PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Master of Management systems and management curriculum is designed

I. To prepare students to excel in research and to succeed in the areas of manufacturing systems engineering and manufacturing management.

II. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve manufacturing systems engineering related problems

III. To train students with scientific and engineering knowledge so as to comprehend, analyze, design and solve the real-time problems.

IV. To inculcate students with professional and ethical attitude, effective communication skills, teamwork skills and multidisciplinary approach.

V. To develop students with an academic excellence, leadership qualities, leading to life-long learning for a successful professional career

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. The students will demonstrate knowledge of mathematics, science and engineering.

2. The students will demonstrate ability to identify, formulate and solve engineering problems.

3. The students will demonstrate ability to experiment, analyze and interpret data.

4. The students will demonstrate ability to design a system, component, product and process as per needs and specifications.

5. The students will demonstrate skills to use modern engineering tools, software and equipments to analyze multidisciplinary problems.

6. The students will demonstrate knowledge of professional and ethical responsibilities.

7. The students will communicate effectively their technical knowledge.

8. The students will understand the impact of engineering solutions on societal transformation.

9. The students will develop ability for life-long learning.
## Mapping of PEOs with POs

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF DEGREE = 67**

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MA7160  STATISTICAL METHODS FOR ENGINEERS  L T P C  4 0 0 4

OBJECTIVE:
• This course aims at providing the necessary basic concepts of a few statistical methods and to apply them to various engineering problems.

UNIT I  ESTIMATION THEORY 12

UNIT II TESTING OF HYPOTHESIS 12
Tests based on Normal, t, $\chi^2$ and F distributions for testing of means, variance and proportions – Analysis of $r \times c$ tables – Goodness of fit.

UNIT III  CORRELATION & REGRESSION 12
Multiple and Partial Correlation – Method of Least Squares – Plane of Regression – Properties of Residuals – Coefficient of Multiple Correlation – Coefficient of Partial Correlation – Multiple Correlation with total and partial correlations – Regression and Partial correlations in terms of lower order coefficients.

UNIT IV  DESIGN OF EXPERIMENTS 12
Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V  MULTIVARIATE ANALYSIS 12

TOTAL: 60 PERIODS

OUTCOME:
• It helps the students to have a clear perception of the power of statistical ideas and tools would be able to demonstrate the application of the statistical techniques to problems drawn from industry, management and other engineering fields.

TEXTBOOKS:

MS7101  ADVANCED MANUFACTURING PROCESSES  L T P C  3 0 0 3

OBJECTIVE:
• To understand the importance of advances in manufacturing processes in manufacturing industries.
UNIT I
ADVANCES IN CASTING & WELDING PROCESS

UNIT II
ADVANCES IN FORMING PROCESS

UNIT III
UNCONVENTIONAL MACHINING PROCESSES

UNIT IV
ADDITIVE MANUFACTURING PROCESS

UNIT V
MICRO & NANO MACHINING PROCESSES

TOTAL: 45 PERIODS

OUTCOME:
- The students should apply the advanced techniques and concepts in casting, welding, forming, unconventional machining, additive manufacturing, micro & nano machining process to the manufacturing industries.

REFERENCES:
UNIT I  LINEAR PROGRAMMING  9

UNIT II  SEQUENCING & NETWORK TECHNIQUES  9

UNIT III  REPLACEMENT  9
Introduction, replacement of items that deteriorate when money value is not counted and counted, replacement items that fail completely i.e., group replacement.

UNIT IV  INVENTORY  9
Introduction, single item deterministic models, production is instantaneous or at a constant rate, shortages are allowed or not allowed and withdrawals from stock is continuous, purchase inventory model with one price break, shortages are not allowed, Instantaneous production demand, production or purchase cost is relevant, stochastic models, demand may be discrete or variable or instantaneous production, instantaneous demand and no setup cost.

UNIT V  WAITING LINES  9
Introduction, single channel, Poisson arrivals, exponential service times, unrestricted queue, with infinite population and finite population models, single channel, Poisson arrivals, exponential service times with infinite population and restricted queue, multi channel, Poisson arrivals, exponential service times with infinite population and unrestricted queue.

TOTAL: 45 PERIODS

OUTCOME:
• The students should apply the various operations research techniques and methods to manufacturing systems and management

REFERENCES:

MS7103 AUTOMATION AND MANUFACTURING SYSTEMS  L T P C  3 0 0 3

OBJECTIVE:
• To impart the necessary basic concepts of industrial automation, robotics, and control methods and to apply them to various manufacturing problems.

UNIT I  AUTOMATION & CONTROL TECHNOLOGIES  9

UNIT II   NUMERICAL CONTROL & INDUSTRIAL ROBOTICS  10

UNIT III   MANUFACTURING SYSTEMS – MANUAL & AUTOMATED ASSEMBLY SYSTEMS – MATERIAL HANDLING SYSTEMS  9

UNIT IV   MANUFACTURING SYSTEMS – CELLULAR MANUFACTURING & FLEXIBLE MANUFACTURING SYSTEMS  9

UNIT V   MANUFACTURING SUPPORT SYSTEMS  8

TOTAL: 45 PERIODS
OUTCOME:
• The students should apply industrial automation, robotics, and control techniques to manufacturing systems, cellular manufacturing systems, flexible manufacturing systems.

REFERENCES:

MS7151   MANUFACTURING MANAGEMENT  L T P C
3 0 0 3
OBJECTIVE:
• To understand the fundamentals concepts of operations management in a manufacturing and service sectors.
UNIT I  FACILITY, CAPACITY & LAYOUT PLANNING  9
Types of plant layout, criteria for good layout, Process layout, Assembly line balancing. Computer based solutions to layout problems such as CRAFT, ALDEP, CORELAP and PREP.
Capacity planning – Analysis of designed capacity, installed capacity, commissioned capacity, utilized capacity, factors affecting productivity and capacity expansion strategies.

UNIT II  DEMAND FORECASTING & PROJECT MANAGEMENT  10
Demand forecasting – Quantitative and qualitative techniques, measurement of forecasting errors, numerical problems, Long term forecast methodologies.
Project management – its role in functional areas of management, network representation of a project, CPM and PERT techniques, Analyzing cost-time trade-offs – Case study.

UNIT III  PRODUCTION PLANNING & CONTROL  9

UNIT IV  INVENTORY PLANNING & CONTROL  8
EOQ models- with and without shortages, price breaks, effect of quantity discount – selective inventory control techniques – ABC, FSN, VED etc. Types of inventory control – Perpetual, two-bin and periodic inventory system – JIT, SMED, kanban, Zero inventory – Case study.

UNIT V  MAINTENANCE SYSTEM  9
Maintenance strategies and planning, Maintenance economics: quantitative analysis, optimal number of machines, Replacement strategies and policies – economic service life, opportunity cost, replacement analysis using specific time period, spares management. Maintenance records.

TOTAL: 45 PERIODS

OUTCOME:
• The students will have knowledge in layout planning, forecasting, production planning, inventory control, maintenance system and effective utilization of resources in manufacturing system.

REFERENCES:

MS7111  TECHNICAL SEMINAR  L T P C
0 0 2 1

OBJECTIVE:
• During this course, each student is expected to prepare and present a topic on manufacturing systems & management, for duration of about 45 minutes.
In a session of three periods per week, 2 students are expected to present the seminar.

A faculty supervisor is to be allotted to
- Maintain attendance of all students for each week.
- Review the presentation of the students.
- Allot a grade / mark for each student’s presentation

The students are encouraged to use power point presentation and demonstrative models.

OUTCOME:
The students would gain confidence in facing the project reviews and job placement interviews

TOTAL: 30 PERIODS

MS7201 LEAN MANUFACTURING SYSTEMS AND SIX SIGMA

OBJECTIVE:
- To impart the knowledge of tools & techniques used in lean manufacturing and six sigma.

UNIT I EVOLUTION & OVERVIEW OF LEAN MANUFACTURING

UNIT II LEAN MANUFACTURING – TOOLS & TECHNIQUES

UNIT III VALUE STREAM MAPPING

UNIT IV SIX SIGMA – TOOLS & TECHNIQUES
Cost of Quality – Conformance and Non-Conformance cost – 7 Basic Quality Control Tools – Seven Management tools – FMEA

UNIT V SIX SIGMA METHODOLOGY
Need for Six Sigma – Six Sigma Team – DMAIC Methodology: Define, Measure, Analyse, Improve and Control – Lean Six Sigma

TOTAL: 45 PERIODS

OUTCOME:
The students should apply the various tools, techniques and methodology of lean manufacturing and six sigma concepts to the potential quality gaps in manufacturing / production industries

REFERENCES:

**MS7202 LOGISTICS AND SUPPLY CHAIN MANAGEMENT FOR MANUFACTURING SYSTEMS**

**OBJECTIVE:**
- To impart the fundamentals of logistics and supply chain management and to apply them to various manufacturing problems

**UNIT I INTRODUCTION TO L&SCM**

**UNIT II INFORMATION, DEMAND FORECASTING, INVENTORY MANAGEMENT**

**UNIT III TRANSPORTATION, WAREHOUSING & DISTRIBUTION**

**UNIT IV PROTECTIVE PACKAGING, ORDER PROCESSING, MATERIALS HANDLING, PURCHASING & SOURCING MANAGEMENT**

**UNIT V L&SCM ADMINISTRATION**

**TOTAL: 45 PERIODS**
OUTCOME:
- The students should apply information, demand forecasting, inventory management, transportation, warehousing & distribution, protective packaging, order processing, materials handling, purchasing & sourcing management techniques to manufacturing systems.

REFERENCES:

MS7203 STATISTICAL QUALITY CONTROL AND RELIABILITY

OBJECTIVE:
- To impart knowledge about quality, controlling methods and reliability

UNIT I INTRODUCTION
Basic concepts of Quality, Meaning and definition of quality, Quality control, objectives of quality control, Quality Characteristics, Quality costs, Quality of Design, Quality of conformance, Concepts in quality management, quality planning, quality measurement, trouble shooting, diagnostic techniques, System approach to quality management.

UNIT II STATISTICAL PROCESS CONTROL
Control chart for attributes – Control chart for proportion or fraction defectives – p chart and np chart – control chart for defects – c and u charts, quality rating – Demerit chart – State of control and process out of control identification in charts.

UNIT III ACCEPTANCE SAMPLING

UNIT IV RELIABILITY

UNIT V RELIABILITY PREDICTION & MANAGEMENT
Reliability of system and models – Serial, parallel and combined configuration – Markove analysis, load sharing systems, standby systems, covariant models, static models, dynamic models.

TOTAL: 45 PERIODS

OUTCOME:
• The students should apply the various quality control techniques to construct the various quality control charts for variables and attributes and also the design concepts for reliable system and its prediction.

REFERENCES:

MS7251 ENTERPRISE RESOURCE PLANNING L T P C
3 0 0 3

OBJECTIVE:
• To impart to students the basic concepts of Enterprise Resource Planning and its role in improving the business dynamics

UNIT I ENTERPRISE RESOURCE PLANNING

UNIT II TECHNOLOGY AND ARCHITECTURE

UNIT III ERP SYSTEM PACKAGES
SAP,.People soft, Baan and Oracle – Comparison – Integration of different ERP applications – ERP as sales force automation – Integration of ERP and Internet – ERP Implementation strategies – Organisational and social issues.

UNIT IV ERP ARCHITECTURE
Overview – Architecture – AIM – applications – Oracle SCM. SAP : Overview – Architecture – applications -Before and after Y2k – critical issues – Training on various modules of IBCS ERP Package-Oracle ERP and MAXIMO, including ERP on the NET

UNIT V ERP PROCUREMENT ISSUES

TOTAL: 45 PERIODS
OUTCOME:
Upon completion of the course, the students will be able
- To provide an integrated view of the various facets of business, including planning, manufacturing, sales, finance and marketing.
- To understand the development of software to integrate business activities such as inventory management and control, order tracking, customer service, finance and human resources.
- To become aware of the software applications and tools that are available to business to use to drive out costs and improve efficiency.

REFERENCES:

MS7211 MANUFACTURING SYSTEMS OPTIMIZATION LABORATORY  L  T  P  C  0 0 4 2

LIST OF EXERCISES:
1. Solving LPP, TP, PERT, CPM and Inventory Problems.
2. Simulation in manufacturing activities: Scheduling & Logistics.
3. Taguchi, ANOVA, RSM, Grey Relational Analysis & TOPSIS
4. Neural Networks, Fuzzy Logic & Genetic Algorithms

SOFTWARE REQUIREMENTS:
Simulation software such as: WITNESS / LINDO / LINGO / TORA / EXTEND.

TOTAL: 60 PERIODS

MS7311 PROJECT WORK PHASE I  L  T  P  C  0 0 12 6

OBJECTIVES:
- A research project topic may be selected either from published lists or from the creative ideas of the students themselves in consultation with their project supervisor.
- The objective of the research project work is to comprehensively investigate, review, redesign / modify a manufacturing and management of a system. Or propose and implement an innovative idea to a manufacturing and management of a system.
- The progress of the project is reviewed and evaluated with a minimum of three reviews.
- The review committee may be constituted by the Head of the Department.
- The student must submit a project report at the end of the semester for evaluation.
- The final project work examination is evaluated jointly by external and internal examiners based on the project report and oral presentation.

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.

TOTAL: 180 PERIODS
MS7411  
PROJECT WORK PHASE II  
OBJECTIVES:
- The objective of the research project work is to produce factual results of their applied research idea in manufacturing and management of a system, from phase – I.
- The progress of the project is reviewed and evaluated with a minimum of three reviews.
- The review committee may be constituted by the Head of the Department.
- The student must submit a project report at the end of the semester for evaluation
- The final project work examination is evaluated jointly by external and internal examiners based on the project report and oral presentation

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.

CI7071  COMPUTER AIDED PROCESS PLANNING  L T P C  3 0 0 3

OBJECTIVE:
- To familiarize the students with process planning in the manufacturing cycle, design, drafting, geometric modeling, systems in CAPP and report generation

UNIT I  INTRODUCTION  8

UNIT II  PART DESIGN REPRESENTATION  10

UNIT III  KNOWLEDGE REPRESENTATION  7

UNIT IV  SYSTEM FORMULATION  10

UNIT V  COMPUTER AIDED PROCESS PLANNING SYSTEMS  10

TOTAL: 360 PERIODS

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the students are expected to use
- Application of computers in the documentation
- Creating database for the future use.
- Use of commercially available CAPP system in Industries
REFERENCES:

WEB REFERENCES:

CI7072 INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS L T P C
3 0 0 3

OBJECTIVES:
- To teach students the basics of robotics, construction features, sensor applications, robot cell design, robot programming and application of artificial intelligence and expert systems in robotics.

UNIT I INTRODUCTION AND ROBOT KINEMATICS 10

UNIT II ROBOT DRIVES AND CONTROL 9

UNIT III ROBOT SENSORS 9

UNIT IV ROBOT CELL DESIGN & APPLICATION 9

UNIT V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS 8

TOTAL: 45 PERIODS
OUTCOME:
- The student will be able to design robots and robotic work cells and write a program for controlling the robots. The student will be able to apply artificial intelligence and expert systems in robotics.

TEXTBOOKS:

REFERENCES:

CI7073 MANUFACTURING INFORMATION SYSTEMS

OBJECTIVE:
- The purpose of the course is to provide an importance of databases and its application in manufacturing systems that prepare students for their engineering practice by organization by conversant with order policies, data base terminologies, designing, manufacturing considerations

UNIT I INTRODUCTION:
The Evolution of order policies, from MRP to MRP II to ERP – Agile Manufacturing Information Systems, Manufacturing Database Integration.

UNIT II DATABASE:

UNIT III DESIGNING DATABASE:
Hierarchical model – Network approach- Relational Database concepts, principles, keys,– functional dependency – Normalization types – relational operations- Query Languages-Case studies.

UNIT IV MANUFACTURING CONSIDERATION:
The product and its structure, inventory and process flow – Shop floor control Data structure and procedure – various models – the order scheduling module, Input/output analysis module, and stock status database – the complete IOM database.

UNIT V INFORMATION SYSTEM FOR MANUFACTURING:
Parts oriented production information system – concepts and structure – Computerized production scheduling, online production control systems, Computer based production management system, computerized manufacturing information system -RFID-Telecommunication– case study.

TOTAL: 45 PERIODS
OUTCOME:
- On completion of this course, the students are expected to create simple to moderately complex manufacturing information system for manufacturing industry.

REFERENCES:

WEBREFERENCES:
1. www.ist.psu.edu
2. www.cse.wustl.edu(UML Notation Guide)

CI7074               MECHATRONICS IN MANUFACTURING       L T P C
                      3 0 0 3

OBJECTIVE:
- To provide the student with the knowledge of sensors, transducers, various types of actuators used in mechatronics systems and also the use of PLCs and mechatronics design.

UNIT I      INTRODUCTION

UNIT II     SENSORS AND TRANSDUCERS:

UNIT III    ACTUATORS
Actuators – Mechanical - Electrical - Fluid Power - Piezoelectric – Magnetostrictive - Shape memory alloy - applications - selection of actuators.

UNIT IV     PROGRAMMABLE LOGIC CONTROLLERS
Introduction - Basic structure - Input and output processing - Programming - Mnemonics- Timers, counters and internal relays - Data handling - Selection of PLC.

UNIT V      DESIGN AND MECHATRONICS CASE STUDIES
Steps in mechatronics design - Possible design solutions-Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Conveyor based material handling system - PC based CNC drilling machine – Mechatronics Control in automated Manufacturing – Data Acquisition - Case studies.

TOTAL: 45 PERIODS
OUTCOME:
- At the end of this course the student should be able to apply Mechatronics in design and practical requirements.

REFERENCES:

CI7251 ADDITIVE MANUFACTURING

OBJECTIVE:
- To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications.

UNIT I INTRODUCTION:

UNIT II REVERSE ENGINEERING AND CAD MODELING:
Basic concept- Digitization techniques – Model reconstruction - Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS
Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications.

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS

22
UNIT V OTHER ADDITIVE MANUFACTURING SYSTEMS: 
Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballistic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting. 
TOTAL: 45 PERIODS

OUTCOME:
• On completion of this course, they will learn about a variety of Additive Manufacturing (AM) technologies, their potential to support design and manufacturing, case studies relevant to mass customized manufacturing, and some of the important research challenges associated with AM and its data processing tools

REFERENCES:

CI7252 COMPETITIVE MANUFACTURING SYSTEMS

OBJECTIVE:
• To emphasize the knowledge on the quality improvement, automation, and advanced manufacturing techniques to create the highest-caliber products quickly, efficiently, inexpensively, and in synchronization with the marketing, sales, and customer service of the company.

UNIT I MANUFACTURING IN A COMPETITIVE ENVIRONMENT

UNIT II GROUP TECHNOLOGY & FLEXIBLE MANUFACTURING SYSTEMS

UNIT III COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS

UNIT IV LEAN MANUFACTURING
(systematic planning methodology) – Lean culture – APQP – SOP – PPAP – Factories of the future.

UNIT V JUST IN TIME

OUTCOME:
• At the end of this course the student will be able to apply the knowledge to implement and work in competitive manufacturing systems. Student will be able to practice the principles of flexible manufacturing, Kaizen, 5S, Jidoka, Poka Yoke and Lean manufacturing.

REFERENCES:

IL7073 CELLULAR MANUFACTURING SYSTEMS L T P C
3 0 0 3

OBJECTIVE:
• To impart knowledge on planning, design, implementation, and control of group technology and cellular manufacturing.

UNIT I INTRODUCTION

UNIT II CMS PLANNING & DESIGN

UNIT III IMPLEMENTATION OF GT/CMS
Inter and intra cell layout and capacity planning – Managerial structure and groups – Batch sequencing and sizing – Life cycle issues in GT/CMS – Linkages to JIT systems.

UNIT IV PERFORMANCE MEASUREMENT & CONTROL

UNIT V ECONOMIC OF GT/CMS

TOTAL: 45 PERIODS
OUTCOME:
- The students should apply the various tools, techniques and methodology used in planning, design, implementation, and control of group technology and cellular manufacturing.

REFERENCES:

IL7083 PROJECT MANAGEMENT

OBJECTIVE:
- To understand the concepts and principles involved in project management
- To have a detailed knowledge about the complexity and challenges involved in managing projects with tight schedules and limited resources

UNIT I STRATEGIC MANAGEMENT AND PROJECT SELECTION
Project selection models, Project portfolio process, Analysis under uncertainty, Project organization, Matrix organization

UNIT II PROJECT PLANNING

UNIT III PROJECT IMPLEMENTATION

UNIT IV MONITORING AND INFORMATION SYSTEMS
Information needs and the reporting process, computerized PMIS, Earned value analysis, Planning-Monitoring-Controlling cycle, Project control: types of control processes, design of control systems, control of change and scope.

UNIT V PROJECT AUDITING
Construction and use of audit report, Project audit life cycle, Essentials of audit and evaluation, Varieties of project termination, the termination process, The Final Report – A project history.

OUTCOME:
- At the end of this course the student will be able to project management strategy design development and deployment. Student will be able to apply methods for solving and avoiding problems associated with project management and have the knowledge about the implications, challenges and opportunities of organizational dynamics in project.

TEXT BOOKS:
REFERENCES:

OBJECTIVES:
- To give an understanding of the advancements in mechanical measurements and their applications in manufacturing industries to optimize manufacturing processes.

UNIT I  FUNDAMENTALS OF METROLOGY  9
Basic metrological concepts, Quality of measurements – errors, Uncertainty, Basic to advanced metrology evolution, Geometric Dimensioning and Tolerancing.

UNIT II  OPTICAL DIMENSIONAL METROLOGY  9

UNIT III  ADVANCES IN SURFACE METROLOGY - 2D, 3D  9

UNIT IV  NANOMETROLOGY  9
OPTICAL MICRO-METROLOGY OF SMALL OBJECTS - White-Light Interference 3D Microscopes, Focus-Based Optical Metrology- Fringe projection method, Measurement of Typical Nanofeatures, Measuring Length to Nanoscale with Interferometers and Other Devices, Nano Geometry in Macro Situations

UNIT V  METROLOGY IN MANUFACTURING  9
Case studies relating to various manufacturing sectors - Automobile, space, nuclear, Tool wear; Metrology in manufacturing research, Role of Metrology in Industry 4.0.

OUTCOMES
- Upon completion of this course, the students can make logical, rational and economical choice of measuring equipment / method to analyse and improve manufacturing processes.

REFERENCES
OBJECTIVE:
- To impart the students with knowledge of the experimental design & analysis.

UNIT I  FUNDAMENTALS
Need for research & design of experiments – Techniques in experimental design – Application of experimental design – Test of hypothesis – Limitations – F-test – Need for ANOVA – Introduction to ANOVA – Simple design of ANOVA – Completely randomized design – Randomized complete block design – Latin square design – Duncan’s multiple range test.

UNIT II  FACTORIAL DESIGNS – I

UNIT III  FACTORIAL DESIGN – II
Confounded design – $2^2$; $2^3$; – Fractional factorial design – One half fraction of $2^2$; $2^3$; – One quarter fraction of $2^n$ – Split plot design – Split-split plot design – Strip-split plot design.

UNIT IV  REGRESSION APPROACH, RESPONSE SURFACE METHODOLOGY, ORTHOGONAL ARRAY

UNIT V  ROBUST PARAMETER DESIGN, GREY RELATIONAL ANALYSIS, MULTIVARIATE ANALYSIS OF VARIANCE

OUTCOME:
- The student should apply the principles and techniques used in experimental design in their future research projects.

REFERENCES:
UNIT I   FINANCIAL MANAGEMENT  10
Investment decisions – Capital Investment process, types of investment proposals, investment appraisal techniques – payback period method, Accounting rate of return, net present value method, internal rate of return and profitability index method.

UNIT III COST ACCOUNTING  10
Cost accounting systems: Job costing, Process costing, Allocation of overheads, Activity based costing, differential cost and incremental cost, Variance analysis, Software costing.

UNIT V FINANCIAL DECISIONS  5
Cost of Capital – Capital structure – Dividend Policy – Leasing

OUTCOME:
• The students should apply the various tools, techniques and methodology of financial and accounting concepts to the management of manufacturing / production industries.

REFERENCES:

MS7004 INNOVATION MANAGEMENT L P T C
3 0 0 3
OBJECTIVES:
• Understand the definitions and concepts of innovation, invention and research and development
• Explore main models of innovation
• Use and apply tools for innovation management
• Diagnostic and analytical skills
• Enhance verbal skills through class and syndicate discussions
• Build up judgemental and interpretation skills
• Learn how to evaluate different options Formulate and develop strategy
• Assess and resolve managerial challenges

UNIT I   INTRODUCTION TO INNOVATION MANAGEMENT  7
UNIT II SOURCES & NETWORKS OF INNOVATION
Where do Innovations Come From - Knowledge Push - Need Pull - Towards Mass Customization - Users as Innovators - Recombinant Innovation - Design-led Innovation - Futures and Forecasting – No Man is an Island - The ‘Spaghetti’ Model of Innovation - Innovation Networks - Networks at the Start-Up - Networks on the Inside - Networks on the Outside - Networks into the Unknown - Managing Innovation Networks - Further Reading and Resources.

UNIT III DECISION MAKING & BUILDING THE INNOVATION

UNIT IV IMPLEMENTATION OF INNOVATION

UNIT V ENTREPRENEURSHIP AND BENEFITS OF INNOVATION

OUTCOMES:
At the end of the course students will be able to demonstrate understanding, and make critical assessments of the following:
- Assess and interpret innovation processes
- Develop and formulate managerial strategies to shape innovative performance
- Utilise tools of innovation management to map and measure innovative activities
- Diagnose different innovation challenges and make recommendations for resolving them

REFERENCES:

MS7005 MANUFACTURING OPTIMIZATION

OBJECTIVE:
- To impart the knowledge of techniques used in manufacturing optimization

UNIT I INTRODUCTION & CLASSIFICATION
Need for optimization of manufacturing processes, Statement of an Optimisation problem, Classification of optimization problems; Single – variable optimization, Multi – variable optimization with No constraints, Equality constraints and Inequality constrains, Convex programming problem.
UNIT II  CLASSICAL OPTIMIZATION TECHNIQUES  10
Linear Programming – Simplex method, Revised Simplex method, Duality, Karmakar’s method; Non-linear programming – One-Dimensional Minimisation methods, Unconstrained and constrained optimization techniques; Geometric programming; Integer programming – Linear and Nonlinear.

UNIT III  ADVANCED OPTIMIZATION TECHNIQUES  10
Genetic Algorithms, Simulated Annealing, Neural Networks, Optimisation of fuzzy systems, Tabu Search and Scatter Search, Ant System, Particle Swarm Optimisation, Gray Relational Analysis.

UNIT IV  OPTIMISATION OF TRADITIONAL & NON-TRADITIONAL MANUFACTURING PROCESSES  8
Modeling and optimization of traditional processes – Milling, Grinding, Turning and Drilling processes; Modeling and optimization of non-traditional processes – Ultrasonic machining, Wire Electric Discharge Machining, Electro Chemical Machining and Rapid prototyping processes.

UNIT V  SYSTEMS OPTIMISATION  9
Optimisation of Supply chain networks, Process planning and scheduling, production and inventory management, process industries.

TOTAL: 45 PERIODS

OUTCOME:
- The students will be able to understand and apply the various techniques and methodologies of optimization to improve manufacturing processes.

REFERENCES:

MS7006 MANUFACTURING PLANNING AND CONTROL  L T P C  3 0 0 3

OBJECTIVE:
- To understand the fundamentals concepts of planning and control in a manufacturing sectors

UNIT I  INTRODUCTION TO MANUFACTURING SYSTEMS ENGINEERING  10
UNIT II  PRODUCTION CONTROL  10

UNIT III  LOADING & SCHEDULING  7

UNIT IV  MATERIAL FLOW PATH ANALYSIS IN MANUFACTURING  9
Material handling function – Types of equipment used – Conveyor systems – Automated guided vehicle systems – Guiding and routing – Traffic control and safety – Interfacing handling and storage with manufacturing-design factors in material handling systems.

UNIT V  LAYOUT OF MANUFACTURING SYSTEMS  9

TOTAL: 45 PERIODS

OUTCOME:
• The student should apply the tools, techniques and methods in planning, production control, loading, scheduling, material flow path analysis, and layout design in a manufacturing system.

REFERENCES:

MS7007  MATERIALS HANDLING SYSTEMS AND DESIGN  L T P C
3 0 0 3

OBJECTIVE:
• To understand the importance of material handling system and its design in manufacturing systems & management

UNIT I  MATERIALS HANDLING EQUIPMENT  10
The material handling function, principles – Types of material handling systems – Material handling equipment – Basic types – Storage systems – Unitizing equipment system – Tracking and identification system – Analysis of material handling system – Material characteristics – Plant and equipment – Production schedule – Layout – Handling condition – Cost consideration – Selection and applications of material handling system – Types of material handling equipment – Characteristics – Analysis and material transfer system – Economic analysis of material handling equipments: Breakeven analysis – Equipment operating cost per unit distance – Work volume analysis – Illustrative problems – Productivity/Indicator ratios.
UNIT II  HOISTS & HOISTING GEAR

UNIT III  CONVEYORS

UNIT IV  ELEVATORS

UNIT V  MECHANIZED ASSEMBLY
Principles and operating characteristics of part feeders such as: Vibratory bowl feeder, Reciprocating tube hopper, Centrifugal hopper feeder and Center board hopper feeder – Orientation of parts – In-bowl and Out-of-bowl tooling – Different types of escapements transfer systems and indexing mechanisms.

OUTCOME:
• The students should apply the concepts of material handling systems and design functions in different manufacturing industries.

REFERENCES:

MS7008  MODERN TECHNIQUES OF MATERIALS CHARACTERIZATION

OBJECTIVE:
• To impart knowledge about various characterization techniques used in materials research.

UNIT I  METALLOGRAPHIC TECHNIQUES
Macroexamination – Applications, metallurgical microscope - principle, construction and working, metallographic specimen preparation, optic properties - magnification, numerical aperture, resolving power, depth of focus, depth of field, different light sources lenses aberrations and their remedial measures, various illumination techniques-bright field , dark field, phase-contrast polarized light illuminations, interference microscopy, high temperature microscopy; quantitative metallography – Image analysis- Confocal laser scanning microscopy.
UNIT II  
**X-RAY DIFFRACTION TECHNIQUES**

9


UNIT III  
**ANALYSIS OF X-RAY DIFFRACTION**

9

Line broadening, particle size, crystallite size, Precise parameter measurement, Phase identification, phase quantification, Phase diagram determination X-ray diffraction application in the determination of crystal structure, lattice parameter, residual stress – quantitative phase estimation. X-ray Fluorescence: Energy Dispersive Spectroscopy (EDS) and Wave dispersive X-ray spectrometry (WDS).

UNIT IV  
**ELECTRON MICROSCOPY**

9


UNIT V  
**CHEMICAL AND THERMAL ANALYSIS**

9


TOTAL: 45 PERIODS

OUTCOME:

- The students should apply the concepts of imaging techniques, X-ray diffraction analysis, spectroscopic and thermal methods of characterization to materials characterization.

REFERENCES:


MS7009  
**NANO STRUCTURED MATERIALS AND TECHNOLOGY**  

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OBJECTIVE:

- To impart the knowledge of the nanomaterials and mechanism of nanostructure formation and its characterization
UNIT I INTRODUCTION TO NANOMATERIALS
Amorphous, Crystalline, microcrystalline, quasicrystalline and nanocrystalline materials – Gleiter’s Classification of nanostructured materials – Properly changes due to size effects, inverse Hall - Petch effects – Polymeric nanostructures

UNIT II ZERO DIMENSIONAL NANOMATERIALS

UNIT III ONE DIMENSIONAL NANOMATERIALS

UNIT IV SUPER HARD COATINGS & BULK NANOSTRUCTURE FORMATION

UNIT V CHARACTERIZATION OF NANOMATERIALS

OUTCOME:
• The student should apply the different types processing technique that can produce zero, one two and bulk nanostructured materials.

REFERENCES:
OBJECTIVE

The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I INTRODUCTION

Need for IPPD-Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement

UNIT II CONCEPT GENERATION, SELECTION AND TESTING


UNIT III PRODUCT ARCHITECTURE

Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems - architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT IV INDUSTRIAL DESIGN


UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.

OUTCOME:

On completion of the course the student will be able to

- Understand the integration of customer requirements in product design
- Apply structural approach to concept generation, selection and testing
- Understand various aspects of design such as industrial design, design for manufacture, economic analysis and product architecture

TEXT BOOK


REFERENCES:


MS7011 PROCESS PLANNING AND COST ESTIMATION L P T C
3 0 0 3

OBJECTIVE

- The course objective is to introduce the process planning concepts and to make cost estimation for various products after process planning.

UNIT I WORK STUDY AND ERGONOMICS 9

UNIT II PROCESS PLANNING 9

UNIT III INTRODUCTION TO COST ESTIMATION 7

UNIT IV COST ESTIMATION 10
Types of estimates – methods of estimates – data requirements and sources- collection of cost- allowances in estimation.

UNIT V PRODUCTION COST ESTIMATION 10
Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course students will be able to demonstrate understanding, and make critical assessments of the following:
- Work Study and Ergonomics
- Process planning
- Introduction to cost estimation
- Production cost estimation

TEXT BOOKS
OBJECTIVE:
• The aim is impart the students with knowledge of the polymers and advanced materials and its manufacturing

UNIT I POLYMERS & COMPOSITES

UNIT II POLYMER MATRIX COMPOSITES

UNIT III METAL MATRIX COMPOSITES

UNIT IV CERAMIC MATRIX COMPOSITE & SPECIAL COMPOSITES

UNIT V INTERFACE & FAILURE ANALYSIS

TOTAL: 45 PERIODS

OUTCOME:
• The student should apply different types of polymers, ceramics and advanced composites manufacturing methods engineering industrial application.

REFERENCES:
OBJECTIVE:

• To impart the students with knowledge of the general design principles, considerations and geometric tolerances for various manufacturing process and assembly.

UNIT I MATERIAL & PROCESS SELECTION & GEOMETRIC TOLERANCES


UNIT II CAST & WELDED COMPONENTS DESIGN


UNIT III FORMED COMPONENTS DESIGN

Design considerations for: Metal extruded parts – Impact/Cold extruded parts – Stamped parts – Forged parts.

UNIT IV MACHINED COMPONENTS DESIGN

Design considerations for: Turned parts – Drilled parts – Milled, planned, shaped and slotted parts – Ground parts.

UNIT V DESIGN FOR ASSEMBLY


TOTAL: 45 PERIODS

OUTCOME:

• The student should apply the design principles, considerations and geometric tolerances to casting, forming, machining, welding and assembly.

REFERENCES:

UNIT I  SAFETY IN METAL WORKING MACHINES  
General safety Consideration, Need for safety, Organization and planning-requirement for successful planning, principles, maintenance, Implementation of safety concepts in of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, wood working machine, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes (saws, types) – IS standards.

UNIT II  PRINCIPLES OF MACHINE GUARDING  
Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards – Point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing-guard construction – Guard opening.

UNIT III  SAFETY IN WELDING & GAS CUTTING  
Personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – Safety in generation, distribution and handling of industrial gases – Colour coding – Safety inspection – Flashback arrestor – Leak detection-pipe line safety-storage and handling of gas cylinders.

UNIT IV  SAFETY IN COLD WORKING & HOT WORKING OF METALS  
Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot – Operated presses, power press electric controls, power press set up and die removal, inspection and maintenance – Metal sheers – Press brakes.
Safety in forging, hot rolling mill operation, guards in hot rolling mills – hot bending of pipes, hazards and control measures.

UNIT V  INDUSTRIAL HYGIENE & SAFETY TESTING  

TOTAL: 45 PERIODS

OUTCOME:
- The students should apply the safety rules and principles for different manufacturing environment like machine erection, welding, gas cutting and forming field with the emphasize on Industrial hygiene.

REFERENCES:

**MS7071 HUMAN RESOURCE MANAGEMENT L T P C**

**OBJECTIVE:**
- To comprehend the important link between human resource management practices and high performance.

**UNIT I HUMAN RESOURCE FUNCTION**

**UNIT II RECRUITMENT & SELECTION**

**UNIT III TRAINING & DEVELOPMENT**

**UNIT IV COMPENSATION & MANAGING QUALITY**
UNIT V  LABOUR RELATIONS & EMPLOYEE SECURITY  10

TOTAL: 45 PERIODS

OUTCOME:
- The students will have thorough knowledge about the practices and analysis of HRM in terms of strategy, techniques and outcomes.

REFERENCES:

PD7072  REVERSE ENGINEERING  L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge to the students about the need for and the various tools required for reverse engineering with exposure to the software needed for implementing reverse engineering.

UNIT I  INTRODUCTION  5
Scope and tasks of RE - Domain analysis- process of duplicating

UNIT II  TOOLS FOR RE  8
Functionality- dimensional- developing technical data - digitizing techniques - construction of surface model - solid-part material- characteristics evaluation -software and application-prototyping - verification

UNIT III  CONCEPTS  12
History of Reverse Engineering – Preserving and preparation for the four stage process – Evaluation and Verification- Technical Data Generation, Data Verification, Project Implementation

UNIT IV  DATA MANAGEMENT  10

UNIT V  INTEGRATION  10
Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering —coordinate measurement – feature capturing – surface and solid members

TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to
- Understand the basic principles of reverse engineering
- Select the suitable tools and methodology for reverse engineering any product

REFERENCES

QE7071 MATERIALS MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
- To understand the importance of materials management system and its concepts

UNIT I INTRODUCTION
Introduction to materials management and productivity, functions, organization structures and role of material management. Materials and profitability and Profit center concept, Contribution to profits, policy manual, internal interface, External Environment, Centralized Purchasing, Decentralization, Delegations of powers.

UNIT II MATERIAL PLANNING
Material Planning, definition, influencing factors, use of standard deviation, Importance of materials Research, Advantages of MIS, Techniques of Materials Intelligence, Environment Conditions, Source of information, Materials requirement planning (MRP) and Manufacturing resource Planning (MRPII), Evolution to ERP and Distribution Requirements Planning (DRP), Pull systems.

UNIT III PURCHASING
Importance and objectives of good purchasing system, Prime and organizational functions, purchasing policy and procedures, responsibility and limitations, purchasing decisions, purchasing role in new product development, role of purchasing in cost reduction, negotiations and purchase, purchasing research: identification of right sources of supply, Vendor relation and selection, vendor rating and standardization, vendor certification plans, supply reliability, developing new source of supply.

UNIT IV COST REDUCTION
Cost control vs Cost reduction, price analysis, material cost reduction techniques, variety reduction, cost reduction and value improvement, material holding cost, Acquisition cost, Settlement of Bills, Accounting, Audit in Materials Management, Internal Audit, Operational Audit, techniques of cost control, cost effectiveness, cost analysis for material management, material flow cost control.

UNIT V INVENTORY MANAGEMENT
Inventory vs Stores, Functions and types of inventory, Types of inventory control, Handling Uncertainties and safety stock, inventory build-up, EOQ for various inventory models, inventory models with quantity discount, exchange curve concept, coverage analysis, optimal stocking policies, inventory management of perishable commodities, ABC-VED analysis, design of inventory distribution systems, spare parts inventory management, information systems for inventory management, cases studies.

TOTAL: 45 PERIODS
OUTCOME:
- To introduce the concepts of materials management with the emphasis on the various material planning, purchasing policies, purchasing system and the concepts of materials management.

REFERENCES: