REGULATIONS - 2013

DEPARTMENT OF
MECHANICAL ENGINEERING

CURRICULUM AND SYLLABI OF
M.E. – MANUFACTURING ENGINEERING
REGULATIONS - 2013
CURRICULUM AND SYLLABI OF FULL TIME
M.E., MANUFACTURING ENGINEERING

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REGULATIONS 2013
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M.E., MANUFACTURING ENGINEERING

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

OBJECTIVE:
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
PEC12 ADVANCED MATERIALS TECHNOLOGY  L  T  P  C
3  0  0  3

AIM:
To impart knowledge on advance concepts of material technology.

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

UNIT I ELASTIC AND PLASTIC BEHAVIOR  10
Elasticity in metals and polymers  Anelastic and visco-elastic behaviour – Mechanism of plastic  
deformation and nonmetallic 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 behaviour – Super plasticity – Deformation of non  
crystalline materials.

UNIT II FRACTURE BEHAVIOUR  10
Griffith’s theory, stress intensity factor and fracture toughness – Toughening  
mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson  
Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high  
cycle fatigue test, crack initiation and propagation mechanisms and Paris law. 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
Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced  
plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides –  
smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

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
   Hill, 2000  

TOTAL: 45 PERIODS


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
6

UNIT II  AUTOMATED MANUFACTURING SYSTEMS
10

UNIT III  GROUP TECHNOLOGY AND FMS
10

UNIT IV  PROCESS PLANNING
10
UNIT V	TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE


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

TOTAL: 45 PERIODS

REFERENCES
PEC14 POLYMERS AND COMPOSITE MATERIALS L T P C
3 0 0 3

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

OBJECTIVE:
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
Chemistry and Classification of Polymers – Properties of Thermo plastics – Properties of Thermosetting Plastics – Applications – Merits and Disadvantages.

UNIT II PROCESSING OF POLYMERS

UNIT III INTRODUCTION TO FIBRES AND COMPOSITE MATERIALS

UNIT IV PROCESSING OF POLYMER MATRIX COMPOSITES

UNIT V PROCESSING OF METAL MATRIX COMPOSITES AND CERAMIC MATRIX COMPOSITES

TOTAL: 45 PERIODS

REFERENCES
PEC15  
APPLIED HYDRAULICS AND PNEUMATICS  
L  T  P  C  
3  0  0  3  

AIM:  
Study the basic functions of Hydraulic and Pneumatic Components and develop the circuits.  

OBJECTIVE:  
To impart the Knowledge of Hydraulic and Pneumatic components application and industrial development.  

UNIT I  
ELEMENTS OF PNEUMATIC SYSTEMS  
9  

UNIT II  
PNEUMATIC SYSTEMS DESIGN  
9  
General approach, travel step diagram. Sequential circuit design, step counter method. K.V. Mapping for minimization of logic equation, fringe condition modules, sizing of components in pneumatic systems.  

UNIT III  
TYPICAL INDUSTRIAL APPLICATIONS OF PNEUMATIC SYSTEMS  
9  
Metal working, handling, clamping, application with counters.  

UNIT IV  
ADVANCED TOPICS IN PNEUMATICS  
9  
Electro pneumatics, ladder diagram. Servo and proportional valves - types, operation, application, hydro-mechanical servo systems. PLC-construction, types, operation, programming  

UNIT V  
DESIGN OF TYPICAL HYDRAULIC SYSTEMS  
9  
Total design of a fluid power system for an industrial application. Specifications of the circuit, circuit design, selection of elements based on force, speed, travel and time, sizing of pipes, design of power packs/selection of compressor, piping layout and accessories.  

TOTAL: 45 PERIODS

REFERENCES  
AIM:
To impart the knowledge and train the students in the area of metal cutting theory and its importance.

OBJECTIVE:
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  9
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  9
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  9
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  9

UNIT V  WEAR MECHANISMS AND CHATTER IN MACHINING  9
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
PEC17 ADVANCED COMPUTING LABORATORY  

L  T  P  C  
0  0  3  2  

AIM:
To train the students in the area of Computer Aided Design & Analysis and Computer Aided Manufacturing.

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

2D AND 3D GEOMETRIC MODELING
1. Exercise on 3D geometric modeling and assembly of Tail Stock.
2. Exercise on 3D geometric modeling and assembly of Screw Jack.
3. Exercise on 3D geometric modeling and assembly of Plummer Block.
4. Exercise on 3D geometric modeling and assembly of Machine Vice.
5. Exercise on 3D geometric modeling and assembly of Lathe Chuck.
6. Exercise on 3D geometric modeling and assembly of Flange Coupling.
7. Exercise on 2D geometric modeling of Sheet Metal Components.

COMPUTER AIDED MANUFACTURING
8. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle

DESIGN AND ANALYSIS
10. Exercises on analysis of Beams with different loading conditions.
11. Exercise on buckling analysis of beams.
12. Exercise on structural analysis with contact options.

TOTAL: 30 PERIODS
PEC21 METAL FORMING PROCESSES L T P C
3 0 0 3

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

OBJECTIVE:
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 9

UNIT II THEORY AND PRACTICE OF BULK FORMING PROCESSES 9
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 9
Formability studies – Conventional processes – HERF techniques – Superplastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, Limitations and application

UNIT IV POWDER METALLURGY AND SPECIAL FORMING PROCESSES 9

UNIT V SURFACE TREATMENT AND METAL FORMING APPLICATIONS 9

TOTAL: 45 PERIODS

REFERENCES
PEC22  MANUFACTURING METROLOGY AND QUALITY  L  T  P  C
CONTROL  3  0  0  3

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.

OBJECTIVE:
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.

TOTAL: 45 PERIODS

REFERENCES
PEC23 COMPOSITE MATERIALS AND MECHANICS  L T P C  3 1 0 4

AIM:
To expose the students, to know the Mechanics of lamina composites.

OBJECTIVE:
To impart through knowledge in laminate composites design.

UNIT I INTRODUCTION  10
Definition - Need - General characteristics, Applications, Fibers -Glass, Carbon, Ceramic and Aramid fibers. Matrices - Polymer, Graphite, Ceramic and Metal Matrices - Characteristic of fibers and matrices. Smart materials - Types and characteristics.

UNIT II MECHANICS AND PERFORMANCE  10
Characteristics of fibre - reinforced Lamina - Laminates - Interlaminar stresses - Static Mechanical Properties fatigue and Impact properties - Environmental effects - Fracture Behaviour and Damage Tolerance.

UNIT III MANUFACTURING  5
Bag Moulding - Compression Moulding - Pultrusion - Filament Winding - Other Manufacturing Processes Quality Inspection methods, Processing of MMC’s.

UNIT IV DESIGN  10
Failure Predictions - Laminate Design Consideration - Bolted and Bonded Joints Design Examples.

UNIT V ANALYSIS  10

TUTORIAL: 15 PERIODS

TOTAL: 60 PERIODS

REFERENCES
PEC24  METROLOGY AND MATERIALS TESTING  L  T  P  C
LABORATORY  0  0  3  2

AIM:
To impart knowledge in the area of metrology and materials testing.

OBJECTIVE:
- To make the students to learn the basic measuring principles followed in metrological instruments.
- To create understanding of testing of mechanical properties of materials.

METROLOGY
2. Study of various types of gauges.
3. Exercises on linear, angular and speed measurements
4. Exercises on Vibration measurements
5. Exercises on Motion controller using AC motor, DC motor, Servo motor and encoder.
7. Exercises on microprocessor based data acquisition system.
8. Exercise on measurements of surface finish parameters.
9. Experiment using pneumatic gauges.

MATERIALS TESTING
10. Study on various standards for testing.
11. Comparison of mechanical properties of any two materials (Metal or non-metal).
12. Exercise on preparation of samples for microstructure study.

TOTAL: 30 PERIODS
PEE2A ADVANCED TOOL DESIGN

AIM:
To measure the importance of various tool design.

OBJECTIVE:
To develop the Knowledge on Tool Design.

UNIT I DESIGN OF SINGLE POINT TOOLS 6
Design of form tools, Selection of tool materials for different application, ISO standard for Inserts, tool holders, Selection of inserts and tool holders for specific examples.

UNIT II DESIGN OF MULTI POINT TOOLS 9
Design of Drills, Reamers, Milling cutters, Tapes and dies, Broaching tools, Gear cutting tools, Thread milling tools for CNC Machining Centers.

UNIT III DESIGN OF CHUCKING SYSTEMS 9
For CNC turning applications.

DESIGN OF JIGS AND FIXTURES: Design of drill jigs and milling fixtures. Welding fixtures, modular fixtures.

UNIT IV DESIGN OF TOOLS FOR PRESS WORK 9
Design of simple, compound and progressive tools, study of power presses and accessories, Application of EDM for tool making.

UNIT V DESIGN OF PLASTIC MOLD DESIGN 12
Design of Thermo plastic tools, two and three plate, design of runner, gate, cooling line, ejection.

DESIGN OF GAUGES: Plug, Ring, Snap, thread gauges, Application of Sine bar, Slip gauges and Air gauges, Toolings for Casting.

TOTAL: 45 PERIODS

REFERENCES
PEE2B ADVANCES IN CASTING AND WELDING L T P C
PROCESSES 3 0 0 3

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

OBJECTIVE:
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
PEE2C  INSTRUMENTATION FOR NON-DESTRUCTIVE TESTING  
(Common to C&I, MPE)  

AIM:  
To stress the importance of NDT in Engineering.  

OBJECTIVE:  
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 Nondestructive Tests, Conditions for effective non-destructive testing 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  ELECTROMAGNETIC TESTING  


Magnetic Particle Testing: Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications.  

UNIT III  RADIOGRAPHY AND THERMOGRAPHY  

Principle of Radiography, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique, Applications and limitations of radiographic inspection - Real Time Radiography  


UNIT IV  ULTRASONIC AND ACCOUSTIC EMISSION TESTING  


Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.  

UNIT V  INDUSTRIAL APPLICATIONS, COMPARISON AND SELECTION OF NDT METHODS  

Applications of NDE in Nuclear, Aircraft, Automotive and petroleum Industries. A Comparison and selection of various NDT techniques. Codes, standards, specification and procedures.  

TOTAL: 45 PERIODS
REFERENCES
4. WWW.ndt.net
PEE2D  ARTIFICIAL INTELLIGENCE  L  T  P  C  
3  0  0  3

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  6

UNIT II  FUZZY LOGIC APPLICATIONS  9

UNIT III  INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS  9

UNIT IV  OTHER ANN ARCHITECTURES  9

UNIT V  RECENT ADVANCES  12

TOTAL: 45 PERIODS

REFERENCES
PEE2E DESIGN FOR MANUFACTURING AND ASSEMBLY  L  T  P  C  
3 0 0 3

AIM:
To know the basics of Design based on Manufacturing and Assembly.

OBJECTIVE:
To make the students familiar with the concepts of design and modeling of mechanical components.
To develop the Knowledge on tolerance, dimensions, manufacturing and applications of software’s.

UNIT I TOLERANCE ANALYSIS 6

UNIT II TOLERANCE ALLOCATION 9

UNIT III GD&T 9

UNIT IV TOLERANCE CHARTING 9

UNIT V MANUFACTURING GUIDELINES 12

TOTAL: 45 PERIODS

REFERENCES
PEE2F  FINITE ELEMENT APPLICATION IN MANUFACTURING  L  T  P  C
3  0  0  3

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  9
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  9
Shape functions for one and two dimensional elements- Three noded triangular and four noded 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  12

TOTAL: 45 PERIODS

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

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

UNIT I INTRODUCTION
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
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

UNIT IV SIMULATION LANGUAGE
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
Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems – case studies.

TOTAL: 45 PERIODS

REFERENCES
PEE2H  MECHANICAL BEHAVIOR OF MATERIALS  L T P C
3 0 0 3

AIM:
To Study the Mechanical Behaviour of Materials

OBJECTIVE:
To know the mechanical behavior of materials under various loading Conditions.

UNIT I  BASIC CONCEPTS OF MATERIAL BEHAVIOR  10

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 – Akrometals, 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:
PEE2J  OPTIMISATION TECHNIQUES IN ENGINEERING  L  T  P  C  
3  0  0  3

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

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

UNIT I  INTRODUCTION  5

UNIT II  CLASSIC OPTIMIZATION TECHNIQUES  10

UNIT III  NON-LINEAR PROGRAMMING  9
Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming – Geometric programming

UNIT IV  INTEGER AND DYNAMIC PROGRAMMING AND NETWORK  TECHNIQUES  12

UNIT V  ADVANCES IN SIMULATION  9
Genetic algorithms – simulated annealing – Neural Network and Fuzzy systems

TOTAL: 45 PERIODS

REFERENCES
PEE2K PROBABILITY AND STATISTICS

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**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**
Random variables – probability density and distribution functions-moment generating and characteristic functions – Binomial, Poisson, Normal distributions and their applications.

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

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

**UNIT IV TESTING OF HYPOTHESIS AND ANOVA**
Hypothesis testing – Small samples – Tests concerning proportion, means, standard deviations – Tests based on chi square – Non parametric methods – Sign test – Rank sum test One, two factor models-Design of experiments

**UNIT V CORRELATION, REGRESSION AND TIME SERIES ANALYSIS**

**TOTAL: 45 PERIODS**

**REFERENCES**
PEE2L RAPID MANUFACTURING L T P C
3 0 0 3

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

OBJECTIVE:
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 9

UNIT II DESIGN STATE 9
Life cycle design of products – opportunity for manufacturing enterprises – modality of concurrent engineering design – Automated Analysis Idealization control – concurrent Engineering in optimal structural design – Real time constraints

UNIT III MANUFACTURING CONCEPTS AND ANALYSIS 9

UNIT IV RAPID PROTOTYPE TOOLING PROCESSES 9

UNIT V MODULAR AND RAPID TOOLING 9
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
PEE2M ROBOT DESIGN AND PROGRAMMING  L  T  P  C
3  0  0  3

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

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

UNIT I  INTRODUCTION  9
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 II  ROBOT KINEMATICS  9

UNIT III  ROBOT DYNAMICS AND TRAJECTORY PLANNING  9
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  9
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  9
Design of Robots – characteristics of actuating systems, comparison, microprocessors control of electric motors, magneto strictive 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
PEE3A  ADVANCED MANUFACTURING PROCESSES  L  T  P  C

3  0  0  3

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 fabrication and devices

UNIT I  NEWER MACHINING PROCESSES - I 9
(Non thermal energy) – Abrasive machining – water jet machining - ultrasonic machining–
chemical machining – electro chemical machining – construction working principle – steps -
types – process parameters – derivations – problems, merits, demerits and applications.

UNIT II  NEWER MACHINING PROCESS – II 9
Wire cut EDM - Electro chemical machining – ECG - Electric discharge machining –
applications.

UNIT III  NEWER MACHINING PROCESS – III 9
Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam
machining – construction working principle types – process parameter – derivations –
problems, merits, demerits and applications.

UNIT IV  FABRICATION OF MICRO DEVICES 9
Semiconductors – films and film de purification – Oxidation - diffusion – ion implantation –
etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free
form fabrication.

UNIT V  MICRO FABRICATION TECHNOLOGY 9
Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology –
programmable devices & ASIC – electronic material and processing.– stereo lithography
SAW devices, Surface Mount Technology

TOTAL: 45 PERIODS

REFERENCES
Co.,1980
PEE3B  COMPUTER AIDED PRODUCT DESIGN   L T P C
3  0  0  3

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

OBJECTIVE:
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  8
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  8

UNIT III  PRODUCT DESIGN CONCEPTS  8

UNIT IV  PRODUCT DESIGN TOOLS & TECHNIQUES  12

UNIT V  PRODUCT DATA MANAGEMENT  9

TOTAL: 45 PERIODS

TEXT BOOK

REFERENCES
### PEE3C  FINANCIAL MANAGEMENT  

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**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.

**OBJECTIVE:**
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**

PEE3D  INDUSTRIAL ERGONOMICS  L  T  P  C
3   0   0   3

AIM:
To introduce the concepts of human and Environmental factors for man and Machine.

OBJECTIVE:
To train the students based on ergonomics and work Physiology

UNIT I  INTRODUCTION  9

UNIT II  ANTHROPOMETRY  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  DESIGN OF SYSTEMS  9

UNIT IV  ENVIRONMENTAL FACTORS IN DESIGN  10

UNIT V  WORK PHYSIOLOGY  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.

TOTAL: 45 PERIODS

REFERENCES
NANO COMPOSITES

PEE3E

L  T  P  C
3  0  0  3

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

OBJECTIVE:
To study Nano matrix-Polymer, Metal and Ceramics matrix materials,
To develop knowledge on processing, interfacial properties and application of Nano Composites.

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 NANO COMPOSITES
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; Polymer carbon 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
4. The search for novel, superhard materials- Stan Vepřek (Review Article) JVST A, 1999
PEE3F LEAN MANUFACTURING SYSTEM AND IMPLEMENTATION L T P C
3 0 0 3

AIM:
To introduce the concepts of lean manufacturing system.

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

UNIT I INTRODUCTION 7

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
PEE3G MANUFACTURING MANAGEMENT  L  T  P  C  3  0  0  3

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  7

UNIT II  WORK STUDY  9

UNIT III  PROCESS PLANNING AND FORECASTING  10
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  9

UNIT V  PERSONNEL AND MARKETING MANAGEMENT  10

TOTAL: 45 PERIODS

REFERENCES
PEE3H  MATERIALS MANAGEMENT AND LOGISTICS    L  T  P  C
3 0 0 3

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
6
Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II   MANAGEMENT OF PURCHASE
7

UNIT III   MANAGEMENT OF STORES AND LOGISTICS
12

UNIT IV   MATERIALS PLANNING
10

UNIT V   INVENTORY MANAGEMENT
10
ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

TOTAL: 45 PERIODS

REFERENCES
PEE3J MECHANICAL PROCESSING AND PROPERTIES OF NANOSTRUCTURE MATERIALS 3 0 0 3

AIM:
To know the processing and properties of Nano Structure materials.

OBJECTIVE:
To Study the Structure, Processing and Properties of Metals Ceramics and Polymers

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 7
Special techniques like injection moulding, thermoforming, vacuum and pressure assisted forming.

UNIT III PROCESSING OF POWDERS OF METALS AND CERAMICS 12
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 10
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
PEE3K MEMS AND NANOTECHNOLOGY  L  T  P  C
3  0  0  3

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

OBJECTIVE:
To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be award of micro actuators.
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 epitoxy – 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

PEE3L QUALITY AND RELIABILITY ENGINEERING L T P C
3 0 0 3

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.

OBJECTIVE:
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 AND STATISTICAL PROCESS CONTROL 6

UNIT II ACCEPTANCE SAMPLING 7

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 12

UNIT IV CONCEPT OF RELIABILITY 10
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, covariantmodels, static models, dynamic models.

UNIT V DESIGN FOR RELIABILITY AND MAINTAINABILITY 10
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.

REFERENCES

TOTAL: 45 PERIODS
PEE3M SYNTHESE AND APPLICATIONS OF NANOMATERIALS

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

OBJECTIVE:
To study Nano matrix-Polymer, Metal and Ceramics matrix materials, To develop knowledge on processing, interfacial properties and application of Nano Composites.

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

UNIT II CHEMICAL APPROACHES
Self-assembly, self-assembled mono layers (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