martand T. Telsang, Production Management, S.Chand & Co., 2005
UNIT I  INTRODUCTION TO TOOL DESIGN  8

UNIT II  DESIGN OF CUTTING TOOLS  9
Mechanics of Metal cutting – Oblique and orthogonal cutting- Chip formation and shear angle - Single-point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters

UNIT III  DESIGN OF JIGS AND FIXTURES  10

UNIT IV  DESIGN OF PRESS TOOL DIES  10

UNIT V  TOOL DESIGN FOR CNC MACHINE TOOLS  8

REFERENCES:
2. E.G.Hoffman,” Jig and Fixture Design”, Thomson Asia Pvt Ltd, Singapore, 2004

TOTAL  :  45 PERIODS
UNIT I   NANO CERAMICS  
Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality.

UNIT II   METAL BASED NANOCOMPOSITES  
Metal-metal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties.

UNIT III   DESIGN OF SUPER HARD MATERIALS  
Super hard nanocomposites, its designing and improvements of mechanical properties.

UNIT IV   NEW KIND OF NANOCOMPOSITES  
Fractal based glass-metal nanocomposites, its designing and fractal dimension analysis. Electrical property of fractal based nanocomposites. Core-Shell structured nanocomposites.

UNIT V   POLYMER BASED NANOCOMPOSITES  
Preparation and characterization of diblock Copolymer based nanocomposites; Polymercarbon anotubes based composites, their mechanical properties, and industrial possibilities.

TOTAL: 45 PERIODS

REFERENCES:

1. Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V. Braun
2. Physical Properties of Carbon Nanotubes- R. Saito
4. The search for novel, superhard materials- Stan Vepršek (Review Article) JVST A,
5. Electromagnetic and magnetic properties of multi component metal oxides, hetero
MPE022 MECHANICAL PROCESSING AND PROPERTIES OF NANOSTRUCTURE MATERIALS

UNIT I PROCESSING OF METALS AND ALLOYS 6
Understanding the following processes from the viewpoints of mechanics and processes: rolling, forging, extrusion, wire drawing, sheet metal forming.

UNIT II PROCESSING OF POLYMERS 6
Special techniques like injection moulding, thermoforming, vacuum and pressure assisted forming.

UNIT III PROCESSING OF POWDERS OF METALS AND CERAMICS 8
Selection and characterization of powders, compacting and sintering; mechanical working. Production of Porous and Dense Composite Components: Metal- polymer- and ceramic- based composites.

UNIT IV PROCESSING OF STRUCTURAL AND FUNCTIONAL NANOCRYSTALLINE MATERIALS 10
Properties required of nanocrystalline materials used for structural, hydrogen storage, magnetic and catalytic applications; processing techniques; techniques for retaining the nanocrystalline structure in service.

UNIT V MICROSTRUCTURE AND PROPERTIES 15
Properties slightly dependent on temperature and grain size; properties strongly dependent on temperature and grain size; strengthening mechanisms; enhancement of available plasticity; grain size evolution and grain size control; Hall-Petch relation, microstructure – dislocation interactions at low and high temperatures; effects of diffusion on strength and flow of materials; methods of enhancing or retarding diffusion; grain boundary sliding and grain boundary migration; current limitations on approaches based on dislocation theory; possibilities for predictive design.

TOTAL: 45 PERIODS

REFERENCES:

UNIT I  BULK SYNTHESIS  
Synthesis of bulk nano-structured materials –sol gel processing –Mechanical alloying and mechanical milling- Inert gas condensation technique – Nanopolymers – Bulk and nano composite materials.

UNIT II  CHEMICAL APPROACHES  
Self-assembly, self-assembled monolayers (SAMs). Langmuir-Blodgett (LB) films, clusters, colloids, zeolites, organic block copolymers, emulsion polymerization, templated synthesis, and confined nucleation and/or growth. Biomimetic Approaches: polymer matrix isolation, and surface-templated nucleation and/or crystallization. Electrochemical Approaches: anodic oxidation of alumina films, porous silicon, and pulsed electrochemical deposition.

UNIT III  PHYSICAL APPROACHES  
Vapor deposition and different types of epitaxial growth techniques- pulsed laser deposition, Magnetron sputtering - Micro lithography (photolithography, soft lithography, micromachining, e-beam writing, and scanning probe patterning).

UNIT IV  NANOPOROUS MATERIALS  

UNIT V  APPLICATION OF NANOMATERIALS  

TOTAL: 45 PERIODS

REFERENCES:

MPE024 MECHANICAL BEHAVIOR OF MATERIALS L T P C
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UNIT I BASIC CONCEPTS OF MATERIAL BEHAVIOR 12

UNIT II BEHAVIOUR UNDER DYNAMIC LOADS AND DESIGN APPROACHES 10
Stress intensity factor and fracture toughness – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law.- Safe life, Stress-life, strain-life and fail - safe design approaches -Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT III SELECTION OF MATERIALS 10
Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – 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 – Computer aided materials selection.

UNIT IV MODERN METALLIC MATERIALS 8

UNIT V NON METALLIC MATERIALS 7
Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al₂O₃, SiC, Si₃N₄ CBN and diamond – properties, processing and applications.

REFERENCES: