PROGRAM EDUCATIONAL OBJECTIVES (PEO)

I. The graduates acquire ability to create model, design, synthesize and analyze essential production operational skills, mechanism and automation system.

II. The graduates use their talent, self-confidence, knowledge and engineering practice which facilitate them to presume position of scientific and/or managerial leadership in their career paths.

III. The graduates apply their consciousness of moral, professional responsibilities and motivation to practice life-long learning in a team work environment.

PROGRAMME OUTCOMES (PO)

1. Graduate will demonstrate strong basics in mathematics, science and engineering which serve as the foundation for the Programme.

2. Graduate will demonstrate the ability to design and conduct experiments, as well as to analyse and interpret data in the spheres of fundamental engineering.

3. Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

4. Graduate will become familiar with modern engineering tools and analyse the problems within the domains of Production Technology as the members of multidisciplinary teams.

5. Graduate will acquire the capability to identify, formulate and solve engineering problems related to production engineering.

6. Graduate will demonstrate an understanding of professional and ethical responsibility with reference to their career in the field of production engineering.

7. Graduate will be able to communicate effectively both in verbal and non verbal forms.

8. Graduate will be trained towards developing and understanding the impact of development of Production Technology on global, economic, environmental and societal context.

9. Graduate will be capable of understanding the value for life-long learning.

10. Graduate will demonstrate knowledge of contemporary issues pertaining to the health and well being of desirable living forms inhabiting the environment.

11. Graduate will demonstrate the ability to use the techniques, skills and modern engineering tools necessary for engineering practice in the field of Production Engineering.

12. Graduate will be able to design and develop innovative/ manufacturable / marketable / environmental friendly products useful to the nation and the society.
13. Graduate will be able to manage any organisation well and will be able to emerge as a successful entrepreneur.

### Mapping of PEOs with POs

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### UNIVERSITY DEPARTMENTS
ANNA UNIVERSITY :: CHENNAI 600 025
REGULATIONS - 2015
M.E. MANUFACTURING ENGINEERING (FT & PT)
I TO IV SEMESTERS CURRICULUM AND SYLLABUS

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 75**
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**SEMESTER VI**

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 75**
### FOUNDATION COURSES (FC)

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### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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[Signature]

Director

Centre for Academic Courses
Anna University, Chennai-600 025
AIM: To introduce the concepts of probability, sampling techniques, estimation to the students.

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

UNIT I  PROBABILITY THEORY  15
Random variables – probability density and distribution functions-moment generating and characteristic functions – Binomial, Poisson, Normal distributions and their applications.

UNIT II  SAMPLING THEORY  15
Sampling distributions – Standard error – t, F, Chi square distributions – applications.

UNIT III  ESTIMATION THEORY  10
Interval estimation for population mean, standard deviation, difference in means, preparation ratio of standard deviations and variances.

UNIT IV  TESTING OF HYPOTHESIS AND ANOVA  10

UNIT V  ANOVA  10
Design of experiments – One, Two factor Models

TOTAL: 60 PERIODS

OUTCOMES:
- To introduce the concepts of probability, sampling techniques, estimation to the students.
- To impart knowledge in the field of ANOVA

REFERENCES:
1. Levin and Rubin, Statistics for Management, Pearson Education India, 2011

AIM: To introduce the various concepts of Research Methodology

OBJECTIVE
- To introduce various types of Research Design
To introduce various sampling techniques, statistical analysis and interpretation of the results.

UNIT I  INTRODUCTION  15

UNIT II  RESEARCH DESIGN  10

UNIT III  SAMPLING DESIGN  10

UNIT IV  PROCESSING AND ANALYSIS OF DATA  10

UNIT V  INTERPRETATION, REPORT WRITING  15

TOTAL: 60 PERIODS

OUTCOMES:
- To introduce various types of Research Design
- To introduce various sampling techniques, statistical analysis and interpreting of the results.

REFERENCE:
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 various design procedures.

UNIT I INTRODUCTION

UNIT II FLUID POWER GENERATING/UTILIZING ELEMENTS

UNIT III CONTROL AND REGULATION ELEMENTS
Direction flow and pressure control valves-Methods of actuation, types, sizing of ports-pressure and temperature compensation, overlapped and underlapped spool valves-operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance.

UNIT IV CIRCUIT DESIGN

UNIT V ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS
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.

OUTCOMES
- The students will be able to understand the working principle of hydraulic and pneumatic components and its selection and design the hydraulic and pneumatic circuits for different applications

REFERENCES:

MN7103 MODERN 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

UNIT II NEWER MACHINING PROCESS – II

UNIT III NEWER MACHINING PROCESS – III

UNIT IV FABRICATION OF MICRO DEVICES

UNIT V MICROFABRICATION TECHNOLOGY
Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.– stereolithography SAW devices, Surface Mount Technology,

TOTAL: 45 PERIODS
OUTCOMES:
- 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.

REFERENCES:

MN7151 MATERIALS TECHNOLOGY

AIM: To impart knowledge on the advanced concepts of material technology

OBJECTIVES:
- To make the students to understand on elastic, plastic and fractured behaviour of engineering materials.
- To train the students in selection of metallic and non-metallic materials for the various engineering applications.

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

UNIT II FRACTURE BEHAVIOUR
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
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

OUTCOMES:
- To impart knowledge on the advanced concepts of material technology
- To impart knowledge in the elastic, plastic, fracture behaviour of materials.
- The students will be able to understand the application and selection of materials for aerospace, automobile, marine etc.

REFERENCES:

MANUFACTURING AND AUTOMATION LAB

OBJECTIVE:
1. To study the functional aspects of different pneumatic and hydraulic Components and its use in circuits.
2. To train the student in machining and prototyping the models using advanced manufacturing machines

MANUFACTURING LAB
1. Plate cutting in abrasive water jet machine
2. Micro hole drilling in ECM
3. Model fabrication in simple CNC router machine
4. 3D model fabrication using RPT machine
5. A study on WEDM Machine and its operations
AUTOMATION LAB
1. Study and use of pneumatic and hydraulic elements.
2. Simulation of speed control circuits in a hydraulic trainer.
3. Simulation of hydraulic circuits in a hydraulic trainer.
4. Simulation of single and double acting cylinder circuits using different directional control values.
5. One shot and regenerative pneumatic circuits.
7. Simulation of Electro-pneumatic circuits.
8. Simulation of Logic pneumatic circuits.
9. Simulation of electro pneumatic sequencing circuits.
10. Simulation of PLC based electro pneumatic sequencing circuits.
11. Simulation of pneumatic circuits using PLC.
12. To design and connect the circuits for the given problem (case study).
13. To compare the ladder diagram for electrical and PLC control for the given sequence.
14. Simulation of circuit for the given sequence using software.

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to design, model and automate simple and complicated industrial automation using hydraulics and pneumatics.
- The students will be able to understand the cutting edge technology by operating the advanced manufacturing machines and the student will be able to do some research work in the manufacturing area.

MN7201 COMPUTER INTEGRATED MANUFACTURING

AIM: To expose the students on the need of automation and integration.

OBJECTIVES:
- To teach the role of computers in processing of information knowing across the various stages and various departments in a manufacturing industries.
- To train them in process planning.

UNIT I INTRODUCTION
6

UNIT II AUTOMATED MANUFACTURING SYSTEMS
10
Automated production line – system configurations, work part transfer mechanisms – Fundamentals of Automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly – Overview of material handling equipments – Consideration in material handling system design – The 10 principles of...

UNIT III GROUP TECHNOLOGY AND FMS 10

UNIT IV PROCESS PLANNING 10

UNIT V TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE 9

TOTAL : 45 PERIODS

OUTCOMES:
- To teach the role of computers in processing of information knowing across the various stages and various departments in a manufacturing industries
- To train them in process planning.

REFERENCES:
MN7202 MANUFACTURING METROLOGY L T P C 3 0 2 4

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.
- To train them in the area of precision and quality manufacturing.

UNIT I LASER METROLOGY AND PRECISION INSTRUMENTS 15

UNIT II CO-ORDINATE MEASURING SYSTEM 15

UNIT III OPTO ELECTRONICS AND VISION SYSTEM 12

UNIT IV QUALITY IN MANUFACTURING AND DESIGN ENGINEERING 13


UNIT V QUALITY MANAGEMENT SYSTEM AND CONTINUOUS IMPROVEMENT


LIST OF EXPERIMENTS

2. Inspection of Internal and External taper angle.
6. Inspection of screw thread parameters using three wire method.
8. Tool makers microscope- thread parameter measurement.
10. Inspection using vision measuring system.
11. Measurements using CMM.
12. Straightness measurement using Autocollimator.
14. Measurement of dimensions using LASER.

TOTAL: 60 PERIODS

OUTCOMES:

- To impart through knowledge in various latest measurement systems such as laser metrology, coordinate measuring machines and electro-optical devices.
- To train them in the area of precision and quality manufacturing

REFERENCES

AIM:
- This course aims to impart knowledge on various techniques of material characterization.

OBJECTIVE:
- On completion of the course the students are expected to be knowledgeable in microstructure evaluation, crystal structure analysis, electron microscopy, Chemical Thermal Analysis, static and dynamic mechanical testing methods.

UNIT I MICRO AND CRYSTAL STRUCTURE ANALYSIS

UNIT II ELECTRON MICROSCOPY

UNIT III CHEMICAL AND THERMAL ANALYSIS

UNIT IV MECHANICAL TESTING – STATIC TESTS

UNIT V MECHANICAL TESTING – DYNAMIC TESTS

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to test and quantify the mechanical properties of Engineering Materials, Engines and Heat Exchangers
TEXT BOOKS:

REFERENCES:

MN7204 PRODUCTION AND OPERATIONS MANAGEMENT L T P C 3 0 0 3

AIM:
To provide a broad introduction to the field of operations management and explain the concepts, strategies, tools and techniques for managing the transformation process that can lead to competitive advantage.

OBJECTIVE:
Understanding of the strategic and operational decisions in managing manufacturing and service organizations and appreciation of the role of operations management function in an organization.

UNIT I INTRODUCTION TO OPERATIONS MANAGEMENT 9
Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy – Strategic fit, framework; Supply Chain Management

UNIT II FORECASTING, CAPACITY AND FACILITY DESIGN 9
UNIT III  DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS  9

UNIT IV MATERIALS MANAGEMENT  9

UNIT V SCHEDULING AND PROJECT MANAGEMENT  9
Project Management – Scheduling Techniques, PERT, CPM; Scheduling - work centers – nature, importance; Priority rules and techniques, shopfloor control; Flow shop scheduling – Johnson’s Algorithm – Gantt charts; personnel scheduling in services.

TOTAL: 45 PERIODS

OUTCOMES:
- Understanding of the strategic and operational decisions in managing manufacturing and service organizations and appreciation of the role of operations management function in an organization.

TEXTBOOKS

REFERENCES

MN7211 CIM AND SOFT SKILL DEVELOPMENT LAB L T P C
0 0 4 2

AIM:
To impart the knowledge on training the students in the area of CAD/CAM
OBJECTIVES:
1. To teach the students about the drafting of 3D components and analyzing the same using various CAD packages and programming of CNC machines
2. To train them to use the various sensors
3. To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
4. To help them improve their soft skills, including report writing, necessary for the workplace situations

CAM LABORATORY
1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle

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.

SOFTSKILLS LAB
1. Making presentations – introducing oneself – introducing a topic – answering questions individual presentation practice
2. Creating effective PPTs – presenting the visuals effectively
3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.
4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills mock GD
8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL: 60 PERIODS

OUTCOMES:
- To teach the students about the drafting of 3D components and analyzing the same using various CAD packages and programming of CNC machines
- To train them to use the various sensors
- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
- To help them improve their soft skills, including report writing, necessary for the workplace situations
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  10
Fundamentals – Initial, boundary and eigen value problems – weighted residual, Galerkin and Rayleigh Ritz methods - Integration by parts – Basics of variational formulation – Polynomial and Nodal approximation.

UNIT II  ONE DIMENSIONAL ANALYSIS  15
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  15
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  10
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

Finite element analysis Lab
1. One Dimensional FEA Problem.
   a. Truss structure analysis.
   b. Cantilever beam analysis.
   c. Temperature distribution problem.
2. Two Dimensional FEA Problems.
   a. Plane stress analysis.
   b. Axisymmetric analysis.
   c. Vibration Analysis.
3. Three Dimensional FEA Problems.
   a. 3D Shell Analysis.
   b. 3D Contact Analysis.
4. FEA Application in metal forming like superplastic forming, deep drawing etc
5. FEA Application in Metal cutting
6. FEA Application in Casting process

OUTCOMES:
- The students will be able to apply the principles of Finite Element Analysis to solve problems in the field of production engineering.

REFERENCES:
7. www.tbook.com
8. www.pollockeng.com

MN7302 ROBOT DESIGN AND PROGRAMMING  
L T P C  
3 0 2 4

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
- To expose the students to build a robot for any type of application

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 II 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 10
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 10
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.

Robotics Lab
1. Modelling and simulation of mechanisms using ADAMS
2. Kinematics and synthesis of 2 DOF RR configuration robot
3. Robotic joint control using stepper motor interfacing
4. Experimental verification of fruedenstein equation for 1 DOF
5. Robot programming for pick and place operation
6. Robot programming for palletizing operation
7. Gripper force analysis for
   a. Screw actuated gripper
   b. Vacuum gripper
   c. Mechanical Linkage type of gripper
8. Dynamic analysis of 1 DOF robot
9. Trajectory planning of 1 DOF robot

TOTAL: 60 PERIODS

OUTCOMES:
• To teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors
• To expose the students to build a robot for any type of application

REFERENCES

MN7311 PROJECT WORK PHASE I

OBJECTIVES
• A project topic may be selected based on the literature survey and the creative ideas of the students themselves in consultation with their project supervisor.
• The topic should be so chosen that it will improve and develop the skills to design, fabricate, analyse, test and research. Literature survey and a part of the project work be carried out in phase I.
• The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.
• A project report for phase I is to be submitted at the end.

EVALUATION
• Project work evaluation is based on the Regulations of the Credit system for the Post graduate programmes of Anna University

TOTAL : 90 PERIODS

OUTCOME
The students would apply the knowledge gained from theoretical and practical courses in solving problems, so as to give confidence to the students to be creative, well planned, organized, coordinated in their project work phase – II.

MN7411 PROJECT WORK PHASE II

OBJECTIVES
• To continue the work from phase I and complete the project work in order to meet the stated objectives of the topic chosen.
• The progress of the project is evaluated based on a minimum of three reviews.
• The review committee may be constituted by the Head of the Department.
• A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Division based on oral presentation and the project report
• To improve the research and development activities of the students.

EVALUATION
• Project work evaluation is based on the Regulations of the Credit system for Post graduate programmes of Anna University

TOTAL = 180 PERIODS

OUTCOME
The students' would apply the knowledge gained from theoretical and practical courses in solving problems, so as to give confidence to the students to be creative, well planned, organized, coordinated project outcome of the aimed work.

ED7080 SURFACE ENGINEERING

OBJECTIVES:
To impart knowledge on surface engineering and surface modification methods that will come in handy to solve the industrial problems. This will also serve as a precursor for future research in the same field.

UNIT I FRICTION
Topography of Surfaces – Surface features – Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction – Rolling Friction – Friction properties of metallic and non metallic materials – Friction in extreme conditions – Thermal considerations in sliding contact

29
UNIT II WEAR
6
Introduction – Abrasive wear, Erosive, Cavitation, Adhesion, Fatigue wear and Fretting
Wear- Laws of wear – Theoretical wear models – Wear of metals and non metals -
International standards in friction and wear measurements

UNIT III CORROSION
10
Introduction – Principle of corrosion – Classification of corrosion – Types of corrosion –
Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated
service, Laboratory testing – Evaluation of corrosion – Prevention of Corrosion –
Material selection, Alteration of environment, Design, Cathodic and Anodic Protection,
Corrosion inhibitors

UNIT IV SURFACE TREATMENTS
12
Introduction – Surface properties, Superficial layer – Changing surface metallurgy –
Wear resistant coatings and Surface treatments – Techniques – PVD – CVD – Physical
CVD – Ion implantation – Surface welding – Thermal spraying – Laser surface hardening
and alloying, Applications of coatings and surface treatments in wear and friction control
– Characteristics of Wear resistant coatings – New trends in coating technology – DLC –
CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant
coatings

UNIT V ENGINEERING MATERIALS
10
Introduction – Advanced alloys – Super alloys, Titanium alloys, Magnesium alloys,
Aluminium alloys, and Nickel based alloys – Ceramics – Polymers – Biomaterials –
Applications – Bio Tribology Nano Tribology.

TOTAL: 45 PERIODS

OUTCOMES:
• To impart knowledge on surface engineering and surface modification methods
  that will come in handy to solve the industrial problems. This will also serve as a
  precursor for future research in the same field.

REFERENCES
   Heinemann, UK, 2005
   Hill, 1985

MN7001 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.

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  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  8

UNIT III  PRODUCT DESIGN CONCEPTS AND PRODUCT DATA MANAGEMENT  10

UNIT IV  PRODUCT DESIGN TOOLS & TECHNIQUES  10

UNIT V  PRODUCT DESIGN TECHNIQUES  9

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to apply the principles of automation and employ the computers for various manufacturing activities.

REFERENCES:

MN7002  CONCEPTS OF GREEN MANUFACTURING  L T P C
3 0 0 3

OBJECTIVE:
- To introduce the concept of Green Manufacturing to the students.
UNIT I AIR POLLUTION SAMPLING AND MEASUREMENT
Primary and Secondary Pollutants, Automobile Pollutants, Industrial Pollution, Ambient air quality Standards, Metrological aspects of air Pollution, Temperature lapse Rates and Stability-wind velocity and turbulence-Pump behavior dispersion of air Pollutants-solution to the atmosphere dispersion equation-the Gaussian Plume Model, Air pollution sampling-collection of gaseous air pollutants collection of particulate pollutants-stock sampling, analysis of air pollutants-sulfur dioxide-nitrogen dixide, carbon monoxide, oxidants and ozone

UNIT II NOISE POLLUTION & CONTROL
Frequency and Sound Levels, Units of Noise based power radio, contours of Loudness. Effect of human, Environment and properties, Natural and Anthrogenic Noise Sources, Measuring Instruments for frequency and Noise levels, Masking of sound, Types, Kinetics, Selection of different reactors used for waste treatment, Treatment of noise at source, Path and Reception, Sources of noise, Effects of noise-Occupational Health hazards, thermal Comforts, Heat Island Effects, Radiation Effects.

UNIT III WATER DEMAND, WATER QUALITY
Factors affecting consumption, Variation, Contaminants in water, Nitrates, Fluorides, Detergents, taste and odour, Radio activity in water, Criteria, for different impurities in water for portable and non portable use, Point and non-point Source of pollution, Major pollutants of Water, Water Quality Requirement for different uses, Global water crisis issues.

UNIT IV FIRE SAFETY

UNIT V SAFETY RADIATION PROTECTION
Radiation fundamentals-Types of radiation Ionizing and Non-lonizing radiation, their uses and biological effects. Radioactive waste disposal radioactive soil, water and air and their fate. Treatment and disposal Liquid and solid Radioactive wastes.

TOTAL: 45 PERIODS

OUTCOMES:
- To introduce the concept of Green Manufacturing to the students.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the business process of an enterprise
- To grasp the activities of ERP project management cycle
- To understand the emerging trends in ERP developments

UNIT I INTRODUCTION
Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems.

UNIT II ERP SOLUTIONS AND FUNCTIONAL MODULES
Overview of ERP software solutions- Small, medium and large enterprise vendor solutions, BPR, and best business practices - Business process Management, Functional modules.

UNIT III ERP IMPLEMENTATION

UNIT IV POST IMPLEMENTATION
Maintenance of ERP - Organizational and Industrial impact; Success and Failure factors of ERP Implementation.

UNIT V EMERGING TRENDS ON ERP

OUTCOMES:
- To understand the business process of an enterprise
- To grasp the activities of ERP project management cycle
- To understand the emerging trends in ERP developments

TEXTBOOK

REFERENCES
4. Mahadeo Jaiswal and Ganesh Vanapalli, ERP Macmillan India, 2009
MN7004  FINANCIAL MANAGEMENT  L T P C
                 3 0 0 3

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
  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
Elements of cost - cost classification - material cost - labour costs - overheads - cost of a
product - costing systems - cost determination - process - costing - Allocation of
overheads - Depreciation - methods.

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

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

REFERENCES:
4. R Kesavan, C.Elanchezian, Vijayaramnath, Process Planning and cost estimation,
   New Age International Publishers, New Delhi 2004
5. RKesavan, C.Elanchezian, Sundar Selwyn, Engineering Economics and Financial
   Analysis Anuratha Publications, Chennai, 2006
OBJECTIVES:
- To impart knowledge in various manufacturing methods in developing automotive components.
- To study the principle of automobile engineering.

UNIT I  MATERIAL NEEDS IN AUTOMOBILE  9

UNIT II  MATERIALS AND TECHNOLOGIES FOR AUTOMOBILE  8

UNIT III  MANUFACTURING OF ENGINE PARTS I  10

UNIT IV  MANUFACTURING OF ENGINE PARTS II  8

UNIT V  MANUFACTURING OF ENGINE PARTS III  10

TOTAL: 45 PERIODS

OUTCOMES:
- To impart knowledge in various manufacturing methods in developing automotive components.
- To study the principle of automobile engineering.

TEXT BOOKS:

REFERENCES:
MN7006 MANUFACTURING TECHNIQUES  L T P C  3 0 0 3  

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 expose the students on the various technique developed in manufacturing  
- To get an idea to implement the modern manufacturing techniques

UNIT I AGILE PRODUCTION SYSTEM AND PRACTICES  9  
Agile production system – the task aligned organization – agile manufacturing production system – production planning and control, quality assurance, purchasing, maintenance, overview of production support, business operation, engineering, human resource, finance and accounting.

Agile practices – Agile practice for product development – manufacturing agile practice – understanding the value of investing in people, removing inappropriate fear from the shop floor – not scarifying agility for perfectionism

UNIT II MANAGEMENT IN THE AGILE ORANIZATION  9  
Old management styles, role of manager in an agile organization – vision champion, team leader, coach, business analyzer, supporting the new culture – performance appraisal systems, selection systems, reward and recognition systems, organizational measurement, organizational learning processes.

UNIT III VARIOUS ELEMENTS IN LEAN MANUFACTURING  9  
Organization element – communication planning, product – focused responsibility, leadership development, operational roles and responsibilities, workforce preparation.  
Matrics element – DuPont model, output-based measures, process – driven measures, goal alignment through polity deployment, measurement definition and understanding.  
Logistics element – planning/control function, A,B,C material handling, service cells, JIT Kanban, demand signals, cell team work plan, mix-model manufacturing. Manufacturing flow element – product/quantity analysis, process mapping, routing analysis, takt time, workload balancing and one piece flow, cell layout, kanban sizing.

UNIT IV VALUE STREAM MAPPING  9  
the VSM – example illustrating the development of VSM – current state mapping – future state mapping.

UNIT V ADDITIVE MANUFACTURING
9

Basics of Rapid Tooling, software for RP and Rapid manufacturing process optimization
TOTAL: 45 PERIODS

OUTCOMES:
• The students will obtain knowledge to try the relevant technique for manufacturing.
• Students gain confident to improve the manufacturing by adopting the suitable techniques.

REFERENCES:

MN7007 MECHATRONICS IN MANUFACTURING PROCESSES L T P C
3 0 0 3

OBJECTIVES:
This syllabus is formed to create knowledge in Mechatronics systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives the frame work of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering.

UNIT I INTRODUCTION
7

UNIT II SENSORS AND TRANSDUCERS
12
UNIT III  MICROPROCESSORS AND MICROCONTROLLERS  12
Introduction – Architectures of 8 – bit microcontrollers (8051) series, PIC Microcontrollers (16f xxx) series – Assembly language programming instruction format, addressing modes, instruction sets, Basic program examples interface of keypads, leds, leds, A/D and D/A Converters, RS 232 serial communication interface, classification of memories.

UNIT IV  ACTUATORS  8

UNIT V  MECHATRONIC SYSTEMS  6
Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies – Engine management system, Automatic camera, Automatic wishing machine, Pick and place robots.

OUTCOMES:
- This syllabus is formed to create knowledge in Mechatronics systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives the frame work of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering.

REFERENCES:
2. W.Bolton, —MICHATRONICSǁ Pearson Education Limited, 2004

MN7008 METAL CUTTING THEORY AND PRACTICE   L T P C  3 0 0 3

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  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
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

### OUTCOMES:
- The students will be able to apply the principles of metal cutting theory and employ the various aspects in manufacturing activities.

### REFERENCES

### MN7009 MICRO MANUFACTURING

| AIM: | To impart the principles of various basic micro manufacturing process |
| OBJECTIVE: | The objective of the course is to acquaint the students with the principles, basic machine tools, and developments in the micro manufacturing process and research trends in the area of micro manufacturing process. |

### UNIT I MICRO MACHINING I
UNIT II  MICRO MACHINING II

UNIT III  NANO POLISHING

UNIT IV  MICRO FORMING AND WELDING

UNIT V  RECENT TRENDS AND APPLICATIONS

OUTCOMES:
The objective of the course is to acquaint the students with the principles, basic machine tools, and developments in the micro manufacturing process and research trends in the area of micro manufacturing process.

REFERENCES:
8. www.cmxr.com/industrial/

MN7010  MICRO SYSTEM TECHNOLOGY

AIM: To inspire the students to expect to the trends in manufacturing of 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 OVER VIEW OF MEMS AND MICROSYSTEMS
Definition – historical development – properties, design and fabrication micro-system, microelectronics, working principle, applications and advantages of micro system. Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds - silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers.

UNIT II FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING

UNIT III MICRO DEVICES

UNIT IV SCIENCE AND SYNTHESIS OF NANO MATERIALS

UNIT V CHARACTERIZATION OF NANO MATERIALS

TOTAL: 45 PERIODS

OUTCOMES:
- 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.

REFERENCES:

MN7011 OPTIMIZATION TECHNIQUES

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
Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming – Geometric 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

OUTCOMES:
• The students will be able to study a given problem, formulate and model it suitably, select an appropriate optimisation technique, solve, find and implement the optimal solution.
REFERENCES:

MN7012 PROCESSING OF POLYMERS AND COMPOSITES L T P C
3 0 0 3

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

OBJECTIVES:
- To study matrix material, reinforcements of polymer matrix composites, MMC and ceramic matrix composites.
- To develop knowledge on processing, interfacial properties and application of composites.

UNIT I PROCESSING OF POLYMERS

UNIT II FIBERS AND MATRIX MATERIALS

UNIT III PROCESSING OF POLYMER MATRIX COMPOSITES
UNIT IV  PROCESSING OF METAL MATRIX COMPOSITES

UNIT V  PROCESSING OF CERAMIC MATRIX COMPOSITES AND CARBON-CARBON COMPOSITES
Processing of CMCs: cold pressing, sintering, reaction bonding, liquid infiltration, lanxide process – in situ chemical reaction techniques: chemical vapour deposition, chemical vapour impregnation, sol-gel – interfaces in CMCs – mechanical properties and applications of CMCs – Carbon-carbon Composites – applications.

TOTAL: 45 PERIODS

OUTCOMES:
- To study matrix material, reinforcements of polymer matrix composites, MMC and ceramic matrix composites.
- To develop knowledge on processing, interfacial properties and application of composites.

REFERENCES:

MN7013  QUALITY AND RELIABILITY ENGINEERING

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


UNIT II ACCEPTANCE SAMPLING


UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD


UNIT IV CONCEPT OF RELIABILITY

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 – Markov analysis, load sharing systems, standby systems, covariant models, static models, dynamic models.

UNIT V DESIGN FOR RELIABILITY AND MAINTAINABILITY

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

OUTCOMES:

- 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.

REFERENCES:

MN7014  SUPPLY CHAIN MANAGEMENT AND LOGISTICS  L T P C
3 0 0 3

OBJECTIVE:
- The objective of this module is to provide the participants with a good knowledge
  on logistics and supply chain management and how these topics can be related
  with the organization and their business needs.

UNIT I  LOGISTICS MANAGEMENT
Logistics Management: Origin and Definition – Types of Logistics – Logistics
Management – Warehouse Management – Automation and Outsourcing - Customer
Service and Logistics Management – A Perspective - Concepts in Logistics and Physical
Distribution - Distribution and Inventory

UNIT II  INVENTORY CONTROL
Types of Inventory Control - Demand Forecasting - Warehousing and Stores
Management – Routing - Transportation Management - Some Commercial Aspects in
Distribution Management – Codification - Distribution Channel Management -
Distribution Resource Planning (DRP) - Logistics in 21st Century

UNIT III  SUPPLY CHAIN MANAGEMENT
Supply Chain Management: Introduction and Development - Nature and Concept -
Importance of Supply Chain - Value Chain - Components of Supply Chain - The Need
for Supply Chain - Understanding the Supply Chain Management - Participants in
Supply Chain – Global Applications

UNIT IV  VALUE OF SUPPLY CHAIN MANAGEMENT
Role of a Manager in Supply Chain - Supply Chain Performance Drivers - Key Enablers
in Supply Chain Improvement - Inter-relation between Enablers and Levels of Supply
Chain Improvement-Systems and Values of Supply Chain

UNIT V  SUPPLY CHAIN BUSINESS STRATEGY
Aligning the Supply Chain with Business Strategy - SCOR Model –Outsourcing and
3PLs – Fourth Party Logistics – Bull Whip Effect and Supply Chain – Supply Chain
Relationships – Conflict Resolution Strategies - Certifications –

TOTAL: 45 PERIODS

OUTCOMES:
- The objective of this module is to provide the participants with a good knowledge
  on logistics and supply chain management and how these topics can be related
  with the organization and their business needs.

REFERENCES:
1. G Raghuram & N Rangaraj, Logistics and Supply Chain Management - Cases and

MN7015 THEORY OF METAL FORMING 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.

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 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 – H E R F 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

OUTCOMES:
- The students will be able to apply the principles of Bulk Metal Forming and Sheet Metal Forming to produce various components of different size and shape.

REFERENCES: