PRIST Deemed to be University

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAMME HANDBOOK

M.Tech. – Manufacturing Technology

PART TIME PROGRAMME

Regulation 2017

(for candidates admitted to M.Tech Mechanical Engineering programme from June 2017 onwards)

COURSE STRUCTURE

Semester I

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17248S11EP	Advanced Engineering Mathematics	3	1	0	4
17254H12P	Theory of Metal Cutting	3	1	0	4
17254H13P	Advanced Manufacturing Processes	3	1	0	4
17254L14P	CIM Lab	0	0	3	3
17254CRSP	Research Led Seminar	0	0	0	1
TOTAL NO. OF CREDITS					**16**

Semester II

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254H21P	Production Management	3	1	0	4
17254H22P	MEMS and Nano Technology	4	0	0	4
17254E23—P (A to C)	Elective - I	4	0	0	4
17254L24P	Automation Lab	0	0	3	3
172TECWRP	Technical Writing/Seminar	0	0	3	3
17254CRMP	Research Methodology	4	0	0	3
17254CBRP	Participation in Bounded Research	0	0	0	2
TOTAL NO. OF CREDITS					**23**

Semester III

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254H31P	Mechanical Metallurgy	3	1	0	4
17254H32P	Automated Computer Integrated Manufacturing Systems	3	1	0	4
17254E33—P (A to C)	Elective II	4	0	0	4
17254CSRP	Design Project /SOCIO Technical Project (scaffolded Research)	0	0	0	4
TOTAL NO. OF CREDITS					**16**

Semester IV

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254H41P	Manufacturing Metrology and Quality Control	4	0	0	4
17254H42P	Metal Forming Process	4	0	0	4
17254E43—P (A to B)	Elective III	4	0	0	4
17254P44P	Project Work Phase I	0	0	6	6
TOTAL NO. OF CREDITS					**18**

Semester V

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254E51—P (A to B)	Elective IV	4	0	0	4
17254E52—P (A to B)	Elective V	4	0	0	4
17254E53—P (A to B)	Elective VI	4	0	0	4
TOTAL NO. OF CREDITS					**12**

Semester VI

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254P61P	Project Work Phase II	0	0	12	12
TOTAL NO. OF CREDITS					**12**

TOTAL NO. OF CREDITS (I to VI) = 97

List of Electives - Elective – I

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254E23AP	Finite Element Application in Manufacturing	4	0	0	4
17254E23BP	Lean Manufacturing	4	0	0	4
17254E23CP	Design and Analysis of Experiments	4	0	0	4

Elective – II

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254E33AP	Materials Management and Logistics	4	0	0	4
17254E33BP	Financial Management	4	0	0	4
17254E33CP	Manufacturing Information Systems	4	0	0	4

Elective – III

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254E43AP	Advanced Metrology and Computer Aided Inspection	4	0	0	4
17254E43BP	Maintenance Management	4	0	0	4
17254E43CP	Optimization Techniques	3	1	0	4

Elective – IV

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254E51AP	Manufacturing Systems and Simulation	4	0	0	4
17254E51BP	Instrumentation and Control Engineering	4	0	0	4
17254E51CP	Artificial Intelligence and Neural Networks	3	1	0	4

Elective – V

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254E52AP	Product Design and Development	4	0	0	4
17254E52BP	Fluid Power Automation	4	0	0	4

Elective – VI

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254E53AP	Advanced Material Technology	4	0	0	4
17254E53BP	Industrial Ergonomics	4	0	0	4

I - SEMESTER

17254H12P THEORY OF METAL CUTTING 3 1 0 4

OBJECTIVE:

To know about the mechanics of chip formation, to analyse the tool failure, and thermodynamics involved in metal cutting and evaluation of tool materials.

UNIT- I: Orthogonal Cutting:

Orthogonal Cutting – Theories of merchant – Lee and Shaffer – Merchant's circle diagram – shear angle relationship – chip velocity – force – velocity relationships

UNIT-II: Chip Formation:

Mechanism of chip formation – Types of Chips – discontinuous,continuous continuous with BUE – Chip Formation in drilling and Milling – effect of cutting variables of chip reduction coefficient.

UNIT-III : Tool Life and Machinability:

Tool Failure:Mode of Plastic failure – Measurement of tool wear – tool life tests – tool life equation for variable theories – variables affecting tool life – machinability – machinability index – problems.

UNIT-IV: Thermal Analysis in Metal Cutting:

Thermodynamics of orthogonal cutting – analysis of temperature at shear plane and tool face – experimental methods for temperature measurement.

UNIT-V: Chatter:

Chatter - Importance of Chatter in machining – types of chatter – avoidance of chatter.Tools materials – requirements – alloy tools - HSS – carbides –PCD and CBN-properties and application.

BOOKS FOR REFERENCE:

1. Juneja .B.L, "Fundamentals of Metal cutting and Machine tools", New Age International,1995.
2. Bhattacharya.A, "Metal Cutting Theory and Practice", Central book publications
3. Kuppusamy .G, "Principle of Metal Cutting", University Press,1996.
4. Shaw .M.C, "Metal Cutting Principles",I BH Publications,1992.

Armarego E.J.A and Brown R.H, "The Machining of Metals", Prentice Hall,1969

SEMESTER II

17254H21P PRODUCTION MANAGEMENT 3 1 0 4

OBJECTIVE:
To gain knowledge in operation management principles and the related quantitative approaches.

UNIT-I : Manufacturing System:
The concept of system - types of manufacturing system- the concept of a model - model classification - model building - decision making approaches. Forecasting: qualitative and quantitative methods - moving averages- single and multiple regression models.

UNIT-II : Aggregate Planning :
Methods of aggregate planning- graphical and charting methods, trial and error, transportation method- concepts of linear decision rule.

UNIT-III: Inventory Management Systems and Models
EOQ, model (without and with shortages)- inventory models allowing price breaks, EPQ model - single period inventory model - inventory control systems - P,Q and S-s system - selective inventory control techniques.

UNIT-IV: MRP & JIT:
Materials requirement planning (MRP) - master production schedule, bill of materials, MRP concepts, lot sizing - lot-for-lot technique, EOQ approach, silver-meal approach, period order quantity approach, least unit cost approach, least total cost approach.
Principles of JIT production pull and push system, kanban, JIT purchasing, supply chain management.

UNIT-V: Scheduling:
Scheduling and assignment problems - notation and definitions - criteria, objective functions for scheduling - job shop scheduling: sequencing of n job s thorough 1 machine - priority rules, n jobs through 3, m machines - Johnsons rule, CDS algorithm, 2 jobs on m machine - graphical method- multi product assignment problem - index method, Hungarian method.

BOOKS FOR REFERENCE:

1. Production Operation Management:Theory And Problems, Chary:S.N, TMH, New delhi,1990.
2. Production Operation Management, Pannerselvam.R, PHI, 1999.
3. Operation Management Theory And Problems, Monks.J,G., McGraw HILL,1987.
4. Production operation management, chase.R.B,. Aquiliano.N.J and Jacobs.R.R.,8th Edition, TMH, 1988.
5. Production Planning And Inventory Control, Narashimhan. S.L., Mcleavy.D.W.,and Billington.P.J., 2nd Edition., PHI,1997

17254L24P AUTOMATION LAB 0 0 3 3

AIM:

To impart knowledge in the area of hydraulic and pneumatic components and its functions.

OBJECTIVE:

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

EXPERIMENTS:

1. Simulation of single and double acting cylinder circuits
2. Simulation of Hydraulic circuits
3. Simulation of electro pneumatic circuits
4. Simulation of electro hydraulic circuits
5. Simulation of PLC circuits
6. Exercises on linear and angular measurements
7. Exercises on speed measurements
8. Exercises on Vibration measurements
9. Exercises on Motion controller using servo motors, encoders, etc.
10. Exercises on fiber optics transducers.
11. Exercises on stepper motor.
12. Exercises on microprocessor based data acquisition system.
13. Software simulation of fluid power circuits using Automation studio.

TOTAL : 30 PERIODS

SEMESTER III

17254H31P MECHANICAL METALLURGY 3 1 0 4

OBJECTIVE:

To study about the behaviour of Metals during the loading conditions related to distribution of Stress and Strain. To know about the fracture of metals and various test procedures.

UNIT-I: Tensile Study:

Study of Engineering stress-strain curve: Derivation of tensile strength , yield strength ductility, Young's modulus, resilience and toughness from stress strain curves, study of stress-strain curves for different materials-true stress-strain curve: true stress at ultimate load, true fracture strain, true uniform strain, true necking strain-necking factor-effect of strain rate, temperature- test of flow properties-Notch tensile test-tensile properties of steel-strengthening theory- strain hardening-strain aging-Yield point phenomena-Solid solution strengthening-Martensite strengthening-Grain refinement,

UNIT-II: Hardness and Toughness:

Hardness and Toughness: Hardness introduction, Hardness measurement methods-Brinell hardness, Meyer hardness, Vickers hardness, Rockwell hardness and Micro hardness- Relationship between hardness and the flow curve-Hardness at higher temperatures-Toughness –introduction, Toughness measurements: Charpy, Izod and instrumented Charpy-TTT curves: Significance, metallurgical factors affecting the curves, Drop weight test, explosion crack starter test.

UNIT-III: Fatigue:

Fatigue study: Introduction: Different stress cycles, S-N curves, Goodman diagram, Soderberg diagram, Gerbar diagram-Cyclic stress curve-Low cycle fatigue- Strain life equation-Fatique mechanism-High cycle fatigue-Effect of folloeing parameters on fatigue: Mean stress , stress concentration, specimen size, surface roughness, residual stress, micro structure and temperature. Fatique crack propagation.

UNIT-IV: Fracture Behaviour:

Fracture – Introduction –Types – Ductile and Brittle Cohesive Strength of Metals- Griffith Theory-Metallographic Examination of Fracture – Fractography – Notch Effect – Concept of Fracture curve – Fracture under combined stresses- Environment sensitive fracture: Hydrogen Embrittlement and Corrosion Cracking

UNIT-V: Creep:

Creep: Creep Curve – Stress rupture test- Structural changes during creep- Creep deformation-Deformation Mechanisms Maps – Activation Energy for Steady state creep – Fracture at higher temperatures.

TEXT BOOKS:

1. George E. Dieter, "Mechanical Metallurgy", Mc Graw Hill, NewYork, 1988.
2. M.A. Meyers and K.Chawla, "Mechanical Metallurgy", PHI.

BOOKS FOR REFERENCE:

1. Metals Hand Book, "Mechanical Testing", Vol. 8, 9th Ed., ASM.

2. Thomas Countney.H., "Mechanical Behaviour of Materials", Mc Graw hill, 2nd Ed., 2000.

3. Hertzberg R.W., "Deformation and Fracture Mechanics of Engineering Materials", 2ne Ed., John Wiley & Sons. 1983.

SEMESTER IV

17254H41P MANUFACTURING METROLOGY AND QUALITY CONTROL 3 1 0 4

AIM:

To expose the students, the importance of measurement and the various latest measuring techniques using Laser, Coordinate measuring machines and Optoelectronics devices. Also to stress upon the Importance of quality in manufacturing.

OBJECTIVES:

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

UNIT – I LASER METROLOGY 8

Introduction – types of lasers – laser in engineering metrology – metrological laser methods for applications in machine systems – Interferometry applications – speckle interferometry – laser interferometers in manufacturing and machine tool alignment testing – calibration systems for industrial robots laser Doppler technique – laser Doppler anemometry.

UNIT – II PRECISION INSTRUMENTS BASED ON LASER 9

Laser telemetric systems – detection of microscopic imperfections on high quality surface Pitter NPL gauge interferometer – classification of optical scanning systems – high inertia laser scan technique – rotating mirror technique – laser gauging – bar coding – laser dimensional measurement system.

UNIT – III CO-ORDINATE MEASURING MACHINE 10

Co-ordinate metrology – CMM configurations – hardware components – software – Probe sensors – displacement devices – Performance Evaluations – Software – Hardware – Dynamic errors – Thermal effects diagram – temperature variations environment control – applications.

UNIT – IV OPTO ELECTRONICS AND VISION SYSTEM 9

Opto electronic devices – CCD – On-line and in-process monitoring in production – applications image analysis and computer vision – Image analysis techniques – spatical feature – Image extraction – segmentation – digital image processing – Vision system for measurement – Comparison laser scanning with vision system.

UNIT – V QUALITY IN MANUFACTURING ENGINEERING 9

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

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, Marcel Dekker, Inc, 1999.
2. Juran J.M. and Gyna F.M., Quality Planning and Analysis, Tata-McGraw Hill, New Delhi
3. Zuech, Nello Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000
4. Elanchezhian.C, Vijaya Ramnath.B and Sunder Selwyn, T., Engineering Metrology, Eswar Press, Chennai, 2004.

17254H42P METAL FORMING PROCESS 4 0 0 4

OBJECTIVE: To study about the response of materials under plastic deformation and the various techniques for finding the stress for various metal working processes, and the recent developments in high speed forming.

UNIT-I: Stress and Strain:

Stress-State of stress in two dimensions – three dimensions – stress tensor-Mohr's circles – 2D and 3D state of stress – Description of strain at a point – Mohr's circle of strain- Hydrostatic and stress deviator component of stress- Plasticity- flow curve-true and true strain yield criteria for ductile loads combined stress test-plastic stress and strain relations- Levy Mises equations-Prandyl_Resus equations.

UNIT-II: Analysis of Metal Forming:

Work Load analysis – work formula for homogeneous deformation- rolling, rod drawing and extrusion processes -Determination of load by stress evaluation method-Determination of drawing load – strip drawing with wedge shaped dies and cylindrical rod drawing with a conical die.

UNIT-III: Stress Evaluation:

Stress evaluation method-Determination of forging load-plane strain forging of a thin strip and a flat circular disc- Determination of extrusion load for round band flat strip-upper bound analysis – plane strain indentation with frictionless interface

UNIT-IV: High velocity Forming:

Study of effect of high speed on stress strain relationships- High velocity forming equipment-Description of high speed forming machine – hot forging, pneumatic-mechanical, high velocity forging – Fuel combustion process- Electro magnetic forming –Introduction- Procedure - process variables- Applications

UNIT-V: Advanced Forming process:

Explosive Forming – Explosives – characteristics- stand off and contact operations-stress waves and their effects- process variables – properties of formed components-applications- Electro hydraulic forming – principles, requirements and characteristics – process variables- water hammer forming- principles and parameters- governing the process.

BOOKS FOR REFERENCE:

1. George E.Dieter, "Mechanical Metallurgy", Mc Graw Hill International Edition, New York,1988
2. Rowe G.W,Edward , "An Introduction to the Principles of Metal Working", Edward Arnold publications.
3. Davies.R and Austin.E.R, "Developments in High Metal Forming", The Machinery Publishing Co.Ltd
4. Robert H.Wagoner and Jean Loup Chenot, "Fundamentals of Metal Forming", John Wiley and Sons Inc, New York,1992

17254E23BP LEAN MANUFACTURING 4 0 0 4

AIM:

To introduce the concepts of lean manufacturing system.

OBJECTIVES:

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

UNIT – I INTRODUCTION TO LEAN MANUFACTURING 7

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT – II CELLULAR MANUFACTURING, JIT, TPM 9

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT – III SET UP TIME REDUCTION, TQM, 5S, VSM 10

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

UNIT – IV SIX SIGMA 9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation.

UNIT – V CASE STUDIES 10

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003
2. Rother M. and Shook J, 1999 ‘Learning to See: Value Stream Mapping to Add Value and Eliminate Muda’ , Lean Enterprise Institute, Brookline, MA.
1. Mikell P. Groover (2002) ‘Automation, Production Systems and CIM.

17254E23CP - DESIGN AND ANALYSIS OF EXPERIMENTS 3 1 0 4

1. INTRODUCTION 7

Defining Research, Scientific Enquiry, Hypothesis, Scientific Method, Types of Research, Research Process and steps in it. Research Proposals – Types, contents, sponsoring agent's requirements, Ethical, Training, Cooperation and Legal aspects.

2. RESEARCH DESIGN 10

Meaning, Need, Concepts related to it, categories; Literature Survey and Review, Dimensions and issues of Research Design, Research Design Process – Selection of type of research, Measurement and measurement techniques ,Selection of Sample, Selection of Data Collection Procedures, Selection of Methods of Analysis, Errors in Research. Research Problem Solving – Types, Process and Approaches – Logical, Soft System and Creative; Creative problem solving process, Development of Creativity, Group Problem Solving Techniques for Idea Generation – Brain storming and Delphi Method.

3. RESEARCH MODELING 10

Mathematical – Classification of Models, Development of Models, Stages in Model building, Principles of Modeling, Use of Analogy, Models as Approximations, Data consideration and Testing of Models (b) Heuristics and Simulation – Definition, Applications and reasons for using Heuristics, Heuristic Methods and approaches, Meta-Heuristics; Simulation – Meaning, Applications and Classification of Simulation Models, Process of Simulation, Steps and Features of Simulation Experiments and their Validation.

4. EXPERIMENTATION 8

Objective, Strategies, Factorial Experimental Design, Applications of Experimental Design, Basic Principles – Replication, Randomization and Blocking, Guidelines for designing experiments; Laboratory Experiments, Methods of manipulating Variables, Errors in Experiments, Steps in Design of Experiments.

5. PROCESS OPTIMIZATION AND ANALYSIS 10

Factorial Design principles, Two factor Factorial Design, General Factorial Design, Fitting response Curves and Surfaces, Blocking, Taguchi Approach to Parameter Design, Robust Design. Analysis of Variance and Co-variance, Hypothesis Testing – Parametric. Report Writing: Pre-writing Considerations, Principles of Thesis Writing, Format of Report Writing, Format of Publication in Research Journals

REFERENCES FOR BOOKS:

1. Krishnaswamy, K.N., Sivakumar, Appa Iyer & Mathirajan M., (2006) -Management Research Methodology: Integration of Principles, Methods & Techniques (New Delhi, Pearson Education)
2. Montgomery, Douglas C. (2004) – Design & Analysis of Experiments, 5/e. (New York, John Wiley & Sons)
3. Kothari, C.K. (2004) – Research Methodology, Methods & Techniques, 2/e. (New Delhi, New Age International Ltd. Publishers)
4. Ross, Phillip J. (1996) – Taguchi Techniques for Quality Engineering, 2/e. (New York, McGraw Hill)
5. Rao S. S. (2004) – Engineering Optimization Theory & Practices, 3/e (New Delhi, New Age International Ltd., Publishers)

List of Electives - Elective II

17254E33AP MATERIALS MANAGEMENT AND LOGISTICS 4 0 0 4

AIM:

To introduce to the students the various functions of materials management and logistics

OBJECTIVE:

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

UNIT I INTRODUCTION 6

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

UNIT II MANAGEMENT OF PURCHASE 7

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

UNIT III MANAGEMENT OF STORES AND LOGISTICS 12

Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

UNIT IV MATERIALS PLANNING 10

Forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production.

UNIT V INVENTORY MANAGEMENT 10

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

TOTAL: 45

BOOKS FOR REFERENCE:

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, 1996.
2. Gopalakrishnan.P, Handbook of Materials Management, Prentice Hall of India, 1996.
3. Guptha P.K. and Manmohan, Problems in Operations Research, Suttan Chand & Sons, 2003.
4. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008.
5. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.

17254E33BP FINANCIAL MANAGEMENT 4 0 0 4

AIM:

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

OBJECTIVES:

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

UNIT – I FINANCIAL ACCOUNTING 8

Accounting principles - Basic records - Preparation and interpretation of profit and loss statement - balance sheet - Fixed assets - Current assets.

UNIT – II COST ACCOUNTING 12

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

BOOKS FOR REFERENCE:

1. Presanna Chandra, Financial Management, Tata McGraw Hill, 1998.
2. G.B.S. Narang, Production and Costing, Khanna Publishers, 1993.
3. R. Kesavan, C.Elanchezian, Sundar Selwyn, Engineering Economics and Financial Accounting, Laxmi Publications, New Delhi, 2005.
4. R Kesavan, C. Elanchezian, B.Vijaramnath, Engineering Economics and Cost Analysis Anuratha Publications, Chennai.

17254E33CP MANUFACTURING INFORMATION SYSTEMS 4 0 0 4

AIM:

To impart the knowledge in manufacturing information system.

OBJECTIVE:

On completion of this course, the students are expected to be conversant with order policies, data base terminologies, designing, manufacturing considerations and information system for manufacturing.

UNIT I INTRODUCTION 5

The Evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

UNIT II DATABASE 7

Terminologies – Entities and attributes – Data models, schema and subschema - Data Independence – ER Diagram – Trends in database.

UNIT III DESIGNING DATABASE 13

Hierarchical model – Network approach- Relational Data model concepts, principles, keys, relational operations – functional dependence – Normalization types – Query.

UNIT IV MANUFACTURING CONSIDERATION 10

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

UNIT V INFORMATION SYSTEM FOR MANUFACTURING 10

Parts oriented production information system – concepts and structure – Computerized production scheduling, online production control systems; Computer based production management system, computerized manufacturing information system – case study.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Luca G.Sartori, "Manufacturing Information Systems", Addison-Wesley Publishing Company, 1988.
2. Date.C.J.,"An Introduction to Database Systems" Addison Wesley, 8th Edn,.2003
3. Orlicky.G., "Material Requirements Planning", McGraw-Hill, 1994.
4. Kerr.R, "Knowledge based Manufacturing Management", Addison-Wesley,1991.
5. Manufacturing Information & Data Systems Analysis, Design & Practice,CECELJA FRANJO, 2002.

List of Electives - Elective III

17254E43AP ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION 4 0 0 4

AIM:

To give a thorough knowledge of measurement and instrumentation of increasing importance in industry. The student will be knowledgeable in various standards and proliferation of computerized and automated inspecting techniques along with the classical metrology.

OBJECTIVES:

- To teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries.
- Expose the students to various modern metrological instruments and the procedure used to operate these instruments.

UNIT I GENERAL CONCEPTS OF MEASUREMENT 8

Definition – Standards of measurement – Errors in measurement – Interchangeability and Selective assembly – Accuracy and Precision – Calibration of instruments.

UNITII MEASUREMENT OF SURFACE FINISH AND MEASURING MACHINES 9

Definitions – Types of Surface Texture: Surface Roughness Measurement Methods- Comparison, Profilometer, 3D Surface Roughness Measurement – Instruments.

UNIT III INTERFEROMETRY 8

Interferometry – Introduction, Principles of light interference – Interferometers – Measurement and Calibration – Laser Interferometry.

UNIT IV COMPUTER AIDED AND LASER METROLOGY 10

Tool Makers Microscope – Microhite – Co – Ordinate measuring machine – Applications – Laser Micrometer, Laser Scanning gauge, Non contact and in-process inspection, Vision system.

UNIT V IMAGE PROCESSING 10

Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. GUPTA, I.C, "A Text Book of engineering metrology", Dhanpat Rai and Sons, 1996.
2. G.N.GALYER F.W. and C.R.SHOTBOLT, "Metrology for engineers", ELBS, 1990.
3. GRAHAM T.SMITH, "Industrial Metrology", Springer, 2002
4. "ASTE Handbook of Industries Metrology", Prentice Hall of India Ltd., 1992.
5. R.K.RAJPUT, "Engineering Metrology and Instrumentations", Kataria & Sons Publishers, 2001.
6. MILAN SONKA, VACLAV HLAVAC and ROGER BOYLE, "Image Processing, Analysis, and Machine Vision", Cengage-Engineering; 3 edition (March 19, 2007).

17254E43BP MAINTENANCE MANAGEMENT 4 0 0 4

OBJECTIVE:

To understand the concepts of maintenance management and to have knowledge in developing a suitable maintenance system for any type of an organization.

UNIT I: Introduction to Maintenance Management: 7

Maintenance: Its role and scope in total Organizational contexts - role of Maintenance. Centralized and decentralized maintenance organization structures. Maintenance Economics – reliability and Availability – MTBF, MTTR.

UNIT II: Maintenance Categories: 10

Maintenance system– Categories - Design and its selection – Breakdown Maintenance –Routine Maintenance- Predictive Maintenance –Preventive Maintenance- Corrective Maintenance-Total Productive Maintenance –Maintenance Schedule – Repair Cycle.

UNIT III: Spare Parts Management: 8

Pareto's principles for repetitive breakdown analysis, spares management, planning considerations for each type of activities.

UNIT – IV: Condition Monitoring: 10

Condition Monitoring (CM) – Introduction- Economics of CM – On-load and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNIT V: Maintenance Manpower Cost, Performance Management: 10

Maintenance man power planning - Selection training - Scheduling maintenance costs - Budget preparation and budgetary control of maintenance expenditures Maintenance effectiveness various performance indices - evaluation, uses and limitations - Monitoring of Maintenance performance.

BOOKS FOR REFERENCE:

1. Gopalakrishnan P. and Sundarajan 1996. Maintenance Management. New Delhi, Prentice-Hall of India.
2. Srivastava S.K., "Industrial Maintenance Management", - S. Chand & Co.,1981.
3. Higgirs L.T and Morrow L.C., 1997, ``Maintenance Engineering Handbook``, McGraw Hill.
Armstrong, "Condition Monitoring", BSIRSA, 1988.

17254E43CP OPTIMIZATION TECHNIQUES 3 1 0 4

UNIT I - INTRODUCTION TO OPTIMIZATION 7

Formulation of an optimization problem- Classification of optimization problem – optimization techniques- Classical optimization technique – Single variable optimization – Multi variable optimization algorithms

UNIT II - MINIMIZATION METHODS 8

One dimensional minimization methods: unimodal function – elimination methods: unrestricted search, exhaustive search, Dichotomous search, Fibonacci methods, Golden section methods, Interpolation methods: Quadratic and cubic interpolation methods.

UNIT III - CONSTRAINED OPTIMIZATION TECHNIQUES 10

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - separable programming and Geometric programming.

UNIT IV - UNCONSTRAINED OPTIMIZATION TECHNIQUES 10

Multi variable unconstrained optimization techniques: Direct search methods: Random search method, unvaried method, pattern search method, steepest descent method and Conjugate gradient method.

UNIT V - APPLICATIONS OF HEURISTICS IN OPTIMIZATION 10

Heuristics-Introduction-Multi objective optimization: Genetic algorithms and Simulated Annealing techniques; neural network & Fuzzy logic principles in optimization.

BOOKS FOR REFERENCE:

1. Rao, Singaresu, S., “Engineering Optimization – Theory & Practice”, New Age International (P) Limited, New Delhi, 2000.
2. Johnson Ray, C., “Optimum design of mechanical elements”, Wiley, John & Sons, 1990.
3. Kalyanamoy Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall of India Pvt. 1995.
4. Goldberg, D.E., “Genetic algorithms in search, optimization and machine”, Barnen, Addison-Wesley, New York, 1989.

List of Electives - Elective IV

17254E51AP MANUFACTURING SYSTEMS AND SIMULATION 4 0 0 4

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

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

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

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

UNIT III DESIGN OF SIMULATION EXPERIMENTS 10
Problem formulation – data collection and reduction – time flow mechanical – key variables - logic flow chart starting condition – run size – experimental design consideration – output analysis, interpretation and validation – application of simulation in engineering industry.

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

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

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Jerry Banks and John S.Carson, “Discrete event system simulation”, Prentice Hall 1991
2. 1 .John H.Mize and J.Grady Cox, “Essentials of simulation” – Prentice hall 1989.
3. Geoffrey Gordon “System simulation” – Prentice Hall of India, 1992
4. Jeffrey L.Written, Lonnie D, Bentley and V.M. Barice, “System analysis and Design Methods”, Galgotia publication, 1995
5. Averill M.Law and W.David Kelton, “Simulation Modeling and analysis”, McGraw Hill International Editions, 1991
6. Shannon R.E., “System simulation”, Prentice Hall 1993.

17254E51CP ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS 3 1 0 4

UNIT – I - Neural Networks 8

Introduction to soft Computing-Neural Networks-Supervised Learning Neural Networks – Perceptrons – Adaline – Back propagation Multilayer perceptrons – Radial Basic Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Learning Vector Quantization – Habbian Learning.

UNIT – II - Fuzzy Logic: 10

Fuzzy Sets – Basic Definition and Terminology – Set –theoretic operations – Member Function Formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning. Fuzzy Logic: Extension principle and Fuzzy Relations – Fuzzy If – Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

UNIT – III Genetic Algorithm: 9

Derivative – based Optimization – Descent Methods – The Method of steepest Descent – Classical Newton's Method – Step Size Determination – Derivative – free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

UNIT – IV Neuro Fuzzy Modeling: 10

Adaptive Neuro – Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – learning Methods that Cross – Fertilize ANFIS and RBFN – Coactive Neuro – Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT – V Applications: 8

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency prediction – Soft Computing for Color Recipe Prediction – Single MLP approaches –CANFIS modeling for color recipe prediction

BOOKS FOR REFERENCE:

1. Jang, J.S.R., C.T. Sun and E. Mizutani., "Neuro – Fuzzy and Soft Computing", PHI, Person Education, 2004.

2. Eberhart, R., simpson, P. and Dobbins, R., " Computatuonal Intelligence PC Tools", AP Professional, Boston 1996.

3. Goldberg, Davis E., "Optimization and Machine Learning" Addison Wesley, New York, 1989.

4. S. Rajasekaran and Pai, G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithms",Prentice Hall of India, New Delhi, 2003.

List of Electives - Elective V

17254E52AP PRODUCT DESIGN AND DEVELOPMENT 4 0 0 4

UNIT I - INTRODUCTION 7

Significance of product design, product design and development process, sequential engineering design method, the challenges of product development.

UNIT II - PRODUCT PLANNING AND PROJECT SELECTION 8

Identifying opportunities evaluate and prioritize projects, allocation of resources Identifying Customer Needs, Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs.

UNIT III - PRODUCT SPECIFICATIONS 8

Establish target specifications, setting final specifications, Concept Generation: Activities of concept generation, clarifying problem, search both internally and externally.

UNIT IV - INDUSTRIAL DESIGN AND CONCEPT SELECTION10

Assessing need for industrial design, industrial design process, management, assessing quality of industrial design, Overview, concept screening and concept scoring, methods of selection.

UNIT V - THEORY OF INVENTIVE PROBLEM SOLVING (TRIZ) AND CONCEPT TESTING 12

Fundamentals, methods and techniques, General Theory of Innovation and TRIZ, Value engineering Applications in Product development and design, Model-based technology for generating innovative ideas Elements of testing: qualitative and quantitative methods including survey, measurement of customers' response, Intellectual Property: Elements and outline, patenting procedures.

BOOKS FOR REFERENCE:

1. Ulrich K. T, and Eppinger S.D, Product Design and Development, Tata McGraw Hill
2. Otto K, and Wood K, Product Design, Pearson
3. Engineering of creativity: introduction to TRIZ methodology of inventive Problem Solving, By Semyon D. Savransky, CRC Press.
4. Inventive thinking through TRIZ: a practical guide, By Michael A. Orloff, Springer.
5. Systematic innovation: an introduction to TRIZ ; (theory of inventive Problem Solving), By John Terninko, Alla Zusman, CRC Press.

17254E52BP FLUID POWER AUTOMATION 4 0 0 4

AIM:

To impart knowledge in the area of hydraulics, pneumatic and fluid power components and its functions.

OBJECTIVE:

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

UNIT I INTRODUCTION 5

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

UNIT II FLUID POWER GENERATING/UTILIZING ELEMENTS 8

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

UNIT III CONTROL AND REGULATION ELEMENTS 8

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports pressure and temperature compensation, overlapped and under lapped spool valves operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance.

UNIT IV CIRCUIT DESIGN 10

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade, method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

UNIT V ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS 7

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall, 1988.
2. Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd.,London, 1979
3. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill, 1978.
4. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.
5. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem, 1994.

List of Electives - Elective VI

17254E53AP ADVANCED MATERIAL TECHNOLOGY 4 0 0 4

AIM:

To impart knowledge on advance concepts of material technology

OBJECTIVE:

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

UNIT I ELASTIC AND PLASTIC BEHAVIOR 10

Elasticity in metals and polymers Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and 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 10

Griffith's theory, stress intensity factor and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law. Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT III SELECTION OF MATERIALS 10

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

UNIT IV MODERN METALLIC MATERIALS 8

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

UNIT V NON METALLIC MATERIALS 7

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

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000.
3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4^{th} Edition) Jaico, 1999.
4. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
5. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

17254E53BP INDUSTRIAL ERGONOMICS 4 0 0 4

UNIT – I INTRODUCTION 7

Concepts of human factors engineering and ergonomics – Man – machine system and design philosophy – Physical work – Heat stress – manual lifting – work posture – repetitive motion.

UNIT – II ANTHROPOMETRY 9

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

UNIT – III DESIGN OF SYSTEMS 9

Displays – Controls – Workplace – Seating – Work process – Duration and rest periods – Hand tool design – Design of visual displays – Design for shift work.

UNIT – IV ENVIRONMENTAL FACTORS IN DESIGN 11

Temperature – Humidity – Noise – Illumination –Vibration – Measurement of illumination and contrast – use of photometers – Recommended illumination levels. The ageing eye – Use of indirect (reflected) lighting – cost efficiency of illumination – special purpose lighting for inspection and quality control – Measurement of sound – Noise exposure and hearing loss – Hearing protectors – analysis and reduction of noise – Effects of Noise on performance – annoyance of noise and interference with communication – sources of vibration discomfort.

UNIT – V WORK PHYSIOLOGY 9

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

TOTAL: 45 PERIODS

BOOKS FOR REFERENCE:

1. Martin Helander, A guide to the ergonomics of manufacturing, East West press, 1996
2. E.J. McCormic, Human factors in engineering design, McGraw Hill 1976
3. R.S. Bridger Introduction to Ergonomics, McGraw Hill, 1995.